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EXHIBITS

Volume 2

Exhibits to Comment Letter Prepared by Shute, Mihaly & Weinberger LLP for the South Orange County Transportation Infrastructure Improvement Project

LIST OF EXHIBITS

1. Patrick DeCorla-Souza, Mainstreaming Pricing Alternatives in the NEPA Project Development Process (November 2002).

2. News articles from various news sources concerning the financial failure of the San Joaquin Toll Road Financing.

3. Marlon G. Boarnet, Departments of Urban and Regional Planning and Economics and Institute of Transportation Studies, New Highways, Induced Travel and Urban Growth Patterns: A "Before and After" Test (September 2002).

4. News articles from various sources regarding TCA Non-Compete Agreeement.

5. Excerpts from Draft Environmental Impact Report No. 589, GPA/ZX, Sch. 2003021141 (The Ranch Plan DEIR).

6. Bent Flyvbjerg, Mette Skamris Holm, and Soren Buhl, Underestimating Costs in Public Works Project, Journal of the American Planning Association, Vol.68, No.3 (Summer 2002).

7. Heather Lourie, "Construction Firm Sues Tollway Agency," The Orange County Register (November 16, 2002).

8. California Department of Parks and Recreation, Mitigation Assessment of FTC - South Impacts on San Onofre State Beach (August 1997).

9. California Department of Parks and Recreation, Relocation Preplanning Letter Report for San Onofre State Beach (August 31, 1998).

10. Ned Madden, "The Death Ray," OC Weekly (October 1999); Page from Surfline Website.

11. The Donna O'Neill Land Conservancy, Conservancy Comments, Volume 12, Number 1 (Winter/Spring 2004).

12. Excerpt: U.S. Environmental Protection Agency, Office of Noise Abatement and Control, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety (March 1974).

13. Excerpt: U.S. Environmental Protection Agency, Indicators of the Environmental Impacts of Transportation, Updated Second Edition (October 1999).

14. Patrick DeCorla-Souza, Evaluation of Toll Options Using Quick-Response Analysis Tolls: A Case Study of the Capital Beltway (November 16, 2002).

15. Toby Eckert, "Toll Road will not be exempt from state laws," The San Diego Union-Tribune (November 15, 2002).

16. Transportation Corridor Agencies, Statement of Intent Regarding Foothill Transportation Corridor, OSO Parkway to Interstate 5, Modified C Alignment (December 1991).

17. Agreement of Lease between State of California Department of Parks and Recreation and United States of America (September 1971).

18. The Rancho Mission Viejo Land Conservancy.

Exhibit

1

Paper No. 03-2941

Mainstreaming Pricing Alternatives in the NEPA Project Development Process

Prepared for presentation at the TRB Annual Meeting in January 2003

Paper Word Count: 7,174
Abstract Word Count: 134

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November 16, 2002

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Abstract

Mainstreaming Pricing Alternatives in the NEPA Project Development Process

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This paper discusses how pricing can be incorporated into alternatives being considered during the NEPA process for major highway improvements in metropolitan areas, and how the transportation performance and other impacts of pricing can be evaluated and compared to more traditional alternatives. The paper demonstrates, using a case study, that relatively simple analytical procedures may be used to estimate the impacts of pricing alternatives and generate information for use by local decision-makers. The case study also demonstrates that pricing alternatives can accomplish the purpose and need of a major highway project in a way that effectively competes with conventional alternatives that exclude pricing, while generating net revenue surpluses to make funding of transportation improvements financially feasible.

Mainstreaming Pricing Alternatives in the NEPA Project Development Process

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1.0 INTRODUCTION

Transportation agencies will need to fundamentally rethink the kinds of solutions that make sense in highly congested metropolitan areas. Three forces will cause a change in conventional thinking. First, a precipitous increase in congestion levels will accompany travel growth. Second, public resistance to traditional major highway projects will continue due to their community and environmental impacts. And third, many States face funding shortfalls. Pricing solutions, although currently novel to members of the public and their elected and appointed governmental officials, will gain in acceptance as their real world performance becomes more widely understood. However, evaluation tools in current use in transportation decision-making processes are not well suited for evaluating pricing alternatives against more traditional highway construction alternatives. This paper introduces emerging evaluation tools that can address pricing, and demonstrates how they might be applied to a major transportation improvement being evaluated as part of the National Environmental Policy Act (NEPA) process.

The paper also discusses how pricing concepts can be incorporated into alternatives being considered during the NEPA process for major highway improvements in metropolitan areas, and how the transportation performance and other impacts of pricing can be evaluated and compared to more traditional alternatives.

As used in this paper, the term "pricing" includes a group of measures that all involve collecting a variable toll for highway use, with the primary intent of managing travel demand so as to reduce or eliminate congestion on the priced roadway facility, corridor or network. Specific examples and definitions are presented later in the paper.

2.0 THE NEPA PROCESS

2.1 Using the NEPA Process to Agree on a Transportation Solution

The NEPA process (1) is the forum for evaluating and deciding upon the key features of transportation improvements for which Federal funding or other Federal approvals are required. Successful completion of the NEPA process is in effect an agreement between the U.S. Department of Transportation (USDOT) and the project sponsor that the approved project is eligible for Federal funding. It is the culmination of a decision-making process that often involves a number of Federal, State, and local governmental decision-makers working together to specify in considerable detail what the improvement will include.

For major transportation improvements that have a high likelihood of having significant environmental impacts, USDOT is obligated by law to prepare an environmental impact

TRB 2003 Annual Meeting CD-ROM Paper revised from original submittal.

statement (EIS). The process of preparing an EIS is highly regulated and is influenced by hundreds of judicial decisions interpreting the governing laws and regulations. Non-regulatory guidance provides a useful, but not fully comprehensive, roadmap for how to prepare an EIS. Considerable thought goes into how each EIS will address the fundamentals of transportation decision-making using a systematic, interdisciplinary approach. Each EIS requires a customized approach that is appropriate to the specifics of the situation.

The EIS process starts with one or more problems to be solved. The problem is framed as the "purpose and need" for the "action." Any given EIS may endeavor to address a number of transportation problems. For example, it may attempt to address current safety problems, current congestion and delays, anticipated congestion and delays, inefficient travel patterns due to gaps in the transportation system, etc. However, in major metropolitan areas, most major transportation improvements frame the purpose and need around attempting to achieve some desired level of personal mobility.

The purpose and need is finalized during preparation of the EIS, but in metropolitan areas the initial work is done as part of the Comprehensive, Coordinated and Continuing (3C) transportation planning process (1). As a result, the process of arriving at appropriate transportation solutions must consider the role of the 3C planning process in framing the problem to be solved. Often this involves looking at alternative ways of addressing broad policy goals and leads to more specific purpose and need statements for specific projects. The importance of the 3C planning process in framing the problem is critical to the eventual solution. Environmental advocacy groups often complain that an overly narrow framing of the problem inevitably leads to implementation of traditional highway construction solutions. Transportation agencies often complain that too broad a framing of the problem leads to such a complex problem that the process of deciding on an appropriate solution involves an unreasonably extensive evaluation of alternatives.

Some purpose and need statements include specific quantitative performance levels that must be attained in order for a project to be considered successful. Others use a more qualitative approach, relying more on a description of the outcome that is sought by the agency that is advancing a project.

No matter how planners arrive at a purpose and need statement, the legal standard is that USDOT evaluate "all reasonable alternatives" in its EIS. An alternative is considered reasonable if it meets the essential elements of the purpose and need statement, and is practical or feasible from the technical and economic standpoint and based on common sense. To satisfy the requirement for evaluation of all reasonable alternatives, USDOT must ensure that its EIS process evaluates the full range of alternatives and provides a logical rationale for winnowing down the selection to a single "selected alternative." Pricing strategies may appropriately be included among the alternatives to be evaluated, either by themselves as add-ons to the base case "No Build" alternative or in combination with alternatives involving roadway capacity enhancement. During the process the most promising short list of alternatives is evaluated in comparable detail in the draft EIS. The final EIS focuses on considering public and agency input to arrive at and present a single preferred alternative. The EIS process is concluded with a

Record of Decision. This finalizes the selection process by presenting the essential elements of the selected alternative.

Not all actions are advanced with an EIS. If USDOT is unclear whether an EIS is needed, it can first prepare an environmental assessment (EA) to assist in making that determination. The legal requirements for an EA generally correspond to those for an EIS, but are not as rigorous. If USDOT determines, after appropriate public comment and interagency coordination, that the action will have no significant impact, then it concludes the NEPA process by presenting the selected alternative in a Finding of No Significant Impact (FONSI).

2.2 The Scoping Process

Whether the NEPA process is done with an EIS or an EA, the process begins with an attempt to determine what issues and topics to address, and at what level of detail. This process is called scoping or early coordination. Ideally, the scoping process will carefully review previous and ongoing work that has a bearing on the particular action at hand. This would include a review of the 3C transportation planning process mentioned above, and other comprehensive or single topic plans, e.g., plans for transportation, land use, air quality, or water quality. Scoping should also look at transportation and related projects that could affect the decision for the action under study in the NEPA process. The goal of scoping is to nail down the scope of the analysis and coordination to be undertaken during the NEPA process. This includes developing or refining the purpose and need for the action, identifying the range of alternatives to be evaluated, developing a set of criteria for evaluating alternatives, determining which potential environmental consequences require the most study, identifying appropriate public involvement and interagency coordination opportunities, and deciding on analytical methodologies to be used in the course of the NEPA process.

The scoping process engages members of the public and representatives from other agencies and governments in addressing the items mentioned above. It is therefore an excellent opportunity to make suggestions that reflect on the viability of pricing alternatives in the NEPA process. For example, one might suggest that the purpose and need be framed as reducing traveler delay and variability in travel time rather than as building additional highway capacity. Such a suggestion would be strengthened by offers of specific evaluation criteria and performance measures to substitute for or supplement traditional measures such as volume/capacity ratios. In addition, one could specifically suggest that certain types of alternatives, including pricing, be studied in the NEPA process either by themselves as add-ons to the "No Build" base case, or in combination with roadway capacity enhancement. In cases where funding for capacity expansion alternatives is uncertain, pricing alternatives could be considered for study as interim solutions. Finally, one could suggest specific methodologies to use in evaluating such alternatives.

2.3 Evaluating Pricing Alternatives in the NEPA Process

As mentioned earlier, the term "pricing" includes a group of measures that all involve collecting a variable toll for highway use, with the primary intent of managing travel demand so as to reduce or eliminate congestion on the priced roadway facility, corridor or network. Other than

conventional toll road alternatives, pricing has usually not been included among alternatives identified during the scoping process. Pricing measures to manage peak demand, such as time-of-day tolls or high occupancy toll (HOT) facilities, have not generally emerged from the scoping process, primarily because they were considered untested or politically unacceptable. Yet, there are examples of projects, such as the SR 91 expansion in Orange County, CA, where pricing has been shown to be publicly acceptable, while enhancing mobility, reducing environmental impacts, and generating new revenues to pay for highway construction or to provide for alternatives to solo-driving.

Given the growing number of real world experiences in evaluating and implementing pricing concepts, it appears that the time is ripe to give more serious consideration to pricing alternatives during the NEPA process. Under FHWA's Value Pricing Pilot Program (2), several feasibility studies have been funded to assess the role pricing can play in highway expansion projects. Among the pricing studies completed or underway are:

- US Route 101 corridor study, Marin and Sonoma Counties, CA
- I-25/US 36 Value Express Lane feasibility study, Denver, CO
- Feasibility study for extension of I-15 FasTrak Express Lanes, San Diego, CA
- Pre-implementation study for expansion of I-10 (Katy Freeway) with managed lanes, Houston, TX
- Feasibility study for expansion of C-470 with HOT Lanes, Denver, CO
- Feasibility study for HOT lanes in the median of US Route 1, Santa Cruz County, CA
- Feasibility study for expansion of US 217, Portland, OR
- Feasibility study for HOT lanes on I-40, Raleigh/Piedmont region, NC
- Feasibility study for HOT lanes on I-30 in Dallas, TX

While many of the above studies have been undertaken as separate studies with results feeding into the NEPA process, three studies (I-15 Express Lanes, US Route 1 and US 217) are being conducted as part of or in close coordination with the NEPA process.

The real world success of value pricing suggests that there is a need to mainstream such studies into the NEPA process. However, problems exist, such as:

- A lack of understanding of the range of pricing possibilities, both among professional planners and engineers, as well as stakeholders and the general public;
- Concerns of politicians about the prospects for public acceptance; and
- A lack of awareness of analytic and evaluation tools available to assist planners in developing information on the impacts of pricing alternatives, to help in decision-making.

The remaining sections of this paper attempt to provide guidance on how these issues can be addressed. We discuss:

- FHWA support of transportation agency efforts to achieve a broader public understanding of pricing possibilities.
- How barriers to public acceptance can be overcome.
- FHWA efforts to support transportation professionals in analysis and evaluation of pricing alternatives.

3.0 EXPANDING THE UNDERSTANDING OF PRICING POSSIBILITIES

FHWA has developed an information kit (available for downloading at www.valuepricing.org) to assist in increasing professional and public understanding of pricing concepts. The kit addresses four main types of pricing alternatives involving road user charges:

- Variable Tolls on Toll Roads
- HOT Lanes, i.e. High Occupancy Toll lanes
- FAIR Lanes, i.e., Fast and Intertwined Regular lanes
- Variable Tolls on Existing Free Roads

The rest of this section of the paper provides a summary of each strategy. It should be noted that under current federal law, pricing strategies applied to existing free Interstate facilities must obtain federal approval through FHWA's Value Pricing Pilot Program prior to implementation. Pricing strategies on free non-Interstate facilities may obtain federal approval under Section 129 of Title 23 of the U.S. Code.

3.1 Variable Tolls on Toll Roads

A variable toll refers to the fluctuation of a toll rate. Typically the toll is higher during peak travel hours and lower during off-peak or shoulder hours (i.e., the times right before and after peak hours). The toll may also vary by day of the week and by vehicle type. The fluctuation in toll generally follows a predetermined schedule. The primary intent is to encourage shifts in travel away from the peak periods. It may also encourage travelers to shift to another mode of transportation, or to change routes. With fewer people traveling during congested periods, the remaining peak period travelers will have decreased delays. Advances in technology, such as electronic toll collection, make the adoption of variable tolling easier to implement and allow traffic to flow even more freely. Vehicles are equipped with transponders, and transponders are read by overhead antennas. Ultimately, shifts in traffic will result in less need for roadway expansion on toll facilities. By reducing peak period travel demand through changes in travel behavior, introduction of variable pricing on toll roads can reduce the need for new highway capacity.

3.2 HOT Lanes

"HOT" is the acronym for "High Occupancy/Toll." On HOT lanes, low occupancy vehicles are charged a toll, while High-Occupancy Vehicles (HOVs) are allowed to use the lanes free or at a discounted toll rate. Tolls vary by time-of-day and are collected at highway speeds using electronic toll collection technology. There are no toll booths. Tolls may be set "dynamically," i.e., they may be increased or decreased every few minutes, to ensure that the lanes are fully utilized. Motorists are informed of the current toll rates through variable message signs placed in advance of the entrances to the HOT lanes. HOT lanes can be introduced either by converting existing HOV lanes or by adding new lanes. They have been implemented in California and Texas. By maximizing the use of spare capacity on existing HOV lanes, HOT lanes can reduce congestion on general purpose lanes, and reduce the need for new highway capacity for

unrestricted use. Variable tolls on new lanes ensure that new lanes will not get congested, and that spare capacity remaining after limited use by HOVs will be fully utilized.

3.3 FAIR Lanes

The new value pricing concept called FAIR (Fast and Intertwined Regular) lanes was developed by FHWA to overcome equity concerns that sometimes surround efforts to implement variable tolls on previously untolled highway capacity (3). FAIR lanes involve separating congested freeway lanes into two sections, Fast lanes and Regular lanes. The separation may be done with methods as simple as using plastic pylons and lane striping. The Fast lanes would be electronically tolled, with tolls set dynamically, i.e., in real time, to ensure that traffic moves at the maximum allowable free-flow speed. Users of the Regular lanes would still face congested conditions, but would be eligible to receive credits if their vehicles had electronic toll tags. For example, if the current toll on the Fast lanes were $4.00, vehicles on the Regular lanes could get a credit amounting to $1.00, i.e., 25 percent of the current toll. The credits would be a form of compensation for giving up the right to use the lanes that had been converted to Fast lanes. Accumulated credits could be used as toll payments on days when a traveler chooses to use the Fast lanes, or as payments for transit or paratransit services, which would be subsidized using toll revenue from the Fast lanes.

FAIR lanes could increase vehicle throughput by as much as 50% on Fast lanes. The higher throughput occurs because freeway vehicle throughput under free flow conditions is significantly higher than when it is congested (4). FAIR lanes could increase *person* throughput even more with the provision of high quality transit and paratransit services. This in turn could lead to more efficient use of existing highway lanes, and thereby reduce the need for new highway capacity.

3.4 Variable Tolls on Existing Free Roads

By introducing tolls on existing toll-free facilities, such that tolls are higher when traffic demand is higher, traffic can be reduced and much or all of the congestion eliminated. With such pricing of existing free roads, commuters would shift to other modes, routes or destinations or may choose to travel before or after the peak times when tolls are higher. Present traffic volumes in metropolitan areas are so excessive that even a small reduction in traffic can eliminate much of the time lost because of congestion. And the revenue from tolls can be used to help pay for improvements to transportation -- both highway and transit. Improvements in transit service will increase commuter choice, and encourage even more commuters to abandon their cars leading to even greater traffic reduction, cleaner air, and safer and quieter streets. This in turn could lead to more efficient use of existing highway lanes, and thereby reduce the need for new highway capacity.

3.5 Lessons Learned from Implemented Projects

The SR 91 Express Lanes in Orange County, CA opened in December 1995 as a four-lane toll facility in the median of a 10-mile section of one of the most heavily congested highways in the United States. The toll lanes are separated from the general purpose lanes by a painted buffer and

plastic pylons. There are eight general purpose lanes, four in each direction. As of November 1, 2001, tolls on the Express Lanes varied between $1 and $3.60 in the westbound direction and $1 and $4.75 in the eastbound direction, with the tolls changing by time of day to reflect the level of congestion delay avoided in the adjacent free lanes, and to maintain free-flow traffic conditions on the toll lanes. Traffic volumes for discrete time intervals during the day are monitored on a regular basis on the Express Lanes. When volumes approach levels at which free flow of traffic might be at risk, a new toll schedule is developed and published. To discourage additional traffic, tolls are raised for those time periods when volumes are close to the maximum volumes that can support free flow. All vehicles must have an electronic transponder to travel on the Express Lanes. Vehicles with three or more occupants pay a reduced toll. These vehicles go through a special toll collection lane for HOVs so that they can be identified as vehicles eligible for the discount.

During heavy congestion periods, 40 percent of total vehicular traffic is carried on the express lanes even though they comprise only one-third of the capacity (5), because throughput is higher under free flow conditions (4). Due to higher HOV use on the lanes, the percentage of *person travel* on the lanes is even higher.

In addition to SR 91, other pilot pricing projects have been implemented and are addressing many community concerns. Revenues from pricing have been used to provide the traveling public with additional travel choices and to increase their mobility. Lane pricing has provided premium service for those willing to pay for it, and has provided for congestion-free movement of transit vehicles. Pricing has promoted more efficient use of highway capacity and delayed the need for new capacity, thereby saving tax dollars. Pricing has decreased time wasted waiting in congestion and the uncertainty of delay times. By reducing congestion and increasing vehicle occupancy and transit use, pricing has also reduced air pollution and fuel consumption. Projects implemented through FHWA's Value Pricing Pilot Program (see www.valuepricing.org for more information) have taught important lessons:

- Pricing *can* work – it can reduce congestion and change travel behavior, and provide additional travel choices.

- Pricing can provide much needed revenues for expansion of transportation services.

- Pricing can be politically and publicly acceptable. Surveys of motorists on SR 91 have repeatedly shown a high level of support from all income groups. A recently completed public opinion survey in San Diego (6) found that both users and non-users of the dynamically priced I-15 HOT lanes strongly support the use of pricing. Support is high across all income groups, with the lowest income group expressing stronger support than the highest income group (80% vs. 70%). While this appears to be counterintuitive, it may be explained by the fact that lower income motorists are more likely to have jobs which require them to be punctual at work, or they have child care arrangements which require them to be punctual in picking up their children from day care at the end of the day. This possibly explains their strong support for an option which allows them to bypass congestion on those days when they absolutely need it in order to be punctual and avoid severe consequences.

Implemented pricing projects have demonstrated that pricing makes sense in conjunction with added highway capacity, especially on freeways. It also makes sense where existing HOV lanes are either underutilized or overutilized, and where existing toll facilities are congested. The technology is not yet ready for general pricing of non-freeway type facilities, although advances have been made in using Global Positioning System (GPS) technology for pricing of trucks on all types of road facilities in European countries. In the U.S., one study (7) suggests that use of GPS technology for pricing passenger cars may be as much as 20 years away, due to the need to have the required technology incorporated into all vehicles at the time of manufacture.

4.0 OVERCOMING BARRIERS TO PUBLIC ACCEPTANCE

Conventional wisdom suggests that it is extremely difficult for the public to accept value pricing alternatives. These public concerns are discussed below, along with ways they have been addressed in existing or proposed value pricing projects.

4.1 Concerns About Paying New or Higher Tolls

Unless they get something in return, few members of the public are willing to pay higher tolls on existing toll facilities or new tolls on roads they currently use for free. For example, some freight transportation companies have expressed concerns with increased costs associated with pricing. Value pricing projects have overcome these concerns in two ways:

- *On toll facilities*, rather than raising tolls during peak periods, discounts have been offered during off-peak periods to vehicles using transponders. However, this could result in loss of revenue. In one case, in order to avoid loss of revenue, the "flat" cash toll rate charged during all time periods has been raised above that charged to vehicles with transponders in the peak periods. This has also provided an incentive for motorists to obtain electonic transponders, saving labor costs for toll collection staff and reducing toll agency operation costs.

- On free facilities, general purpose free lanes have remained free, with new tolls being charged only on new lanes or on previously restricted lanes, so that motorists always have a choice to travel free of charge. Trucking companies indicate that they like having the option to pay a premium price to bypass congestion, as long as a free (but congested) option is also available to them.

4.2 Concerns About Double Taxation

Tolls are often viewed as "just another tax increase" which will lead to bigger government. Many believe that pricing involves double taxation, once through gas taxes and again through the imposition of tolls. Another major barrier to public acceptance is the suspicion of some that politicians will divert revenues from any pricing scheme to their pet projects, instead of using the revenues to benefit those who contribute the revenues. These concerns have been addressed in two ways:

- Clear commitments have been made that toll revenue will be used strictly to support transportation services or facilities in the corridor where the revenues are collected.

- Some states have instituted rebates on state fuel taxes paid on tolled facilities. With transponder technology, it is possible to do this without excessive administrative costs, by providing mileage-based credits on the monthly bills that motorists receive.

4.3 Concerns About Equity

Some perceive tolls as being regressive since they can have a disproportional impact on low income groups, taking a larger share of their incomes. Pricing can be perceived as favoring high income travelers, offering them a higher level of mobility than those less wealthy can afford. These concerns can be addressed in one of three ways:

- The revenue generated by the pricing project can be used to mitigate the perceived inequity by financing transportation improvements such as new or improved transit services that benefit lower income travelers. However, the use of pricing revenue to support transit services presents a number of institutional challenges that have not been fully overcome. Support for use of toll revenue for transit is strong in some metropolitan areas such as New York, where even the local automobile club supports the use of toll revenue for transit, based on the understanding that more people riding in transit vehicles results in less congestion for motorists. However, this type of strong support may not prevail in other metropolitan areas.

- Toll revenues may be used to provide "life line" toll credits to low income travelers.

- With lane pricing, all travelers in the regular lanes may be provided with small credits which can be accumulated and used to pay for transit fares or highway tolls (as in the FAIR lanes concept). Drivers from low income households could be provided with credits at a higher rate than that provided for middle and upper income households.

4.4 Concerns About Traffic Diversion

Possible diversion of traffic from tolled freeways to free surface streets is a concern for those who live in neighborhoods through which traffic is diverted. Traffic diversions to secondary roads caused by imposing pricing can have their own impacts on communities and safety that must be evaluated. However, if value pricing is used to pay for new highway capacity which might otherwise be delayed or not built, diversion of traffic from tolled freeways to free surface streets will be less of an issue. This is because, when freeway capacity is expanded, traffic could actually be diverted away from surface streets to the expanded freeway due to faster travel conditions. When value pricing is introduced without capacity expansion, as in the case of HOV lanes converted to HOT lanes, or FAIR lanes on existing right-of-way, diversions will actually occur from secondary roads *to* the freeway, because of the additional throughput of vehicles made possible, and the resulting reduction in congestion on general purpose lanes. Of course, nowhere in the U.S. is there any consideration being given to forms of pricing which involve pricing *all lanes* on existing freeways while secondary roads in the corridor remain free. Such a

strategy *would* result in negative impacts on secondary facilities. That is one reason why such strategies are not under serious consideration in the U.S.

4.5 Concerns About Privacy

Some members of the public are concerned about their privacy, since they would be required to use electronic vehicle transponders allowing "Big Brother" to know where and when they travel. This issue has not been a big concern in the Northeast, where over 10 million motorists voluntarily use E-ZPass transponders. However, if privacy is a concern, those concerned about having their privacy compromised can be satisfied if the toll collection system allows use of anonymous smart cards with stored value, such as those in use in Japan. However, such systems are more expensive than the transponder systems currently used for toll collection in the U.S. Toll booths, another way to maintain anonymity, are not amenable to variable tolls, an essential feature of value pricing to manage demand.

4.6 Credibility as a Congestion Management Tool

Some question the ability of pricing to make a dent in the severity of congestion in metropolitan areas. It is true that the success of pricing solutions depends largely on traveler behavior changes, which in turn depend on availability of alternative modes and employer policies regarding work hours and telecommuting. Travel behavior changes are difficult to predict and may vary with economic cycles. Fortunately, evaluation data from several implemented projects are now available, and these data are being used to make a credible case for the magnitude of congestion relief and additional revenues for transportation that can result from pricing strategies.

5.0 ANALYSIS OF PRICING ALTERNATIVES

This section of the paper discusses available tools and provides guidance on how transportation professionals can perform analysis and evaluation of pricing alternatives.

5.1 Available Analysis Tools

An analyst attempting to generate information on the impacts of pricing alternatives needs tools to:

- Forecast travel demand impacts (i.e., changes in modal shares for commuters, peak period and daily traffic on highway facilities in the travel corridor, HOV and toll-paying vehicle volumes, etc.)
- Estimate mobility impacts (i.e., changes in travel delays, vehicle and person throughput, user costs for tolls, etc.)
- Estimate environmental impacts, including the social costs or benefits of any changes in vehicular travel.

Based on the above information, an analyst can generate measures of financial feasibility (e.g., excess of costs above revenues), and measures of economic efficiency (e.g., excess of social benefits over public implementation costs).

Through the Travel Model Improvement Program (TMIP), FHWA has been developing and disseminating advanced travel demand forecasting techniques to estimate the travel effects of pricing alternatives (8). Four-step travel demand models are being used in many cases to estimate traffic impacts of pricing alternatives, e.g., a recent study in Portland, OR (9). When results from four-step models are available, FHWA's Surface Transportation Efficiency Analysis Model (a.k.a. STEAM) may be used to generate estimates of mobility impacts (10). STEAM can also be used to generate estimates of a variety of environmental impacts from vehicle operation on the highway. These estimates are generated at the system level, to ensure that only *net* effects are reported. A pricing study in the Twin Cities, MN, has used STEAM to estimate the mobility and environmental impacts of alternative strategies (11).

However, the above procedures tend to be complex and often expensive to implement. Therefore, at initial stages in a study, when it is desirable to evaluate a wide range of alternatives, use of these tools may be cumbersome. Quick-response sketch planning procedures are a feasible solution for initial evaluation or "screening" of reasonable alternatives, especially in areas that do not have the resources to implement complicated four-step modeling procedures to evaluate a broad range of pricing strategies early in the study process.

FHWA has developed quick-response sketch planning tools which can assist in travel demand and impact estimation at the screening stage. FHWA's IMPACTS model (12) provides for estimation of impacts for pricing alternatives. Other tools developed by FHWA, such as its Sketch Planning Analysis Spreadsheet Model (a.k.a. SPASM) (13) and its Spreadsheet Model for Induced Travel Estimation (a.k.a. SMITE) (14) may also be modified for use in evaluation of pricing alternatives. FHWA's SMITE model was modified for the case study analysis presented below. The modified model is called SMITE-Managed Lanes (SMITE-ML), and may be downloaded with case study project data from www.fhwa.dot.gov/steam (go to the Related Links page).

5.2 Case Study Alternatives

The case study presented below demonstrates application of screening analysis techniques using a typical major freeway widening proposal in a large metropolitan area. A detailed description of the analysis is provided in a companion paper (15). Data were obtained from the draft EIS document. The proposed project is 14 miles long. The existing freeway facility has 8 lanes, and the alternatives evaluated involved expansion to 10 lanes or 12 lanes. The purpose and need statement identified four main purposes for the project:

- Improve access to activity centers
- Preserve the link in the transportation system which sustains the regional economy
- Meet the transportation needs of a growing population
- Upgrade the region's transportation infrastructure

Three conventional Build alternatives were evaluated for the EIS. In addition, a No Build alternative was evaluated in the draft EIS for comparison purposes. The conventional alternatives included:

- Alternative 1: Add one concurrent HOV lane in each direction.
- Alternative 2: Add one HOV lane in each direction, reconfiguring the cross-section in each direction to two local lanes and three inside Express lanes (including the HOV lane).
- Alternative 3: Add two barrier-separated HOV lanes in each direction, for a total of six lanes in each direction (four regular and two HOV).

Three pricing alternatives which address the purpose and need statement were developed for the case study analysis, in addition to the above conventional alternatives evaluated in the Draft EIS. These pricing alternatives were variations on the No Build alternative and two of the three Build alternatives. Note that the pricing alternatives were not identified in the scoping process for this EIS and were therefore not evaluated in the EIS. The case study is simply intended to illustrate how pricing alternatives could have been evaluated.

In each pricing alternative, tolls would be charged only during peak hours (6-10 am and 3-7 pm) on priced express lanes and would vary dynamically, to ensure that traffic flows freely at all times, including the peak hour of each peak period. This would ensure premium delay-free service for transit and paratransit riders, carpools and toll-paying vehicles. It is important to understand that the primary intent of pricing is not to reduce mobility or freedom of travel, but to *increase* it by providing funding and uncongested travel conditions for better quality, cost-efficient alternative modes while instituting financial incentives to encourage use of these modes. In the alternatives developed, pricing revenues would fund high quality alternatives to solo-driving, including demand-responsive paratransit services, express bus or Bus Rapid Transit (BRT) services, and non-motorized options. And solo drivers willing to pay would enjoy a higher level of mobility.

The physical configurations for each of the three pricing alternatives developed for this case study are described below:

- Alternative 4: Divide the existing four-lane cross section in each direction into two sections of two lanes each, one local and the other priced express with free access for HOV and transit vehicles. Provide toll credits to motorists using regular lanes, as in the FAIR lanes concept. This is essentially the 8-lane No Build alternative with a pricing add-on.

- Alternative 5: Add one concurrent lane in each direction. Using barriers, divide the new 5-lane cross section into two sections - two regular lanes and three priced express lanes, with free access on the express lanes for carpool and transit vehicles. This is essentially the 0-lane Alternative 2 with a pricing add-on.

- Alternative 6: Add two barrier-separated priced express lanes in each direction, with free access on the express lanes for carpool and transit vehicles. This is essentially the 12-lane Alternative 3 with a pricing add-on.

Note that a pricing add-on to the 10-lane Alternative 1 was not evaluated. Barrier-separated priced lanes on a 10-lane cross-section are evaluated under Alternative 5.

5.3 Forecasting Travel Demand Impacts of Alternatives

A "pivot point" mode choice model (16), incorporated into SMITE-ML, was used to estimate impacts of the alternatives on peak period mode shares, pivoting off of estimated No Build mode shares in the year 2020. Table 1 presents the results from this analysis for one of three segments into which the project was divided for analytical purposes. The results are for the southern segment which had mid-range traffic levels. For this segment, the model estimated:

- An additional 3,400 transit person trips for conventional Alternatives 1, 2 and 3.
- An additional 21,000 to 24,000 transit person trips for pricing Alternatives 4, 5 and 6.

As shown in Table 1, carpool use estimated by the model ranged from an increase of about 14,000 person trips for the conventional alternatives, to smaller increases of 8,000 to 12,000 person trips under the pricing alternatives. Note that pricing does not generate as much carpool use as conventional alternatives because some would-be carpool commuters are attracted to transit due to the superior transit services under pricing alternatives provided with funding from toll revenues.

5.4 Evaluation of Analysis Results

Table 1 presents key evaluation information for the six alternatives for all three freeway segments combined, as estimated by SMITE-ML.

Delay Reduced

Table 1 first presents the delay reduction estimates (in person hours daily) for each of the six alternatives. The pricing alternatives reduce significantly more delay than alternatives with the same physical configuration but no pricing. Table 1 suggests that pricing Alternative 4, which does not increase capacity, is still able to reduce delay significantly. Delay reduced amounts to more than 75% of the delay reduction with conventional Alternative 1, which *does* increase capacity by one lane in each direction. Thus, if funding is not available in a timely fashion for capacity improvement alternatives, this alternative could be a very good interim solution. Alternative 5, which involves the same amount of new capacity and the same configuration as conventional Alternative 2, reduces delay by about 50% more than Alternative 2. Similarly, Alternative 6, which involves the same amount of new capacity and the same configuration as conventional Alternative 3, reduces delay by almost 50% more than Alternative 3.

Cost per Hour of Delay Reduced

The bottom line of Table 1 also presents the cost of each alternative per hour of delay reduced. As the table shows, the most cost-effective alternative with regard to delay reduction is Alternative 4. It costs only about $3 per hour of delay reduced. On the other hand, the

conventional Alternatives 1, 2 and 3 and pricing Alternative 5 are the least cost-effective. They cost about $9 to 13 per hour of delay reduced.

Toll Revenue

Gross annual toll revenue is relatively lower for Alternative 6 primarily because toll rates are lower, since the four regular lanes are less congested and travel time saved by taking the priced lanes is correspondingly lower. Revenues shown in the Table are gross revenues. For Alternative 4, approximately 25% of the revenue will be needed to pay for credits to motorists in the regular lanes, assuming a credit payout of 25% of the toll rate.

Transit Subsidy

Estimates of new transit trips from the mode choice model (see Table 1) were used to calculate new transit subsidies that would be needed to support service for the new trips and provide discount fares. Additional public subsidies were estimated at 50 cents per passenger mile, based on nationwide subsidies of $23.5 billion supporting 50 billion passenger miles annually (28). Estimates of new transit trips were used to calculate new transit subsidies that would be needed to support service for the new trips and provide discount fares. Table 1 shows the resulting transit subsidy estimates. Transit use under the pricing alternatives is about two and one-half times its use under the conventional alternatives. This results in a need for new public subsidies for transit which are about eight times the new subsidies needed for the conventional alternatives.

Annualized Public Costs

Table 1 presents estimates of annualized highway facility construction and right-of-way costs based on estimates from the Study report. These are then aggregated with annualized transit subsidy and pricing infrastructure and operation costs, to get total annualized public costs. Total annualized public costs, including capital costs for highway facilities, is higher for the pricing Alternatives 5 and 6, relative to the comparable "no pricing" Alternatives 2 and 3, primarily because of the larger transit subsidies needed.

Net Financial Impact

Despite the very conservative assumptions that were used in estimating toll revenue, the pricing alternatives bring in gross toll revenues estimated at about 70-75% of the new public subsidy needs for transit under Alternatives 4 and 5, and about 25% of that needed for Alternative 6. If alternative sources can be found for transit funding, the toll revenue will be available to provide a source of funding to support construction bonds for the highway improvements.

Net Benefits

The estimated excess travel delay costs during project construction and external costs from increases in vehicular travel relative to the No Build alternative were subtracted from estimates

of user benefits (i.e., time and fuel savings) to get net annual benefits. The present value of benefits over a 20-year period was estimated assuming a 7% discount rate.

Net Present Value

The present value of public costs for a 20-year period is then subtracted from the present value of benefits aggregated over all three segments, to get net present value. The pricing alternatives all demonstrate significant positive net present values, ranging from $517 million to $ 1.7 billion. Only one of the three conventional alternatives, Alternative 3, has a positive net present value amounting to $138 million. However, this is much lower than any of the pricing alternatives.

6.0 CONCLUSIONS

As pricing becomes increasingly tested and proven in the real world, it is moving out of the laboratory and into the field. This indicates that the time is ripe for pricing to be more seriously considered during the NEPA process, the forum for arriving at major transportation decisions. Given the variability of situations across the country, the authors offer no specific guidance on how or when this consideration is most appropriate -- as part of the 3C planning process that lays the foundation for the NEPA process, during NEPA scoping, or as part of the detailed consideration of alternatives under NEPA. Nevertheless, this paper has introduced relatively simple analytical procedures that may be used to estimate the impacts of pricing alternatives and generate information for use by decision-makers. The case study has also demonstrated that pricing can often effectively compete with conventional alternatives in addressing the purpose and need of a major highway project, while generating net revenue surpluses to make transportation improvements financially feasible.

Transportation agencies could use techniques such as those discussed in this paper to evaluate pricing alternatives and provide impact information to decision-makers. Transportation agencies could also undertake a concerted effort to educate the public about pricing alternatives and their advantages and disadvantages during the alternatives development phase of any study for a major highway project in a metropolitan area. As discussed in this paper, FHWA has developed several tools, both for public education as well as for analysis and evaluation. These tools will make it easier for transportation agencies to incorporate pricing alternatives into NEPA studies for major highway projects in metropolitan areas.

Evaluating pricing alternatives in the NEPA process will be an evolving practice for many years to come. Practitioners will need to constantly monitor the work of their peers. One resource to assist in this effort is the FHWA sponsored NEPA community of practice, Re:NEPA, (http://nepa.fhwa.dot.gov)

ACKNOWLEDGEMENTS

The authors would like to acknowledge valuable comments received from Dr. Bruce Spear of FHWA, and anonymous reviewers from the TRB Committee on Environmental Analysis in Transportation. However the authors alone are responsible for any errors or omissions, and the

views expressed are those of the authors and not necessarily those of the U.S. DOT or the FHWA.

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TABLE 1. SUMMARY OF IMPACTS OF ALTERNATIVES

		Conventional Alternatives			Pricing Alternatives		
		No 1	No 2	No 3	No 4	No 5	No 6
Travel Demand on Southern Segment							
Total daily person trips	445,000	445,000	445,000	445,000	445,000	445,000	445,000
Solo driver	178,000	160,952	160,952	160,952	142,266	144,864	149,103
Carpool	35,600	49,238	49,238	49,238	47,383	45,849	43,345
Transit	8,900	12,310	12,310	12,310	32,851	31,787	30,051
Total	222,500	222,500	222,500	222,500	222,500	222,500	222,500
Total daily vehicle trips	333,689	335,570	337,453	341,123	303,954	312,830	345,622
Portion of daily vehicle trips: On Freeway	280,299	289,488	292,094	297,620	249,723	268,079	309,107
On Arterials	53,390	46,081	45,359	43,503	54,231	44,751	36,515
Estimated Impacts for Entire Corridor							
Total travel delay reduced daily (person hours)		89,221	94,490	118,597	68,962	143,520	173,343
Gross annual revenues from tolls (mil.$)		$0	$0	$0	$28	$31	$9
Total annualized costs for pricing (mil.$)		$0	$0	$0	$3	$3	$3
Annual transit subsidy increase (mil.$)		$5	$5	$5	$42	$40	$37
Annualized highway facility cost (mil $)		$250	$303	$272	$14	$303	$272
Total annualized public cost (mil $)		$255	$308	$277	$59	$346	$312
Present value of benefits (Mil.$)		$2,279	$2,420	$3,075	$2,053	$4,184	$5,073
Present value of costs (mil. $)		$2,704	$3,266	$2,937	$477	$3,667	$3,306
Net present value (mil. $)		-$425.22	-$845.84	$137.56	$1,428	$516.88	$1,766.32
Cost per hour of congestion delay reduced		$11	$13	$9	$3	$9	$7

EXHIBIT

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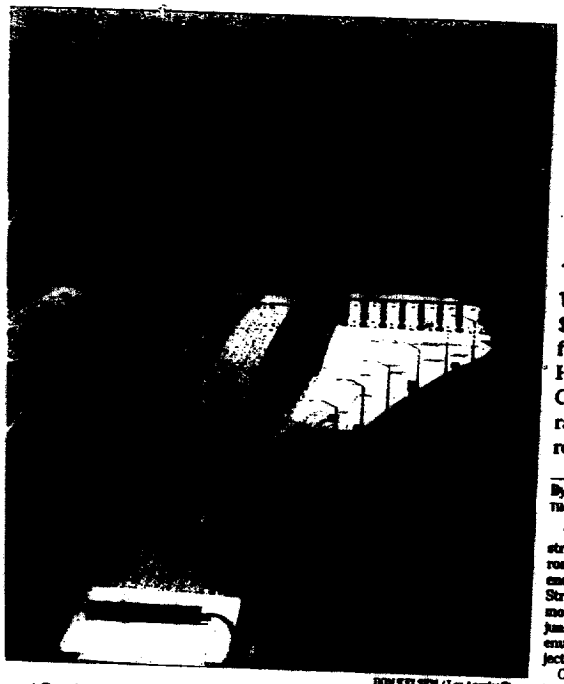


DON KELSEN / Los Angeles Times

vport Beach and San Juan Capistrano, is the second in two years by Fitch IBCA.

O.C. Tollway Bonds Are Downgraded

Transit: More than $1 billion in notes that funded the San Joaquin Hills Transportation Corridor are given 'junk' rating as traffic and revenue fall short.

By DAN WEIKEL
TIMES STAFF WRITER

The financial picture for the struggling San Joaquin Hills toll road in west Orange County worsened Tuesday, when a major Wall Street ratings agency downgraded more than $1 billion in bonds to junk status because traffic and revenue continue to fall short of projections.

Citing higher potential risks for investors, New York-based Fitch IBCA lowered the rating for more than half of the tollway's $1.8 billion in bonds from BBB-minus, the lowest investment grade, to BB, or speculative grade—so-called junk bonds.

Toll road officials said paying customers won't be affected by the lowered rating and that the turnpike's financial future appears sound.

But one director of the agency that oversees the tollway said the downgrade raises serious concerns about the road's future.

Tuesday's rating change is the second time in two years that the agency has downgraded bonds that were sold to finance the 15-mile tollway that runs from Newport Beach to just north of San Juan Capistrano.

In February 2000, Fitch lowered its rating from BBB to BBB-minus because the growth in traffic and revenue from the tollway had fallen short of 1997 estimates. Late last year, Standard & Poor's, another rating agency, concluded that the financial outlook for the turnpike was bleak.

"There has been a meaningful downward shift, from the 1997 forecast, in the growth rate of revenue over the past two years," said Cherian George, a senior director at Fitch Ratings. "With the compounded effects of a toll increase in July 2001 and the recession, traffic performance in fiscal year 2001 has been tepid."

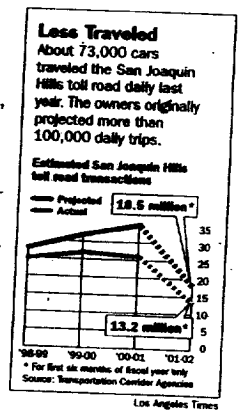
George and other bond consultants say the downgrade will hurt toll road investors by lowering the value of $789 million in uninsured bonds issued in 1997 and $220 million in revenue bonds sold in 1993. An additional $795 million in San Joaquin Hills bonds sold by the agency in 1997 still retain their AAA rating because they are insured.

Standard & Poor's and Moody's Investors Service, a third rating agency, have yet to reevaluate their investor-grade ratings of the turnpike's bonds.

The San Joaquin Hills toll road is part of a 51-mile network of Orange County tollways operated by the Transportation Corridor Agencies, based in Irvine.

Figures dating to 1998 show that the tollway has never met its annual projections for traffic and revenue.

TCA officials had forecast that the turnpike would generate almost $37 million in toll revenue for the last six months of 2001. The actual amount was about $28 million. For fiscal year 2000-01, the TCA projected toll revenue of more than $63 million but received about $51 million.



Los Angeles Times

"We are disappointed" at the lowered rating, said Walter D. Kreutzen, the chief executive for TCA. "However, this action will have no impact on the agency's ability to make its debt payments, operate the road or service our customers."

The TCA has substantial re-

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public outcry," said Gerald Manpearl, an attorney representing Hollywood Bowl Easter Sunrise Service Inc., which says its predecessors initiated the annual service 80 years ago.

"People were outraged," Manpearl said. "The service is part of the long history of Los Angeles and Hollywood. Trinity has demonstrated in the past that what they put on isn't a community event, it's for Trinity."

Elizabeth Hinckley, a spokeswoman for the Los Angeles Philharmonic Assn., which handles Hollywood Bowl leases for the county, confirmed that Trinity had dropped out.

She said the veteran Bowl group apparently will now produce this year's event.

Questions to Trinity were referred to Colby May, an attorney in Washington.

May's family declined to call him to the phone Tuesday night.

A squabble between the Orange County television ministry and the Los Angeles civic group had raged for months over rights to produce this year's service.

Trinity said it had been unfairly excluded from past sunrise services, but the Los Angeles group said Los Angeles County had pledged to lease the bowl to the group each Easter for a token payment of $1.

The group said the agreement was good for 99 years and was renewable.

But county officials said they

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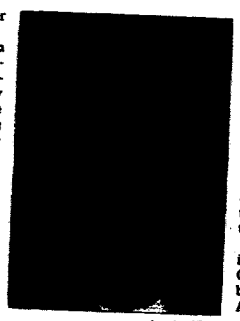
perts determine they are no longer likely to offend again.

The predictability of recidivism is a question that has long tantalized mental health experts and social scientists. Study upon study has been performed to determine the percentage of sex offenders who will attack again after being returned to society.

But whether any individual sex offender will be among those who commit more crimes is extremely difficult to predict. The language of the law does not always translate in psychiatry, and vague legal standards often fail to reflect the realities of predicting future threats.

"It's like weather forecasting," said R. Karl Hanson, a Canadian government researcher who is a leader in the field of predicting

Please see PREDATOR, B9



Associated Press

Three California-licensed mental health experts concluded that Patrick Ghilotti should be freed.

O.C. Fire Volunteers May Get New Role

Public safety: Plan would focus 322-member program on emergency medical response instead of firefighting.

By DAVID HALDANE
TIMES STAFF WRITER

In what could lead to a major overhaul of a decades-old volunteer firefighting program, the staff of the Orange County Fire Authority will recommend to the board today that most volunteers no longer fight fires and only provide emergency medical service.

Scott Brown, a Fire Authority spokesman, said the board also will be urged to close two of the county's 62 fire stations.

"The bottom line is that we need to build a program that is more accessible, more reliable and more sustainable into the future," Brown said. "At the end of the day, people in Orange County will be better served: We're not taking anything away, we're making it better."

After hearing the recommendations at a workshop this afternoon, Brown said, the board is expected to take action on them at its March 28 meeting. If the proposals are adopted, he said, "I would anticipate we would move fairly quickly—as early as April."Though some volunteers expressed concerns, many said the proposal has merit.

Chad Selk, 31, a volunteer firefighter at Orange's Station 1 for seven years, said Tuesday that he is "bummed" that the station would close under the plan and that he

Please see FIRE, B9

'E LOPEZ
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lahn's Political Puberty

passing himself off as the best friend of the black man since Abe Lincoln.

And now, before those wounds have been licked, he dumps Parks without first building a case for doing it.

But whether Hahn acted for reasons of conviction, politics, or just felt the need to establish that he isn't a pushover, I'm going to say something in the mayor's defense. Los Angeles ought not to be choosing or holding on to a police chief on the basis of skin color, simple as that.

Given the LAPD history of brutality, we can all understand why the African American community feels a sense of comfort in seeing a Willie Williams or Bernard Parks at the helm. But if we wanted a top cop who best reflected the new L.A. color-wise, wouldn't we go brown?

bystanders. And the crime rate, last I checked, is not on Parks' side.

There's only one question that matters as the Police Commission figures out whether to send Parks into early retirement, and this is it:

Is he getting the job done?

You could argue all day and night without a consensus because there is no easy answer.

It's like trying to figure out if the school principal is getting the job done, and you can't trust everything you hear from teachers or students.

Parks is a reformer who made the LAPD honest and professional in ways it has never been. But morale has sunk because he's like the overbearing Dad who inspects your plate after dinner and sends you off to your room for not clearing every pea.

"We don't have a problem

zeal, Parks has guarded his empire from the highest turret, sniping at critics and heading off every attempt to open the department to outside review by citizens or professionals.

We'll never know how deep and wide the Rampart scandal ran because Bernard Parks, in the moment that sealed his entry into the control freak hall of fame, wouldn't let anyone in to have a look.

You have to admire the man's confidence, ego, or whatever it was. But how effective can he be with rock-bottom morale and a mayor he refuses to work with?

At the press conference, Hahn talked about what a tough decision this was. I don't know. I think Parks made it easy for him.

Steve Lopez writes Monday, Wednesday and Friday. He can be reached at steve.lopez @latimes.com.

RATING: Tollway Bonds Downgraded

Continued from B1

sources available, including $140 million in cash reserves and a $12-million line of credit from the federal government, which has never been tapped.

The agency is also set to increase tolls again throughout its system Sunday, which could increase revenue by about $3.1 million a year.

Fares at the main San Joaquin Hills toll plaza will increase from $2.50 to $3 for cash-paying drivers who travel the entire road any time of day.

Those who use a FasTrak transponder, an electronic billing device, will pay a maximum of $2.75, a 25-cent increase, during peak travel times.

Kreutzen said the San Joaquin Hills toll road made a scheduled debt payment of $35.9 million three weeks ago.

The TCA will make all future bond payments and the financial picture looks "very strong" for the agency over the next five years, he said.

"We are not in a panic mode yet. We will be fine at least until 2007," said Orange County Supervisor Todd Spitzer, who sits on the San Joaquin Hills board of directors. "But we had better do a reality check about this toll road in 2008 and beyond to determine what we are going to put into place to ensure its solvency."

Spitzer said the projected performance of the San Joaquin Hills has been dramatically overstated since the beginning. The elected officials who sit on the tollway board already are doing a lot of soul-searching, he said.

"Is our duty to the bondholders or our constituency, those who elected us?" Spitzer said. "The magic answer isn't always going to be raising tolls."

In their rating report, Fitch analysts said the growth in traffic and revenue for the San Joaquin Hills toll road has been 9% to 10% a year, several percentage points below projections. There has been some concern that the growth rate might not keep pace with the road's debt payments, which are scheduled to increase over the years.

Fitch analysts said they remain confident in the TCA's ability and willingness to deal with the increasing economic risks of the San Joaquin Hills tollway. But they contend that the effects of the impending toll increases remain unclear.

The Fitch report said traffic and toll revenue for other turnpikes operated by the TCA generally have exceeded projections. Fitch has rated the bonds sold to build the Foothill and Eastern tollways as BBB investment grade.

EASTER: Trinity Drops Sunrise Service

Continued from B1

could find no records of such an agreement.

The officials said a lottery was the only fair way to settle the dispute, and ordered the coin toss.

On Jan. 25, the coin was tossed by William Jacobs, an auditor for an accounting firm hired by the Philharmonic Assn. Trinity won.

But Hollywood Bowl Easter Sunrise Service vowed to carry on

"This is not the end," Norma Foster, president of the group, said after the coin toss. "We'll battle on behalf of the people of Los Angeles."

Attorneys for the group vowed to seek an injunction that would prevent Trinity from taking over. Now, apparently, that court action, scheduled for today, will not be necessary.

Many have criticized Trinity's

sonalities and the lifestyles of network founders Paul and Jan Crouch.

The Crouches drive expensive cars and own several homes, including a Newport Beach estate reported to be worth $5 million.

According to year 2000 tax documents, Trinity Christian Center of Santa Ana, which oversees a network of Trinity Broadcasting organizations and overseas ventures

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Toll-road bonds are junk

Debt • A rating agency reacts to flagging revenue on the San Joaquin Hills tollway.

By HEATHER LOURIE, JOEL ZLOTNIK and JAMES KELLEHER
The Orange County Register

Wall Street sent a warning Tuesday that the operators of the San Joaquin Hills (73) Toll Road may have trouble paying their bills when a rating agency downgraded the road's bonds to junk status.

The announcement comes as the tollway plans to increase rates Sunday – the third hike in two years – and analysts said more hikes may be on the way.

"We think they'll have to keep raising rates over time," said Cherian George, a senior director of public finance at Fitch Ratings in New York. "They may have to do more of it."

He said the downgrade was based on lower-than-expected revenue growth.

Revenue from the 73 Toll Road was at 77 percent of projections for all of 2001, with a monthly low of 72 percent in December.

"There may not be a scenario where you can generate enough revenue where you can pay those bonds," said County Supervisor Todd Spitzer, a toll-road board member. "That's the message Fitch is sending.

"We're not in panic mode, but

TOLL • PAGE 4

MORE INSIDE » **Business 1**
Jonathan Lansner – Battle lines forming: drivers vs. bondholders

Tanning lamps, cancer

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2 killed in 63-car pileup in dense fog near Fresno

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organization represents more than 5,000 facilities nationwide.

Q. How prevalent is skin cancer?

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A. Dr. Kenneth Linden, assistant professor of derma-

causing effect.

"The indoor-tanning industry has taken steps to get rid of the most harmful wavelengths from a tanning booth, but it is not 100 per-

this report.

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Contact Liddane at (714) 796-7854 or liddane@ocregister.com

Help for a new start

Ani Duna Torres has found plenty of parances and motivational-speaking engaging a gold medal at the 2000 Olympics at three Olympics, I didn't win, and I ed and wondering "What am I going photo: Bruce Chambers / The Register

no interest in school, an injured shoulder and little chance of making the 1980 U.S. team.

Depressed, scary-thin and defeated, she went to the school's Sunset Canyon Recreation Center pool. The morning was pre-dawn dark and cold enough that frost clung to the deck.

"I wanted to start my life over under a whole new identity," she said, recalling the morning she decided to quit swimming, transfer to Long Beach State and dive into another life.

With no skills and no job experience, Heddy-Drum took work as a hostess at Captain Jack's in Sunset Beach, as a waitress at the former Chart House, and as a sales representative for a food company and a temp service before coming across a newspaper classified ad for a United Airlines sales position in 1985.

"Every time I landed another account, I got that same rush that I felt when I won in swimming," she said. "I found a way to stay competitive."

The walls in Heddy-Drum's home office are lined with pictures of her last and only Olympics, 26 years and a whole other identity ago.

"As time passes, I appreciate having been an Olympian," she said. "But that was my other life."

Now she hopes other athletes find theirs.

• Contact Smith at (714) 796-2297 or msmith@ocregister.com

Where they are now

Here's what some former Orange County Olympians are now doing. Following their names are Olympic year(s), sport, and current job and residence.

Mark Bucher: 1992; volleyball; financial management; Newport Coast

Chuck Gilchrist: 1960, 1964, water polo; insurance broker; Yorba Linda

Cathy Gundlund: 1988, 1992; kayak; Long Beach Fire Department captain; Huntington Beach

Wendy Burge-Middleton: 1976; figure skating; teaches figure skating; Mission Viejo

Janet Evans: 1988, 1992, 1996; swimming; motivational speaker; Placentia.

Janet Evans

Cathy Ferguson: 1964; swimming; AVSO vice president, chief marketing officer; Huntington Beach

Ken Fuller: 1972, 1976; cycling; property management; Anaheim Hills

Bruce Furniss: 1976; swimming; commercial real estate; Anaheim Hills

Steve Furniss: 1976; swimming; former TYR owner; Huntington Harbour

Kathy Heddy-Drum: 1976; swimming; United Airlines corporate sales executive; Seal Beach

Rex Maughan: 1964; track and field; Tustin electronics manufacturer; Yorba Linda

Jim Mills: 1988; tae kwon do; chiropractor; Aliso Viejo

Karch Kiraly: 1984, 1988, 1996, 2000; professional volleyball; San Clemente

Bill Leach: 1976; kayak; high school teacher; Irvine

Julie Leach: 1976; kayak; high school teacher; Irvine

Dr. Sammy Lee: 1948, 1952; platform diving; semi-retired physician; Huntington Harbor

Ann Meyers-Drysdale: 1976; basketball; sportscaster; Huntington Harbor

Lori Ogren: 1992; handball; coach; Huntington Beach

Bob Pelce: 1968; track and field; computer consultant; Irvine

Dwight Stones: 1976, 1984, 1988; track and field; real estate broker; Irvine

Julie Swail: 2000; water polo; UC Irvine women's water polo coach; Irvine

Peter Vidmar: 1984; gymnastics; motivational speaker; Coto de Caza

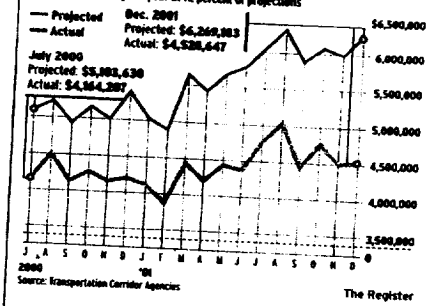
Jim Wooley: 1972, 1976, judo; chiropractor; Irvine

Amy White-Bellidis: 1984; swimming; paralegal; Lake Forest

• Source: Southern California Olympians

Toll shortfall

Revenue on the San Joaquin Hills (73) Toll Road remains behind projections, ending the year at 72 percent of projections



Source: Transportation Corridor Agencies

The Register

TOLL: Rates due to rise

FROM PAGE 1

we have to strategize how we do the pricing. There's only so much traffic you can eke out of the system, and the numbers now aren't even close to the original projections," Spitzer said.

Fitch lowered the road's credit rating on $795 million of bonds by two notches, from BBB- to BB, skipping the BB+ rating in between.

Moody's and Standard & Poor's still have investment-grade ratings for the road's bonds - but they are the lowest ratings before junk.

Tollway officials insist the road is viable and "nowhere near default."

"We certainly are disappointed," said Lisa Telles, spokeswoman for the Transportation Corridor Agencies.

But, she said, the announcement will not endanger future debt payments or the ability to operate the road that runs from Newport Beach to San Juan Capistrano. The tollway has access to an $11 million federal line of credit to protect against default.

The $1.8 billion tollway opened in December 1996 and was refinanced in 1997, after ridership levels fell 40 percent below projections. About 80,000 drivers a day pay up to $2.50 each to drive the route under current rates.

Spitzer said Tuesday's action could have "serious implications" for the proposed southern extension of the Foothill (241) Toll Road from Rancho Santa Margarita to San Clemente.

"It gives a boost to those against the Foothill-South to say, 'See? Toll roads don't work,'" Spitzer said.

Finding financing for the extension could be rough.

"Any further construction of toll roads is not feasible," said San Clemente City Councilman Wayne Eggleston, a Foothill-South opponent. "Who's going to buy these bonds now?"

Linda Lindholm, the San Joaquin Hills board chairwoman and a Laguna Niguel councilwoman, said that the Foothill Toll Road and board are separate and would be unaffected by the 73's problems.

The Foothill road was running 8 percent ahead of projections last year, and the bonds remain rated BBB by Fitch.

Peter Samuel, publisher of a Washington D.C.-based toll-road newsletter, said the downgrade is unusual, but not the first.

Garcon Point Bridge outside Pensacola, Fla., is near default.

"It's only gotten half the traffic it was expected to get," he said.

Previously, the Chesapeake Bay Bridge-Tunnel and the Chicago Skyway have both been in default, although the Skyway is now healthy because traffic has grown.

"I don't think the San Joaquin Hills (Road) is so bad, but it was an expensive road to build, and it's got some pretty hot competition from the I-5 and I-405 freeways, where Caltrans has improved the traffic flow on that. They should have been able to forecast that, but forecasting is a very inexact science," he said.

Pete Van Nuys, an advertising salesman from San Clemente, said he drives 30,000 miles a year and, despite being critical of the TCA, he uses the toll roads when he has to. He said he wasn't surprised by the bond-rating downgrade, especially in a slumping economy.

"In a free market with freeways around, tollways are not a real attractive investment right now," he said. "It's not like a (toll) bridge where the only other option is you're going to drown."

Speak your mind:
How high do tolls have to be before you'll stop using the 73? Join the discussion at www.myoc.com/toll/tolls

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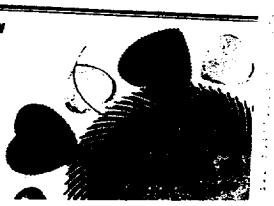
CORRECTIONS & CLARIFICATIONS

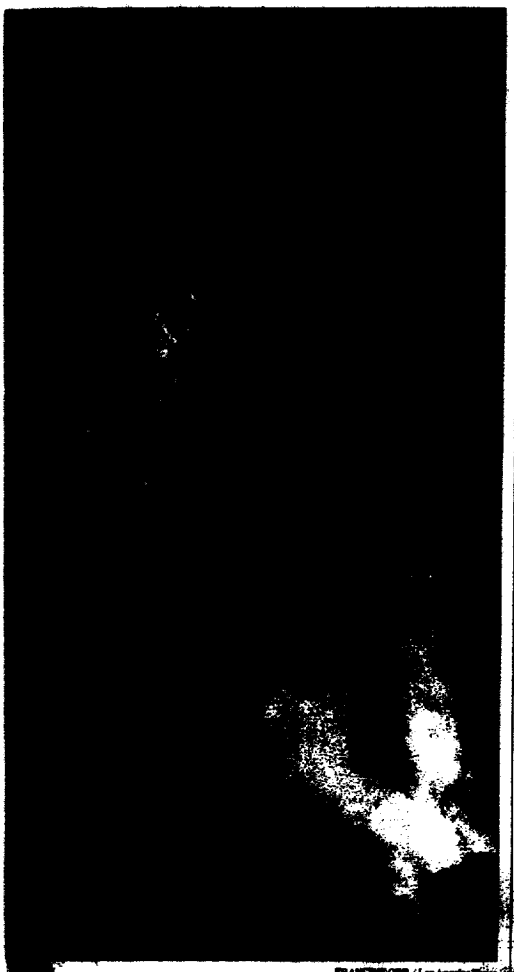
• It is The Orange County Register's policy to correct promptly all errors of substance. To report an error or clarify a news story, please direct your letter to the attention of the publisher at Box 11626, Santa Ana, CA 92711-1626.

TOMORROW

ACCENT/FOOD: Paris in Orange County? Restaurant critic Patricia Wells gives an irresistible Valentine's dinner menu from her favorite Paris haunts.



Los Angeles Times 2-11-02



FRANCINE ORR / Los Angeles Times

...ter on the fire Sunday. So far, flames have stayed clear of homes.

Bigger Burn:
...ush fire in northern San Diego County chars 14 homes and routs hundreds, with some injured. A1

California Department of Forestry and Fire Protection. Four water-dropping helicopters also were on hand, although only two were flying most of Sunday because of the winds.

About 650 acres in Coal Canyon became part of Chino Hills State Park last year, after a development company that planned to build 1,550 homes agreed to sell the property to the park system for $30 million.

Advocates say the canyon is important because it joins two large wilderness tracts in one of California's fastest-growing areas. That connection allows animals to roam freely between Chino Hills State Park and Cleveland National Forest.

"It's a critical missing link in that chain of wild lands," said Claire Schlotterbeck, president of Hills for Everyone, which spearheaded the deal. "It's an opportunity for plants to spread themselves where they once were."

The landscape hit by the weekend fire features several rare plants and trees, including one of the world's four remaining stands of Tecate Cypress, a species that once blanketed the southwest. Riversidian sage scrub, dudleyas and Braunton's milk-vetch are among other shrubbery and flowers in the area.

"A lot of these plants and trees are dependent on fire," Schlotterbeck said. "It might not be bad for them. But it sure does pain the heart to see [the canyon] burn after we just saved it."

As ground crews made their

Please see WILDFIRE, B7

Financial Jam Mires O.C.'s Toll Highways

Transportation: Rosy predictions were hurt by recessions, lack of drivers. The system teeters on the economic edge as TCA officials seek a cure.

By DAN WEIKEL
TIMES STAFF WRITER

Traffic consultants for the San Joaquin Hills toll road, which runs through one of the wealthiest swaths of coastal California, were effusive back in 1992 when they prepared to sell $1.2 billion in bonds to finance the turnpike.

The tollway, they predicted, would average about 94,500 motorists a day within a year of its opening—more than enough to pay expenses and interest on the project's enormous debt.

A decade later, the sky is not so blue.

The 15-mile tollway, which opened in late 1996, has failed to live up to its traffic and revenue projections. As of December, an average of 72,000 motorists traveled the road each day, well short of the 1992 forecast or even a revised, more conservative, estimate issued in 1997.

"It remains a hard sell," said Michael McNally, an engineering professor at UC Irvine's Institute for Transportation Studies. "It doesn't surprise me that they are having problems. The road was premature."

Now, with a Wall Street rating firm reducing the highway's bond rating to "junk" status, the toll road authority has been going about the sobering business of revisiting its finances. The CEO for the toll agency said he fears the road could be in technical default within five years, a financial path that has put other toll roads across the nation in financial peril.

All this comes as tolls on the road are being raised to $3 a trip, a move that could generate new revenue or drive away customers.

The scenario for technical default is real, according to Walter D. Kreutzen, chief executive officer for the Transportation Corridor Agencies. He said bondholders were promised that the toll road would earn $1.30 for every dollar of debt. The ratio was offered as a margin of security for investors.

If the toll agency fails to maintain that ratio—which Kreutzen said is very possible—that financial covenant with investors will be broken. "It is not good," Kreutzen said, "to be in any kind of default."

Failing to meet the requirement does not mean that bondholders won't receive their interest payments. The declining margin, however, is a substantial warning of in-

Please see TOLL, B8

DNA Bank Helps Solve Old Crimes

Law enforcement: Samples taken from criminals provide a boon. But California lags some states, critics say.

By BETTINA BOXALL
TIMES STAFF WRITER

Years had passed without an arrest in the rape and murder of a teenage hitchhiker in redwood country's Del Norte County. Then, last summer, a name popped up on a state computer.

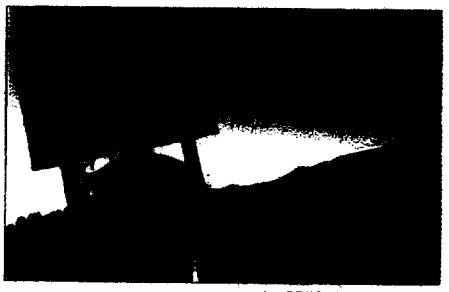
Robert Allen Wigley was a "cold hit" in the state's convicted offender databank. His DNA matched evidence samples from the crime.

"This is just a wonderful thing that happened," said Del Norte County sheriff's Det. Gene McManus, who had investigated suspects since the 1994 killing—but never Wigley. "He was a gift from heaven."

Wigley's identification and homicide arrest were, more precisely, a gift of California's 8-year-old DNA databank, which is slowly kicking into gear after a history of underfunding and neglect.

In 2001 there were 48 cold hits matching DNA evidence from unsolved crimes with the genetic material of convicted felons—the program's most successful year by far.

Please see DNA, B6



LAWRENCE K. HO / Los Angeles Times

Yedvart Tchakerian, one of few individual volunteers who clean roadside, says, "When I go out there, I feel like I'm doing a good deed."

Firms Cleaning Up on Roadside Maintenance

Transit: Adopt-a-Highway is serviced by

kerian, who patrols his adopted roadway in the Santa Monica Mountains with a litter pickup

'EZ

Parks Battle

...our ... pointed to a big, peach-colored house.

"That's where Chief Parks lives," he said. "I can't go knock on his door in the middle of the night if I need something, but he's not in some gated community. He's right here in the 'hood, and you see him at the 7-Eleven and he says hello."

Evans drove me past his own

INSIDE

GOP Convention Favors Simon
Millionaire businessman Bill Simon Jr. tops two rival gubernatorial candidates in a straw poll at the state Republican convention. B5

Irvine Traffic Tie-Ups?
Two developments near the former El Toro base would add twice as much traffic as an airport. B3

No Graffiti Guards
A panel recommends that the pub-

TOLL: Roads' Future in Doubt

Continued from B1

creased risk and serious financial problems for the toll road.

The slower-than-expected traffic growth on the toll road had already prompted two of three Wall Street rating agencies to downgrade more than $1 billion in corridor bonds to the lowest investment grade. Last week, Fitch IBCA went a step further and kicked its rating down to speculative grade, or so-called junk bond status.

The San Joaquin Hills tollway, which runs from Newport Beach to north of San Juan Capistrano, is part of a 51-mile network of toll roads built and operated by the Transportation Corridor Agencies. Each of the network's two corridors—the San Joaquin and the Foothill-Eastern—has its own board of directors and financial obligations.

The San Joaquin Hills tollway has long been the problem child of the family. Transportation analysts blame its low ridership on factors that have hampered similar toll-road projects across the country: lower-than-expected population growth, recessions and competing public highways.

The San Diego Freeway and Interstate 5, they say, remain viable options for drivers who might not want to spend as much as $3 to shave 10 to 15 minutes from a peak-hour trip.

Both freeways, which run through central Orange County, have been steadily improved over the years, including elimination of the notorious congestion at the El Toro Y. The dreaded interchange linking the two freeways has been completely rebuilt and widened.

Two Recessions Take Toll on San Joaquin Corridor

From an economic standpoint, the San Joaquin Hills toll road has been battered by two recessions since it opened, slowing growth in Orange County and particularly in the area served by the tollway.

In a 1997 report, traffic consultants Wilbur Smith Associates concluded that traffic growth was hurt by a significant economic downturn in Orange County and the rest of Southern California during the early to mid-1990s.

Researchers said the recession delayed increases in employment in Orange County for at least six years and somewhat longer along the San Joaquin Hills corridor.

By the time the toll road opened, the Smith report stated, employment levels in the project area were still lower than they had been in 1990 and about 21% less than had been forecast for 1997.

"The 5 and 405 are very viable alternatives and the growth in housing and commercial development has not occurred as rapidly as thought," said Kia Mortazavi, manager of planning for the Orange County Transportation Authority.

Peter Fielding, a professor at UC Irvine's Institute of Transportation Studies, predicted in the mid-1990s that the San Joaquin Hills would encounter financial difficulties because of a lack of motorists for such a large highway. He said a smaller four-lane road would have accommodated growth for many years as long as tolls were raised and lowered based on demand.

"This advice was rejected," Fielding said.

Whether the San Joaquin Hills will default on its bond is unclear. But if it does, it will not be the only tollway in the nation to have suffered severe financial setbacks.

The Chicago Skyway defaulted on its bonds for about 10 years before it finally recovered in the mid-1980s. During that time, the tollway stopped paying interest to bondholders. The Chesapeake Bay Tunnel went into default as well in the late 1970s.

Today, the Garcon Point Bridge, east of Pensacola, Fla., is on the brink of default on its bonds. The $100-million project includes a 3½-mile long bridge and more than seven miles of connecting roads.

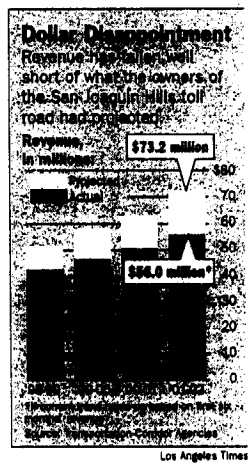
Peter Samuel, editor of Toll Roads Newsletter, based in Maryland, said some of these operations recovered and resumed paying interest to bondholders.

"Many of these roads depended on development for their success," Samuel said. "But the expected development often takes a lot longer than the boosters say it will."

Forecasts by Wilbur Smith Associates had originally called for 94,500 riders a day on the San Joaquin Hills toll road during its first year of operations. But by spring, six months after its grand opening, the tollway was averaging only 48,250.

DON KELSEN/Los Ange

The San Joaquin toll road, which goes from Newport Beach to of San Juan Capistrano, handles about 72,000 drivers pe



Los Angeles Times

Tollways Fell Short of Projections From Start

Toll officials predicted the shortfall would not hurt the corridor's ability to meet expenses and pay the interest on its bonds. They also predicted the gap would disappear within a year.

It didn't.

From July 1998 to June 1999, projections called for the road to earn almost $51 million in toll revenue from 28.5 million riders. But it actually collected $42.6 million from 24.8 million transactions.

The latest available figures indicate that the gap is widening. For the first six months of fiscal year 2001-02, projected revenue was about $37 million from 18.5 million riders. The actual revenue was $28 million from 13.2 million riders.

If trends continue, the to enue for the current fisca might be about $56 millior 26.5 million motorists. The tions call for almost $73 mil revenue from 37 million drive

The question facing corri ficials is whether revenue ca pace with the road's deb ments, which increase ever for the life of the bonds. Th service is scheduled to go u $46.7 million in January 2 $186 million in 2034.

Kreutzen said he is co that the San Joaquin Hil meet its financial obligation 2007. There is a cash rese $140 million and a $12-milli eral line of credit, which ex five years. The toll agency a been cutting its adminis costs to save money.

To help pay the debt serv corridor agency already has $36-million infusion of cas the settlements of lawsuits to the Orange County bankr

Today, transportation are considering ways to re the tollway, including a me the two boards that govern Joaquin Hills, the Foothill Eastern turnpikes.

They say they hope to proposals to the corridor's ship this year.

Bond rating reports sho the transportation authority sidering refinancing the ou ing bonds of all three toll Revenue would be combi cover the annual debt ser the unified system.

"My goal is to do a solid term fix," Kreutzen said.

The Foothill and the tollways are the healthiest three highways, with riders ning ahead of projections b 8%. Bond rating agencie evaluate the agencies' del described the economic ou the two turnpikes as stable.

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Troubled Tollway to Get Financial Review

Transit: Frustrated by low ridership and revenue, San Joaquin Hills board votes to hire a consultant.

By DAN WEIKEL
TIMES STAFF WRITER

Operators of the San Joaquin Hills toll road Thursday agreed to hire an independent consultant to study the highway's economic problems and determine how to keep the coastal Orange County turnpike solvent.

The tollway's board of directors unanimously approved a proposal by chairwoman Linda Lindholm to hire an outside firm to complete a financial analysis of the 15-mile highway that runs from Newport Beach to San Juan Capistrano.

"I would like a second set of eyes for our board," Lindholm said. "We need to take some positive steps to improve the economic future for Highway 73. The financial news is not good right now."

The measure grants board members the power to create a hiring committee and seek proposals from national transportation consultants with experience in toll road financing. The contract amount is not to exceed $50,000, and whoever is hired will answer to the board of directors.

Lindholm, a Laguna Niguel councilwoman, called for an independent analysis after Fitch IBCA, a Wall Street ratings agency, downgraded to junk status about $1 billion of the $1.8 billion in bonds sold to finance the San Joaquin Hills tollway.

Board members also are concerned about a chronic failure of the highway to meet revenue and traffic projections since it opened in 1996. Tollway figures show the gap between projected and actual performance is widening.

Though they acknowledged that the road's financial problems are serious, board members said the situation is not critical. They noted that traffic continues to grow on the tollway and the corridor agency has the resources to cover its interest payments until 2007.

"This should not be construed to mean there's a crisis," said board member William S. Craycraft, who is the mayor of Mission Viejo. "I applaud and support the review. Maybe it should have been done sooner."

Toll road officials said the turnpike has $140 million in cash reserves, the ability to raise tolls and a $12-million federal line of credit that has not been tapped. They noted that two other Wall Street ratings agencies have not lowered their assessments of the tollway's bonds to junk status.

MARK BOSTER / Los Angeles Times

San Joaquin Hills Transportation Corridor Agency board member Bert Hack listens to the discussion. The board unanimously approved hiring a financial consultant in a contract not exceeding $50,000.

"In the Hands of the People," Dwyer's appraisal of the jury system.

"Among federal judges in the Northwest in modern times, he's without peer," said Stewart Jay, professor of law at the University of Washington. "Frankly, I think he's one of the great federal judges, period. He stands very well among some of the great trial judges of our history."

"He was a towering figure before he was ever put on the bench," District Judge Robert Lasnik said.

A liberal Democrat, Dwyer was appointed to the U.S. District Court for the Western District of Washington in 1967 after 30 years of practicing law in Seattle, where he earned the nickname "Destructo" for his low-key yet relentless way with opponents on the witness stand.

Among Dwyer's better-known cases as a district judge were the

Associated Press

WILLIAM L. DWYER

He held the American League to its promise of baseball for Seattle and the government to its pledge of protection for old-growth forest.

and Okanogan County jury members, many in jeans and dirt-splattered shoes, with his arguments that a decent man had been libeled.

In a tragic twist 22 years later, Goldmark's son, Charles, a prominent Seattle attorney, and his wife and two young sons were beaten and stabbed to death by a jobless steelworker. David Rice, who told a friend the night of the murders that he was going to kill "the top communist," was sentenced to death in 1986.

In 1970, Dwyer was hired to represent the state and King County in a lawsuit against the American League and baseball owners. Government officials accused the American League of a breach of contract when it allowed the Seattle Pilots to move to Milwaukee, where they became the Brewers.

A 1976 settlement, after four weeks of a jury trial, led to the creation of the Seattle Mariners.

Woman Governor

Vesta Roy, 76, the first Republican woman to serve as governor of a state, died Saturday at her home in Kenmore, N.Y. The cause of death was not announced.

Roy was not elected but served for seven days as chief executive of New Hampshire after the death of Gov. Hugh Gallen in 1982.

As president of the state Senate, she had served as acting governor for a month while Gallen was hospitalized with liver and kidney failure, which ultimately brought about his death.

Roy served until John H. Sununu, who had beaten Gallen in the November 1982 election, was sworn into office in January.

A native of Michigan, Roy graduated from Wayne State University and served in the Royal Canadian Air Force during World War II.

She entered politics in New Hampshire after the war, holding a series of municipal posts before running for the state Senate, where she served from 1979 to 1986.

Born in the central Poland city of Lodz, which before World War II was the home of the country's second-largest Jewish community, Mostowicz treated fellow Jews who were forced into the Lodz ghetto.

He also played an active role in the Resistance movement. After the ghetto was eliminated, he was sent to Auschwitz.

Mostowicz worked as a journalist and author after the war. He gained international attention for writing and narrating a 1999 documentary about the Lodz ghetto called "Fotoamator" ("The Photographer").

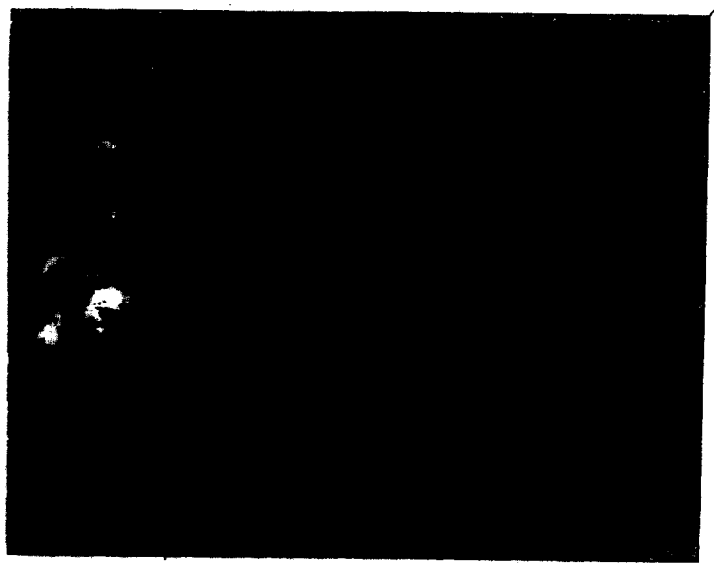
The film was based on 400 color slides taken by Walter Genewein, who was the Austrian chief accountant of the Lodz ghetto for the Nazis. The pictures were discovered in 1987.

Memorial Set for Retired Botanist

ISSING: Parents Plead for Girl's Return

ued from B1

LA Times 4-11-03



Irfan Khan Los Angeles Times

lexus

er negotiates the solar cube that sits above Discovery Science Center in Santa Ana. Crews are installing 4,096 f more efficient solar panels on one side of the cube. The other five sides will be covered with aluminum mesh. Much g and labor is being provided by New Vision Technologies of San Clemente and BP Solar.

Trial Run Starts for Merger of Tollways

Move is a bid to stave off a default on bonds for San Joaquin Hills road. Joint-powers venture would govern it and the more lucrative Foothill.

By Dan Weikel
Times Staff Writer

Directors of Orange County's tollway operations Thursday approved an exploratory merger of their highways — a step designed to solve the financial woes of the San Joaquin Hills tollway.

The decision establishes a 21-member board of directors to lay the groundwork for a permanent consolidation of the San Joaquin Hills and the Foothill-Eastern tollways if traffic and economic studies show a merger will work.

The San Joaquin Hills and Foothill-Eastern, each with its own board of directors, are run by the Transportation Corridor Agencies, a joint powers authority that operates 51 miles of tollways in Orange County.

Plagued by lower-than-expected traffic and revenue, the 16-mile San Joaquin Hills toll road through southwestern Orange County has been the problem child of the operation for years.

If nothing is done, tollway officials say that within a few years the San Joaquin Hills road could default on about $1 billion in bonds used to finance the road's construction. Such a default would occur when the TCA can no longer maintain its promise to bondholders to earn $1.30 for every dollar of debt.

A possible solution, TCA officials say, is to form a joint powers authority that would buy and operate the San Joaquin Hills and the Foothill-Eastern, which has higher than expected traffic and revenue. The purchase could be financed through $4 billion in tax-free bonds.

On Thursday, the boards of both toll roads agreed to form an interim body to test the waters for permanent consolidation. It is made up of 21 members drawn from the existing boards that oversee the two toll roads.

The only dissenting vote came from Eric Norby, the brother and chief of staff of Supervisor Chris Norby, who serves as his alternate on the Foothill-Eastern board.

Norby said an interim merger was premature.

The exploratory panel will hire financial and legal experts to complete an analysis of the proposed merger. It is also responsible for developing a financial plan and drafting the documents for a bond sale.

All non-merger business specifically related to the Foothill-Eastern and the San Joaquin Hills will continue to be handled by their respective boards.

At its first meeting Thursday, the new panel appointed Supervisor Tom Wilson as its chairman.

Whether the merger proceeds depends on the findings of a traffic and revenue study due by July.

There is concern that decisions by the Irvine Co. to dramatically scale back residential and commercial development in east Orange County might hurt the Foothill-Eastern.

If it does, the merger could be in jeopardy. It could also dash plans for moving forward with the controversial Foothill South tollway through South County.

"If the studies show it is not feasible and it will not pencil out, there will be no sale and the ex-

taurant closures

ty Health Care Agency can shut down food g as the owners fail to correct conditions that ublic health. Here are the restaurants closed in

	Date closed-reopened	Reason for closure
a Mesa	3/4-3/4	Rodent infestation
Park	3/4-3/5	Lack of hot water
ton	3/5-3/5	Lack of hot water
ntain Valley	3/6-3/7	Lack of hot water
Garden Grove	3/7-3/8	Sewage overflow
n	3/10-3/11	Failure to comply with a notice of violation citing improper food temperature control, improper food handling techniques and improper food storage
a	3/11-3/11	Sewage overflow
ort Beach	3/12-3/12	Lack of hot water
ort Beach	3/12-3/14	Cockroach infestation
ness	3/13-3/14	Cockroach infestation
erba Linda	3/13-3/14	Rodent infestation
lerton	3/13-n/a	No Health Permit has been issued for this facility
ds Fullerton	3/18-3/19	Sewage overflow; plumbing in disrepair
	3/18-3/18	Cockroach infestation
to Ana	3/18-3/18	Sewage overflow
nta Ana	3/18-3/18	Sewage overflow
nta Ana	3/18-3/18	Sewage overflow
Placentia	3/19-3/20	Rodent infestation
Beach	3/19-3/20	Failure to comply with a notice of violation citing improper hand-washing techniques, lack of hand-washing facilities and failure to submit remodel plans
ente	3/19-3/20	Rodent infestation
#3, Fullerton	3/20-3/21	Cockroach infestation
minster	3/24-3/25	Failure to comply with a notice of violation citing evidence of rodent activity
	3/26-3/27	Cockroach infestation
	3/26-3/28	Cockroach infestation
Fullerton	3/26-3/27	Cockroach infestation
a Linda	3/31-4/1	Rodent infestation

Local Educators Missing Conference

State budget crisis keeps some area districts from sending elementary and middle-school principals to an Anaheim symposium.

By Daniel Yi
Times Staff Writer

About 4,000 elementary and middle school principals are expected to gather in Anaheim this weekend for a professional conference, according to organizers, but the state budget crisis will make local educators harder to spot.

Garden Grove, Santa Ana and Placentia-Yorba Linda unified school districts have no principals attending the National Assn. of Elementary School Principals' 82nd annual convention, which begins today at the Anaheim Convention Center.

"We are really watching our pennies," said Barbara Barnard, associate superintendent of elementary education at Garden Grove Unified School District.

The conference, which continues through Tuesday, includes workshops on testing and standards, student discipline and a presentation about "school safety, terrorism and snipers."

The group also will unveil a guide for principals to help them understand and implement the No Child Left Behind Act, the federal education law passed in 2001 and the cornerstone of President Bush's education initiative.

During the convention, about 150 volunteer principals and psychologists will be manning a public hotline to answer questions about education and children.

The hotline will begin operating Sunday at 1 p.m. and can be reached at 800) 944-1601 or by e-mail on the group's Web site, *www.naesp.org*.

Barnard said her district, like many others, has had to curtail the number of professional conferences its employees attend in light of the state's multibillion-dollar fiscal crisis.

"All education groups have felt a dip this year in [convention attendance] numbers" because of budget cuts, said association spokeswoman June Million. "And then, of course, there is the war."

The belt-tightening at schools around the country combined with anxiety over the war and airline travel have meant about 1,000 fewer attendees than last year's convention in San Antonio, Million said.

Lottery Results

For Wednesday, April 9, 2003

Super Lotto Plus
Mega Number is Bold

8-14-25-27-46—Mega 14
Jackpot: $10 million

Winners per Category:

	No. of Winners	Amount of Prize(s)
5 + Mega	1	$10 million
5	1	$102,089
4 + Mega	34	$1,501
4	827	$102
3 + Mega	1,315	$58
3	35,364	$10
2 + Mega	17,962	$11
1 + Mega	89,068	$2
Mega only	131,160	$1

For Thursday, April 10, 2003

Fantasy Five: 1-10-14-18-19

Daily Three (midday): 2-9-2

Daily Three (evening): 5-4-1

Daily Derby:
(8) Gorgeous George
(4) Big Ben
(5) California Classic
Race Time: 1:44.65

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73 toll board pursues bailout

Transportation • Merger with successful 241 would shift $14 million a year to 73.

By JOEL ZLOTNIK and HEATHER LOURIE
The Orange County Register

The financially beleaguered San Joaquin Hills (73) Toll Road would be bailed out by its richer eastern sister under a proposal approved Thursday.

The board that runs the 73 voted unanimously to seek a merger with the Foothill/Eastern (241/261/133) Toll Road after receiving a financial analysis that said the 73 would otherwise default on its bond repayment in 2012.

"This option is a lifejacket that if we don't take, we'll drown," said board member William Ossenmacher, a Dana Point councilman.

The 73, which runs from San Juan Capistrano to Newport Beach, has failed to meet traffic projections since it opened in 1996. The 241, from Rancho Santa Margarita to Anaheim Hills, has exceeded projections. The merger would shift $14 million a year from the 241 to the 73.

Foothill/Eastern customer Drew Kovacs, 48, of Huntington Beach said the merger is the wrong way to solve problems on the 73.

"Why should I salvage something on the other side of town for poor management?" he asked. "The 241 people shouldn't be bailing out the 73."

But members of the 241 board say the 73's default would hurt the agency's credit as it seeks to borrow money for a 16-mile extension of the Foothill (241) Toll Road to San Clemente. In February, the 73's bonds were downgraded to "junk" status by a Wall Street rating agency.

The separate 241 board is scheduled to consider the consolidation proposal June 13. Board members said they need to look at the details but are open to the idea to protect the integrity of the whole toll-road system.

"We have the responsibility to do what's best for all of Orange County and not just one board or another," said Scott Diehl, chairman of the 241 board and a San Clemente councilman.

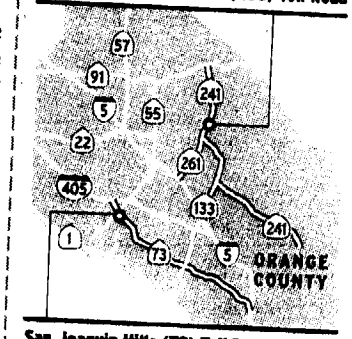
MORE INSIDE » Local 2
Q&A – Answers on bailout proposal.

More online:
See the board presentation at www.ocregister.com/local

Seeking a merger

The governing board of the San Joaquin Hills (73) Toll Road on Thursday voted to seek a merger with the more successful Foothill/Eastern Toll Road.

Foothill/Eastern (241/261/133) Toll Road



San Joaquin Hills (73) Toll Road

Source: Transportation Corridor Agencies
The Register

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Our Town

Courts • beaten at school, sue and three

2 tollways already share same staff

By JOEL ZLOTNIK
The Orange County Register

The board of the San Joaquin Hills (73) Toll Road on Thursday asked for a merger with the Foothill/Eastern (241/261/133) Toll Road, which is more financially stable.

Q: Aren't the toll roads already one operation?

A: Although the tollways share the same staff and marketing, they are legally separate. They were built using separate bonds, and the debt is paid off by customers and taxpayers paying separately depending on which road they use or live near. And elected officials from different areas sit on two separate boards.

Q: What would be the process to merge them?

A: The consolidation proposal needs approval of the

RELATED STORY << ON PAGE 1

Foothill/Eastern board. The board is expected to consider the plan at its meeting June 13. If approved, the process would begin to create a new joint-powers authority. That authority would acquire the assets and pay the debt of the existing agencies and refinance the debt of both roads. Before final sign-off on the merger, officials would conduct and consider results of a $2.5 million study to predict revenue and traffic on the two roads.

Q: How will the people who sit on both boards maintain their fiduciary responsibility to each in evaluating this deal?

A: Four officials sit on both toll-road boards – Supervisor Todd Spitzer, Supervisor Tom Wilson, Irvine Councilwoman Beth Krom and San Juan Capistrano Councilman David Swerdlin. Wilson and Swerdlin were absent from Thursday's meeting.

Krom said that she has constituents who use both roads and that she looks at the issue from their perspectives. She said serving on both boards gives her the chance to view the toll roads as one system.

"It's not such schizophrenic position," she said.

Wilson said board members could vote in favor of the merger for the 73 and be opposed to it from the 241's perspective.

"We want to do the right thing for both and have to look at them individually," Wilson said.

Q: Would a merger be fair to the people who paid taxes for the 241, or those who pay tolls on the 241?

COUNTY LINE >> Local 3
Question – Should 241 toll-road board bail out the 73 toll road?

A: Officials said the overall health of Orange County's toll-road system needs to be maintained. Commuters should see no impact on tolls because of the consolidation.

"It seems like the best way to go to keep everything going," said 241 board member Michael Duvall, a Yorba Linda councilman. "I just think right now they need a little bit of a helping hand."

If the 73 goes into default, analysts said, it could threaten the ability to finance the proposed southern extension of the 241.

Q: What is the problem on the 73?

A: The 73 has failed to meet established revenue and traffic projections. Revenue was at 77 percent of projections for all of 2001. Because of the shortfalls, the ongoing ability to repay bonds used for the road's construction is in question. According to the financial analysis, if financing isn't restructured, the TCA would default on bond payments beginning in 2012.

Q: Wasn't there another toll-road issue this week?

A: Yes, but it involved separate agencies. The Orange County Transportation Authority on Monday agreed to buy the 91 Express Lanes from a private tollway company for $207.5 million.

The express lanes are in the center of the Riverside (91) Freeway in Anaheim Hills.

• Contact Zlotnik at (949) 492-0484 or e-mail jzlotnik@ocregister.com

REDEVELOPMENT: Residents want voice

FROM PAGE 1

whole-heartedly back the project.

What residents fear, said M[illegible]a Duncan, one of the [illegible]

big government, of intrusive change, of being very cold and nonsympathetic to all the citizens.

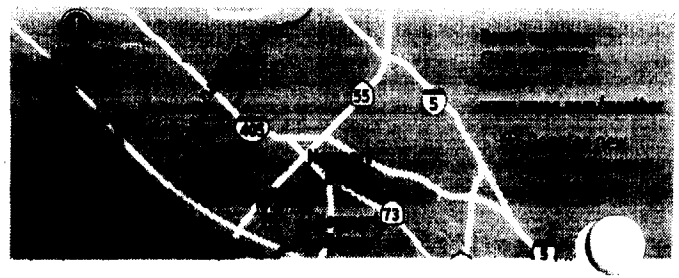
"The problem is really one of communication. And it's a [illegible]

tee expand to include three or four more residents.

"As far as I'm concerned, what we want is to have an inviting environment in that area for all t[illegible]izens of Pla[illegible]

Beach watch

A health advisory is issued when bacteria levels exceed state standards. Swimmers and surfers are urged to stay out of the water in the posted areas. The ocean is closed to water-contact activity when sewage is present. A list of current bacteria-related ocean health advisories:



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review required for annexation by Sept. 1, with approval in January by the Local Agency Formation Commission, which oversees annexations and incorporations. City officials were still in meetings Thursday and couldn't be reached.

Supervisor Todd Spitzer said he left his meeting convinced the Navy will work with Irvine.

"If they have to go the extra mile to make the deal work with Irvine, they have to make that happen," he said.

Spitzer said he was heartened that the officials couldn't answer all the supervisors' questions. That showed, he said, that they did not have their own agenda and would work with Irvine on the answers.

Supervisor Chuck Smith, a longtime supporter of a commercial airport at the base, said his message to Johnson and Coad was that annexation will be a complicated undertaking. Irvine's previous applications to take over the base were withdrawn because the city's documents were incomplete. Among the studies is a financial review showing how the city will pay for servicing the new area.

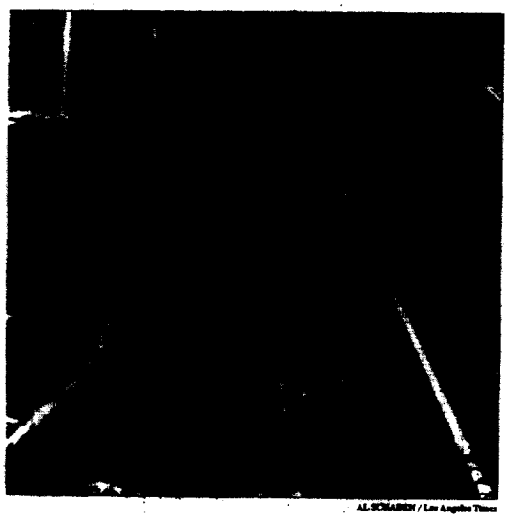
"It's going to be a huge process," Smith said. "Their being ready to annex by the end of the year is a myth. The system doesn't work that way. I don't think the Navy recognized that."

Protecting county taxpayers from paying any more for the upkeep of the 4,700-acre base was the main concern of Supervisor Jim Silva. The cost was to be about $7 million this year. Navy officials have said they will end the county's responsibility for the base June 30.

"I have concern about the additional cost to the county," said Silva, who sits on LAFCO as a county alternate and will vote on Irvine's annexation request.

Coad and her advisor/husband, Tom Coad, said they became familiar with sales of federal property in the 1980s when they bought land at Camp Elliott in San Diego. The sales brochure promised the area would be developed into neighborhoods with parks and schools. Nearly 40 years later, nothing has been built and the property remains in litigation, they said.

"Only three years ago, they were still sweeping for spent ordnance," Cynthia Coad said.



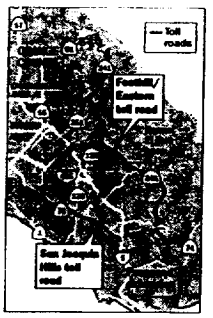
AL SCHABEN / Los Angeles Times

, a 40-foot sailboat, for the Newport to Ensenada Yacht Race, which begins today.

Toll Board Sees a Merger as Cure for Ills

Roads: Underused, debt-ridden San Joaquin route would gain in pact with busier Foothill and Eastern turnpikes.

By DAVID REYES
TIMES STAFF WRITER



Faced with a shortage of customers and dire financial warnings, directors for the San Joaquin Hills toll road on Thursday authorized a merger with a second county toll agency in an effort to deal with the turnpike's growing debt.

The unanimous vote comes nearly three months after a major Wall Street ratings agency downgraded more than $1 billion in San Joaquin toll road bonds to junk status because traffic and revenue for the 15-mile highway continued to fall far short of projections.

Board members for the second toll agency, which oversees the other two Orange County tollways, the Eastern and Foothill, are scheduled to cast a deciding vote on a merger June 13.

The San Joaquin has struggled financially from the start, never quite recovering from its early years, when revenue dipped to only 50% of projections.

A panel of financial analysts, which examined the toll agency's ledger books and recommended a merger, said that even with an infusion of as much as $400 million, the agency would fail to establish long-term financial stability.

Directors of the San Joaquin were warned Thursday that without quick action—such as a merger—the agency would miss crucial bond payments as early as 2005 and would probably default by 2012 unless revenue grew 11.5% annually.

The toll for drivers on the San Joaquin was recently raised to a maximum of $3 for a one-way trip, which could eventually generate needed revenue—or, as some suggest, discourage customers. A further rate hike is not anticipated right now.

A merger of the two toll agencies, creating a single board and combining all revenue and debt, would put the joint debt at roughly $4 billion.

Critics have previously worried that while a merger could prop up the San Joaquin's sagging finances, it could drag down the more successful Eastern and Foothill tollways.

That second toll agency is operating at a much healthier 110% of projected revenue. At least one of its board members is eager to consider a merger.

"I believe the toll roads have been a success, and we want to continue along in that vein," said Peter Herzog, a Lake Forest city councilman. "This is just some of the bumps and grinds."

The San Joaquin, which stretches from Newport Beach to San Juan Capistrano, has had its share of bumps. In January, revenue was 82% of projections but has since slipped to 77%, said board Chairwoman Linda Lindholm, a Laguna Niguel city councilwoman.

"Each month it went down, and when it hit 77%, I told myself I don't think we are going to make our debt [payments]," Lindholm said. "Now is the time to take these steps."

If the board failed to act, it ran the risk of creating a domino effect that could further erode Wall Street's ratings of the toll bonds, undermine the agency's borrowing ability and affect other toll agencies, analyst Mark T. Young said.

Young said another ratings downgrade is likely without a merger.

Previous downgrades have already hurt toll road investors by lowering the value of $789 million in uninsured bonds issued in 1997 and $220 million in revenue bonds sold in 1993. An additional $795 million in San Joaquin Hills bonds sold by the agency in 1997 still retain an AAA rating because they are insured.

Scott Diehl, chairman of the Foothill/Eastern toll board, said a decision whether to merge will come down to "what is the best for all of Orange County."

The Foothill/Eastern agency still hopes to add a 16-mile southern extension that would eventually serve San Clemente and push into San Diego County.

"I can't tell you what the vote will be in two months, but we would be foolish if we didn't take a look at what is the best structure for us," Diehl said. "We still have quite a bit of [research] for our board to do."

A merger would allow the joint $4 billion in debt to be restructured under a new agency, analysts said. They added that consolidation would add efficiency and streamline operations.

The San Joaquin toll road opened in 1996. After its first year, revenue was 50% short of projections. Bonds had been sold in 1993 assuming that annual revenue would grow an average of 6.6%.

The agency refinanced a majority of its debt in 1997, reducing the interest rate from 7.6% to 5.7%, resulting in significant long-term savings.

Revenue and traffic have increased in recent years, but not enough.

The San Joaquin board also instructed its staff to work with a Foothill/Eastern agency committee to plan for a new board structure, select traffic and revenue consultants and prepare a joint-powers agreement.

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Investigators said Mildred "Gayle" Barrett, 60, was last seen April 11 at her home on Meads Avenue in Orange Park Acres, where she lives with her husband, Richard.

Family members reported Barrett missing April 17. The relatives acted after Barrett failed to show up for several appointments and classes at Santiago Canyon College, said Jon Fleischman, spokesman for the Orange County Sheriff's Department.

Barrett's car, a green 1996 Jeep Cherokee, is also missing, police said.

The Cherokee's license plate number is 3STH532.

IRVINE

Pickup's Driver Badly Hurt; Traffic Choked

A one-car crash on the San Diego Freeway shut all northbound lanes for 15 minutes Thursday.

Police said the driver of a silver pickup, a 16-year-old girl, was seriously injured when the truck flipped and landed on the right shoulder near Jeffrey Road at 6:15 p.m. One lane was closed for an hour.

The driver, who had to be cut out of her vehicle by rescuers, was flown by helicopter to a hospital.

Her name and condition were not immediately available.

From Times Staff Reports

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Los Angeles Times

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By DANIEL YI
Times Staff Writer

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construction. Such a default would occur when the TCA can no longer maintain its promise to bondholders to earn $1.30 for every dollar of debt.

A possible solution, TCA officials say, is to form a joint powers authority that would buy and operate the San Joaquin Hills and the Foothill-Eastern, which has higher than expected traffic and revenue. The purchase could be financed through $4 billion in tax-free bonds.

On Thursday, the boards of both toll roads agreed to form an interim body to test the waters for permanent consolidation. It is made up of 21 members drawn from the existing boards that oversee the two toll roads.

The only dissenting vote came from Eric Norby, the brother and chief of staff of Supervisor Chris Norby, who serves as his alternate on the Foothill-Eastern board.

Norby said an interim merger was premature.

The exploratory panel will hire financial and legal experts to complete an analysis of the proposed merger. It is also responsible for developing a financial plan and drafting the documents for a bond sale.

All non-merger business specifically related to the Foothill-Eastern and the San Joaquin Hills will continue to be handled by their respective boards.

At its first meeting Thursday, the new panel appointed Supervisor Tom Wilson as its chairman.

Whether the merger proceeds depends on the findings of a traffic and revenue study due by July.

There is concern that decisions by the Irvine Co. to dramatically scale back residential and commercial development in east Orange County might hurt the Foothill-Eastern.

If it does, the merger could be in jeopardy. It could also dash plans for moving forward with the controversial Foothill South tollway through South County.

"If the studies show it is not feasible and it will not pencil out, there will be no sale and the exploratory joint powers authority will be disbanded," said Lake Forest Councilman Peter Herzog, chairman of the Foothill-Eastern's board of directors.

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ORANGE COUNTY EDITION

Tuesday, May 11, 2004

latimes.com/california

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Associated Press
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sponsibility for his role in the bank robbery that led to her death. "If there is one day in my life I could live again," Kilgore said, "it would be that moment."

Opashi's family members said they were happy to see Kilgore finally brought to justice, but expressed regret that with time for good behavior he might serve as little as three years in prison for the murder.

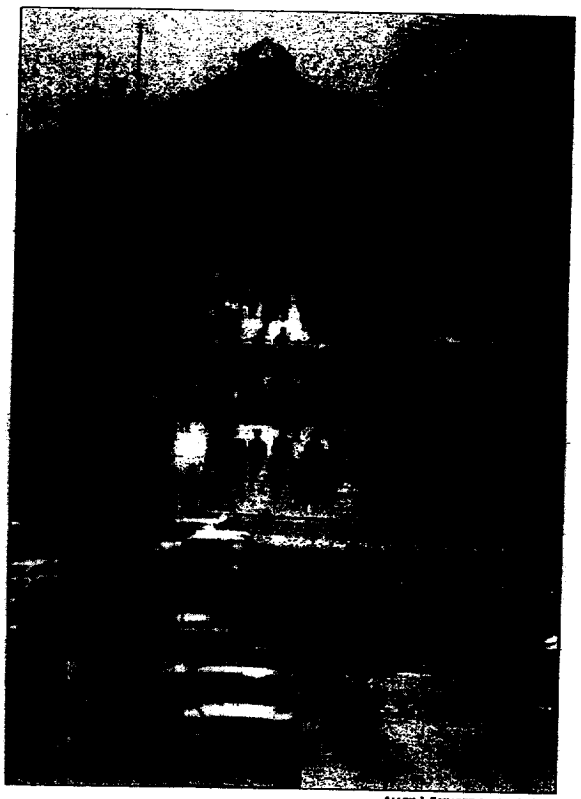
"It's difficult to accept," said Jon Opashi, 44, one of the sons. "He's not really being punished to the degree that taking a human life deserves."

The sentencing marked the final chapter in the long and twisted saga of the SLA, the violent West Coast revolutionary group that made headlines in the turning days of the Vietnam War with a wild series of bank robberies, bombings, the slaying of Oakland's school superintendent and the kidnapping of newspaper heiress Patricia Hearst, who eventually joined the group.

After a fiery 1974 shootout with police in Los Angeles left the group's founder and several core members dead, Kilgore joined SLA survivors to continue a car-bline-toting battle with the establishment in an attempt to foment revolution.

In April 1975, the group set up shop in Sacramento, plotting a series of bank robberies. But their plans quickly went awry at Crocker National Bank in Carmichael. Inside the bank, SLA member Emily Harris brandished a loaded shotgun at Opashi, and the gun went off. Harris

[See Kilgore, Page B3]



ALLEN J. SCHABEN Los Angeles Times

Huntington Beach Plans Promenade

Huntington Beach is considering banning cars on Main Street for shoppers and strollers. Many believe it would create a district similar to Santa Monica's Third Street Promenade. B3

Toll Road Duo Feels Pinch

Two cities each pressure a delegate to reverse opposition to a merger seeking to save one ailing O.C. tollway. Stakes are high: $4 billion in debt.

By DAN WEIKEL
Times Staff Writer

Two city councils will put pressure tonight on their delegates to Orange County's turnpike authority, hoping to save a plan to merge operations of two toll roads and refinance about $4 billion in construction debt.

Anaheim Councilman Bob Hernandez and Santa Ana Councilman Brett E. Franklin — two of at least six Transportation Corridor Agencies directors opposed to the merger — will be the focus of a pair of special council meetings.

Hernandez and Franklin represent their cities on a 21-member TCA board that is scheduled to decide Thursday whether to combine the successful Foothill-Eastern tollway and the faltering San Joaquin Hills tollway to keep it from defaulting on $1.5 billion in bonds.

To pass, the consolidation requires a supermajority of 16 votes, something backers of the merger have not been able to muster for several months. If Hernandez or Franklin changes his views or one of them is replaced, the merger could be approved.

Tonight, the Anaheim and Santa Ana city councils are set to consider resolutions in support of the merger and a related $4-billion bond issue, which Hernandez and Franklin oppose. Also on the Anaheim council agenda is a measure to replace Hernandez on the TCA board in time for Thursday's decision.

Hernandez contends that the pending council actions are a blatant attempt to silence critics and opponents of the controversial merger proposal on the eve of the vote.

He says the effort is being orchestrated by Anaheim Mayor Curt Pringle, who worked for several years as a lobbyist for J.P. Morgan Securities Inc., a member of the TCA's team of fi-

[See Tollways, Page B4]

st

Ex-Sheriff Pleads Guilty in Guns Case

Floyd Tidwell is fined $10,000 on stolen property charges in San Bernardino County.

By LANCE PUGMIRE
Times Staff Writer

Floyd Tidwell, the former sheriff of San Bernardino County, pleaded guilty Monday to four felony counts of concealing stolen property as investigators said he took at least 523 guns from evidence rooms during his eight-year tenure.

During his terms, from 1983 to 1991, Tidwell would walk through evidence rooms "as if shopping, to take his pick of weapons," one sheriff's official said. Among the weapons was a military M-2 carbine, a fully automatic assault weapon banned under state and federal gun control laws.

Under a plea agreement with the San Bernardino County district attorney's office, Tidwell will pay a $10,000 fine and cooperate with investigators who are trying to recover the firearms. He will not serve any time in jail.

"Incarceration was never an option," said Assistant Dist. Atty. Michael Risley. "He's 74. He did serve the people well in many respects for many years. We wanted him to acknowledge his wrongdoing and to seek his cooperation in correcting this matter."

Under state law, confiscated firearms must be returned to their owners, sold at public auction by the county or used for approved law enforcement purposes, such as target practice, Risley said. "What you can't do is take them."

Tidwell stashed boxes of guns in his garage in Phelan and would give them away to family and friends, his daughter-in-law told investigators.

Tidwell accepted the plea agreement to limit the stress of a trial on his ailing wife, according to his attorney, David Call.

"If I win a jury trial, but the result is his wife's funeral, how do I win that?" Call said. "This was an opportunity for the sheriff to stand up and end this sorry mess."

Call said Tidwell didn't believe his handling of the guns was illegal, and that the number of guns Tidwell is accused of taking might be inaccurate.

"It used to be common practice for law enforcement officers to keep their guns," Call said after the hearing. "This [case] is about different times, different eras and closed chapters."

Tidwell first came under suspicion on June 25, when investigators with the San Bernardino County Sheriff's Department ex-

[See Sheriff, Page B12]

INSIDE

Ackerman of Irvine Takes Senate Helm

Dick Ackerman, 61, is a quiet but fiercely partisan Irvine Republican who has now ascended to his party's leadership in the state Senate. He has his work cut out for him, with Democrats in control since 1971. B3

Hike in Bail Sought for Gang-Rape Defendant

Prosecutor requests the increase for son of O.C. assistant sheriff, alleging reckless behavior.

this pattern of behavior, it would be foolish to repose any trust in defendant to follow the laws requiring him to make all further appearances."

Haidl is free on $100,000 bail. In the motion, Deputy Dist. Atty.

2 Tollway Delegates Pressured Before a Momentous Vote

[Tollways, from Page B1]

nancial advisors for the proposed bond issue.

"Pringle is behind all this," Hernandez said. "It's so self-serving. It's kind of embarrassing."

Pringle said he was reviewing his relationship with J.P. Morgan, which ended in August, to determine whether there is any conflict of interest, and said he had not yet decided whether to vote.

He said the Anaheim city attorney's office had told him there is no conflict, while the state Fair Political Practices Commission has told him not to participate in the City Council vote because it is "a close call."

California's Political Reform Act, which the FPPC enforces, prohibits elected officials from voting on matters that have a "material financial impact" on any business within 12 months of receiving $500 or more in income from that business.

Pringle worked for J.P. Morgan Securities from 1999 to 2003. His agreement called for retainers ranging from $3,000 to $18,500 a month, plus expenses, bonuses and other compensation.

'We need direct connections from the 241 to the 91.'

Curt Pringle, Anaheim mayor, favoring a toll road merger

Though he has not decided whether he will vote on the issue, Pringle said, he favors consolidation because it will give the TCA enough money to make improvements in the tollway system that will benefit Anaheim and other cities. Otherwise, he said, the work will be delayed for years.

Franklin and Santa Ana Mayor Miguel A. Pulido, who sought the advisory vote from City Council, could not be reached for comment Monday. In the past, Franklin has warned that there might be political moves to purge merger opponents from the TCA board or influence their votes.

The Transportation Corridor Agencies, a joint-powers authority, operates a 51-mile network of highways in east and west Orange County. They include the Foothill-Eastern tollway, the San Joaquin Hills tollway and a short stretch of California 133.

After more than 26 months of study, the TCA's staff and a team of Wall Street advisors have recommended that the operations of the San Joaquin Hills and the Foothill-Eastern be combined and refinanced with a $4-billion bond issue.

The preferred plan calls for about $3 billion in bonds with fixed interest rates and $1 billion in bonds that involve so-called interest rate swaps with financial institutions. Swaps in which fixed interest rates are exchanged for adjustable rates are considered more risky than conventional fixed-rate bonds.

Supporters contend that the plan is the only way to prevent the San Joaquin Hills from defaulting on its bonds by 2014 without jeopardizing $1 billion in planned improvements to the tollway system and construction of the proposed Foothill South extension through south Orange County.

Opponents say the consolidation plan is a risky and expensive venture that will cost the TCA at least $160 million in fees and force drivers to pay $2.6 billion more in tolls.

Some opponents support an alternative by county Supervisor Bill Campbell that would allow the Foothill-Eastern to lend money to the San Joaquin Hills to keep it out of default. Campbell's proposal is scheduled to be considered along with the merger plan on Thursday.

Without a merger, improvements to the interchange of the Foothill-Eastern and the Riverside Freeway will be delayed for years, Pringle said.

During rush hours, traffic backs up on the interchange, and there is no direct link from the Foothill-Eastern to the 91 Express Lanes, a tollway in the Riverside Freeway median.

"We need direct connections from the 241 to the 91," said Pringle, who asked for the advisory vote from his council. "If there isn't a revenue stream from the Foothill-Eastern, it will impact our residents."

IN BRIEF

REDWOOD CITY

Prosecutors Oppose Moving Peterson Trial

Because juror bias in Scott Peterson's double-murder trial could be found anywhere in California, moving the trial again would be pointless, prosecutors said Monday.

Defense attorney Mark Geragos wants the case moved to Los Angeles, where he says media saturation has not been as intense. Geragos says an impartial jury cannot be seated in Northern California, where potential panelists are intimately involved in the case.

He is set to argue for a change of venue today.

SANTA ROSA

Purchase Would Nearly Double Size of State Park

A proposal to add more acreage to Sonoma Coast State Beach could nearly double the size of the popular state park.

The Sonoma County Board of Supervisors is considering a $20.5-million deal to buy nearly 3,400 acres from the Mendocino Redwoods Co.

The pitch to acquire the historic timberlands would bring the park's size to more than 6,000 acres.

HEALDSBURG

Proposed Hotel Tax Could Raise $160,000

City leaders in Healdsburg are considering a proposal that would ask voters to approve an increase in the city's hotel tax.

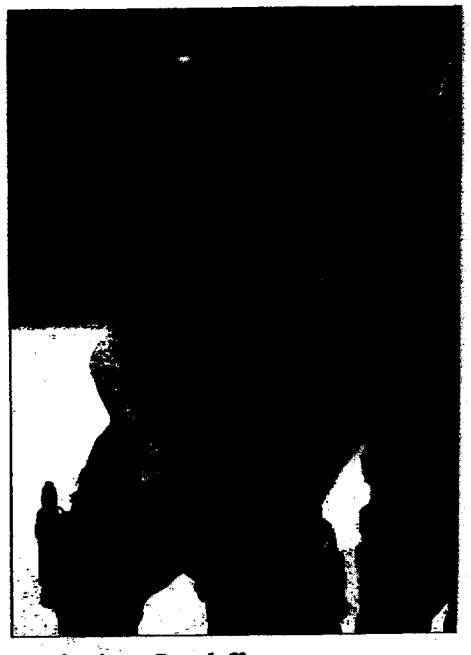
The City Council might put the increase on the Nov. 2 ballot.

Increasing the tax on the daily bill of occupants of Healdsburg's 326 hotel rooms from 10% to 12% would raise about $160,000 a year, City Manager Chet Wystepek said.

SAN FRANCISCO

After Being Fined, Bars Sue Underage Drinkers

Local bars have started fighting back against underage drinkers by taking them to court and making them pay thousands of dollars.



Monitoring a Standoff

Members of the LAPD's SWAT team gather near a home in Tujunga where a hostages. Eventually three women, all unharmed, were able to leave the h surrendered after a five-hour standoff and was arrested on unspecified ch

Ex-SLA Member Prison Term in 19

[Kilgore, from Page B1]

later would say the weapon discharged by accident.

Opsahl was rushed to an emergency room and her husband, a surgeon, was called to the hospital, where he joined in trying to save her life.

Within months, several members of the SLA were arrested along with Hearst. Kilgore managed to slip away, living in hiding around the U.S. before leaving the country with a forged birth certificate. He borrowed the name of a child that had died.

The son of a wealthy Marin County family, Kilgore was a former honors student and letterman in golf and baseball at San Rafael High. After graduating from college, he joined the SLA. After fleeing the U.S., Kilgore spent more than two decades in Zimbabwe and South Africa under the adopted name Charles William Pape.

Like his onetime SLA colleagues back in America, Kilgore grew into middle age and sunk roots. He married an American overseas and raised two sons. Since 1996, Kilgore had worked as a university professor in Cape Town, South Africa. Several colleagues heralded his work to help impoverished labor unions during the country's post-apartheid struggles.

In the U.S., the Opsahl murder case appeared to have hit a dead end until the arrest in 1999 of Sara Jane Olson, a Minnesota homemaker who a quarter-century before had been active in the SLA.

WITNESS: *Beckey Fischer addresse Fischer was a teller at Crocker Nationa*

Two Los Angeles County deputy district attorneys, Eleanor Hunter and Michael Latin, assigned to dig into old SLA investigative files, became convinced enough evidence existed to justify reviving the dec-

Gas Leak Closes Freeway in Riverside,

Work crews puncture a large main, tying up traffic through rush hour and later.

inch natural gas pipeline near UC Riverside.

Authorities feared a fire or an explosion and quickly evacuated about one square mile.

"The only thing we can do is hopefully eliminate ignition

nia Gas Co. was able to close the line about four hours later.

The accident happened about 4:30 p.m. as crews were demolishing an overpass as part of a freeway widening project, Laycock said.

Police evacuated the area

GLENN KOENIG Los Angeles Times

-controlled plane Tuesday at Kite Hill in Laguna Niguel.

lents at UCI Plan Protest

Malalai Farooqi, 19, a member of the Muslim Student Union, was studying in the library when the fire began. She ran outside and saw that the cardboard wall was ablaze.

"It was so sad. Everyone worked so hard on it," Farooqi said. She said it took about a day for 10 students to build the wall. "It broke my heart. The point of the display was to [provoke] thought and communication, both positive and negative."

Hadi Ghazvini, a second-year international studies major, said the wall illustrated images of Israeli checkpoints and posters with quotes from Nelson Mandela and Malcolm X.

"We're supposed to be able to express our opinions freely without having to worry about something like this happening," said Ghazvini, 19, of Rowland Heights.

Randy Lewis, executive associate dean of students at UCI, said the university condemns the destruction.

"UCI is committed to an atmosphere of mutual respect, and to protecting and upholding the rights of others to express themselves, without fear of harm or retaliation," he said in a statement released Monday.

Universities and colleges nationwide have among the lowest reported incidences of hate crimes, authorities say. But the number of reported hate crimes in Orange County against people of Middle Eastern descent and Muslims increased by nearly 50% in 2003 to 22 cases.

Rusty Kennedy, executive director of the Orange County Human Relations Commission, which recently released its annual report on hate crimes and bigotry, said there has been a steady increase in hate crimes and incidents against people of Middle Eastern descent since the Sept. 11 terrorist attacks.

"The burning of the Muslim students' wall of protest at UCI is a troubling sign of this upward trend in intolerance toward Arabs/Muslims/Middle Easterners," Kennedy said. "We must reach out to protect our Arab and Muslim American neighbors; they are not the enemy."

Some students, including Ghazvini, said they felt targeted after the Sept. 11 terrorist attacks and wanted to foster communication with the display.

"Everyone started to generalize after 9/11. Hate crimes are a result of ignorance," Ghazvini said. "I'm just appalled this would happen in a place like Irvine."

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For Tuesday, May 25, 2004

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Daily Three (evening): 0-5-3

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(2) Lucky Star
(8) Gorgeous George
Race Time: 1:40.67

Results on the Internet:
www.latimes.com/lottery
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(800) 568-8379
(Results not available at this number)

Another Blow for Tollway Bonds

Moody's lowers San Joaquin Hills to junk status. The 16-mile road is beset by light traffic.

By DAN WEIKEL
Times Staff Writer

The last of three Wall Street ratings agencies on Tuesday downgraded to junk status $1.9 billion in bonds sold to build the faltering San Joaquin Hills toll road through western Orange County.

Moody's Investors Service lowered its rating from Baa3 — the lowest investment grade — to Ba2, a non-investment grade. Moody's also announced that it would keep the San Joaquin Hills tollway on its watch list for possible additional downgrades.

Over the last year, Wall Street rating agencies Standard & Poor's and Fitch IBCA have lowered their ratings of San Joaquin Hills bonds to junk status.

The 16-mile tollway between Newport Beach and San Juan Capistrano has been plagued for years by lower-than-expected traffic and revenue.

In 2006, the tollway is expected to violate a pact with bondholders to take in $1.30 in revenue for every $1 of expenses.

Forecasts predict that by 2014, the road will be unable to pay interest to investors.

The San Joaquin Hills is part of a 51-mile network of highways operated by the Transportation Corridor Agencies, a joint-powers authority based in Irvine.

The Foothill-Eastern toll road and a stretch of California 133 are other sections.

Ratings are an important gauge of risk to investors because they indicate the ability of the issuing company or government agency to pay interest and principal. Aaa is the best Moody's rating; C is the lowest.

Financial experts say that downgrades to speculative ratings, or so-called junk status, can hurt individual investors and institutions, such as mutual funds, by lowering the market value of their bonds.

Moody's analysts said they lowered the San Joaquin's rating because of weak economic performance, the 2007 expiration of a federal $240-million line of credit, and the road's potential inability to meet debt payments that increase over time.

Analysts also noted that TCA board members have not reached a clear consensus on how to deal with the highway's financial problems.

Two weeks ago, board members killed a plan to merge highway operations and refinance their combined debt with a $4-billion bond issue. Moody's views consolidation as one way to save the San Joaquin Hills. Instead, board members agreed to consider a proposal by Supervisor Bill Campbell to bail out the San Joaquin Hills with loans and cash transfers from the successful Foothill-Eastern.

The proposal is scheduled for TCA committee discussions next week. Board members want to explore how Campbell's plan can prevent a default for the San Joaquin Hills.

L.A. Times
OC Wednesday
May 26, 2004

A Beverly Hills physician was convicted in a $3 million bankruptcy-fraud case a day after her husband leaped to his death from a 10th-floor balcony of a Santa Ana hotel.

Dr. Leticia Bussell, 53, a dermatologist, was convicted of conspiracy, attempted tax evasion and bankruptcy fraud.

Jurors were sequestered Tuesday morning after Dr. John Bussell, 55, died. He had been accused in the case, but jurors were told to consider the charges against Leticia Bussell only.

Police ruled John Bussell's death a suicide.

Distraught family members were upset that U.S. District Judge Alicemarie Stotler had ordered Leticia Bussell back to court so soon after her husband's death, said H. Dean Steward, John Bussell's attorney.

Bussell's daughters Kelly, 18, and Lisa, 22, were led out of the courtroom after one yelled, "You murdered my father. You murdered my father," Steward said.

"I was surprised and would have thought they would have given Mrs. Bussell time to grieve and digest what had happened, and (I) thought it was an unfortunate way to handle it," he said.

Thom Mrozek, a spokesman for the U.S. District Attorney's Office, said Bussell had to appear in court because the jury had reached a verdict and the judge did not want to continue to keep them sequestered.

Bussell's conviction carries a maximum sentence of 30 years, five for each count, but Mrozek said she probably will receive less time under sentencing guidelines.

She is free on bail but expected back in court Feb. 14 where she faces possible incarceration or home detention monitoring, Mrozek said.

• Contact Tokarski at (714) 240-6330 or ktokarski@ocregister.com

Teen says she missed 17 school days

The Orange County Register

An Anaheim girl who was the first to be charged with truancy under a new district attorney program admitted Wednesday to missing 17 school days of this year.

The girl, 17, appearing before a judge in Juvenile Court, had received numerous warnings from school officials and police about skipping classes at Gilbert East High School in Anaheim.

Judge Robert Hutson ordered the girl to report to a probation officer regularly and tell the officer if she would be absent from school.

The judge also ordered her to attend school every day and possibly meet with a school counselor.

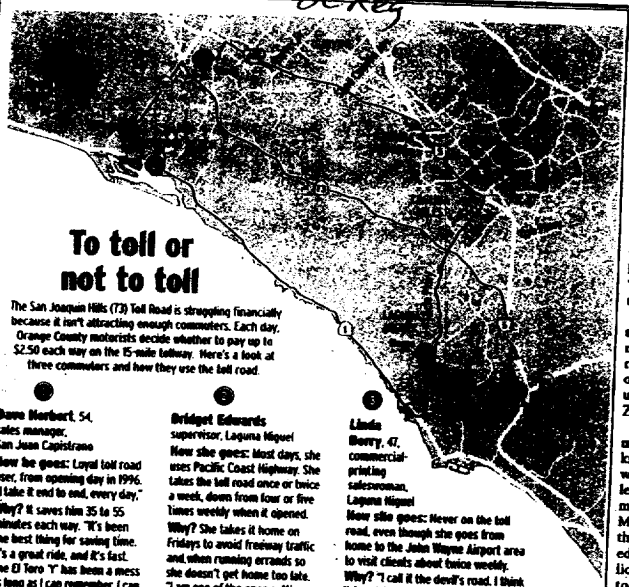
The girl, a junior, was ordered back in court April 10 for a progress report.

The district attorney is cracking down on students and parents who allow their kids to be chronically late to or absent from school.

In another case, an Anaheim father is due back in court this month so Hutson can determine whether his 9-year-old son is regularly attending school.

... green jumpsuits, Kim girl and a male victim urged A girl, 15, wrote, "Some- ... or ghardesty@oc...

OC Reg 2-7-02



To toll or not to toll

The San Joaquin Hills (73) Toll Road is struggling financially because it isn't attracting enough commuters. Each day, Orange County motorists decide whether to pay up to $2.50 each way on the 15-mile tollway. Here's a look at three commuters and how they use the toll road.

1

Dave Herbert, 54, sales manager, San Juan Capistrano

How he goes: Loyal toll road user, from opening day in 1996. "I take it end to end, every day."

Why? It saves him 35 to 55 minutes each way. "It's been the best thing for saving time. It's a great ride, and it's fast. The El Toro 'Y' has been a mess as long as I can remember. I can come home and relax before supper." Suggests opening up the toll road for free for a few days to lure new users.

2

Bridget Edwards supervisor, Laguna Niguel

How she goes: Most days, she uses Pacific Coast Highway. She takes the toll road once or twice a week, down from four or five times weekly when it opened.

Why? She takes it home on Fridays to avoid freeway traffic and when running errands so she doesn't get home too late. "I am one of the ones cutting back, because of the expense. When it first opened, it was very inexpensive ($2). I love it as far as convenience. I just can't justify the expense (oftentimes) for the short trip."

3

Linda Berry, 47, commercial-printing salewoman, Laguna Niguel

How she goes: Never on the toll road, even though she goes from home to the John Wayne Airport area to visit clients about twice weekly.

Why? "I call it the devil's road. I think it is cutting a scar into Mother Nature with each trip. I won't drive it. I have to admit, I have been on it once as a passenger. I freaked."

She says a better solution to ease congestion would have been to double-deck freeways.

The Register

Road lost revenue along the way

Traffic • Tollway agency blames widening of the El Toro 'Y' for decline in use of the San Joaquin Hills (73) Toll Road.

By HEATHER LOURIE and JIM RADCLIFFE
The Orange County Register

The widening of the El Toro "Y" was unexpectedly effective, one factor that tollway officials say has caused a chronic drain on demand from the San Joaquin Hills (73) Toll Road.

This week, Fitch Ratings in New York downgraded the bonds that financed the tollway to "junk" bond status because of revenue that has slumped because of free alternatives like the Y.

"The Y ended up being able to handle more capacity, which had a negative impact on us," said Wally Kreutzen, chief executive of the tollway authority, known as the Transportation Corridor Agencies.

The San Joaquin toll road opened in 1996. One year later, the $166 million, 26-lane confluence of the San Diego (I-405) and Santa Ana (I-5) freeways opened – putting an immediate dent in demand for a parallel toll road.

The road has run behind projections from its first day, but officials say they have $140 million in reserves and a $12 million federal line of credit they could tap into.

Kreutzen said he's not worried about making bond payments. But he is worried that the agency might not make as much revenue as needed to provide a cushion promised to bondholders above the amount needed for payments.

"It's a business. We'll take a step back and re-evaluate ourselves," Kreutzen said. "We've learned a lot. Hindsight is sometimes better than foresight.

"We've been paying our bills," he said.

Three weeks ago, TCA made a $35.9 million debt payment.

But analysts said Tuesday's downgrade of $795 million in bonds could hurt the tollway's opportunity to refinance and that other rating agencies, such as Moody's and Standard & Poor's, could follow Fitch's lead.

Still, Kreutzen said he is looking at long- and short-term alternatives and will present several options to the agency's board in April.

In addition to the alternative free routes, other factors that contributed to the road's shortfall were revenue forecasts based on inaccurate housing and employment figures, Kreutzen said.

"It's still a short-term look at the life of this road," said Jeffrey Spring, spokesman for the Automobile Club of Southern California. "Orange County is still growing. It still may fill a need."

"It sounds like they've already pulled a lot of rabbits out of a hat," said Marilyn Cohen, a Los Angeles-based money manager, also author of the "Bond Bible." "I don't know how they will increase usage. People will pay $3 for Starbucks coffee, but they're clearly not paying it on the toll road."

Sheila Hammer of San Clemente says she takes the road occasionally to her flight attendant job, based at John Wayne Airport.

She said the tollway has to find that perfect toll amount – high enough to produce sufficient revenue but low enough not to scare off riders. As for her, she would pay as much as $3.75 per trip.

"They need to find a medium that works for them and for the public," she said.

• Contact Lourie at (949) 454-7335 or hlurie@ocregister.com

• Register staff writer Joel Zlotnik contributed to this report

Toll increase

Tolls are going up starting at 10 p.m. Sunday at the Catalina View Toll Plaza on the San Joaquin Hills (73) Toll Road. The fare is now $2.50 for all customers. Starting Sunday, it will go up for two groups:

• Commuters who pay by cash instead of a FasTrak transponder will pay $3.

• Commuters who use FasTrak will pay $2.75 northbound from 7-9 a.m. and southbound from 4-7 p.m. on weekdays. They will continue to pay $2.50 at other times.

Source: Transportation Corridor Agencies

Speak your mind:
How high does the toll on the 73 have to go before you'll stop using it? Join the discussion at www.myoc.com/talk/talk

Ex-Tustin wo... arrested in ki...

By RACHANEE SRISAVASDI
The Orange County Register

TUSTIN

A former Tustin woman wanted in connection with the August 2000 slaying of her husband was arrested Wednesday in Phoenix, authorities said.

Palmira Galache, 36, was taken into custody as she arrived for an 8 a.m. appointment with the Phoenix office of the Immigration and Naturalization Service, Lt. Brent Zicarelli said.

Galache disappeared a month after the Aug. 17, 2000, killing of Luis Carlos Vega, 47, who was found lying in the alley of the El Presidio apartment complex at 16661 McFadden Ave. The father of three had been struck repeatedly with a blunt object. Police say they think Galache took the children to Mexico.

Police issued arrest warrants for Gal... ment maint... Carlos Erne... eight months ... which they s... ted by a love ...

Authorities ... who worked ... tin apartment ... ple had lived ... were respon... death. Ceron i...

Galache con... office in Phoe... ago because ... re-enter the co... said. The INS ... police, who se... gators to Phoe...

Galache cam... fice and seeme... be arrested, Zi...

She is being ... Phoenix Polic... pending extrac... fornia.

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Exhibit

#

3

New Highways, Induced Travel, and Urban Growth Patterns: A "Before and After" Test

A final report submitted to
The Environmental Protection Agency

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September, 2002

I. Introduction and Background

A. Induced travel

Background

Several recent studies have demonstrated an association between increases in highway capacity and increases in vehicle miles of travel (VMT). That phenomenon, called induced travel, has increasingly been cited as a basis for rethinking travel demand modeling, land-use/transportation interactions, and the environmental impacts of highway projects. Yet before the policy community can firmly conclude that induced travel is an important phenomenon, one lingering doubt must be addressed. Do new highways really induce additional travel, or are the associations between lane miles and VMT driven by a reverse causal link – namely that new highways are built in anticipation of expected increases in travel demand? The debate remains contentious, in part because the empirical evidence on induced travel is mostly from aggregate data that are better suited to establishing correlations than causality. As Noland and Lem (2000) note, the studies to date, while often supportive of the hypothesis, do little to illuminate the behavioral underpinnings of the phenomenon. Determining causality with data that are aggregated over broad geographic areas, such as counties or states is difficult, and focusing on individual projects can help clarify matters. In this light, we examine three highways in a rapidly growing urban area to pose the following question: Do new highways influence urban development in ways that suggest that they induce new automobile traffic, or are urban growth patterns somewhat impervious to the completion of new highways?

Behavioral impacts of new highways

If increases in highway capacity cause increases in VMT, the behavioral underpinnings can be divided into two broad classes. First, an increase in capacity that reduces congestion and lowers travel times reduces the full cost of travel. This lower price of travel can induce more travel. This is part of the underpinning of Downs' (1962) "law of peak hour expressway congestion".[1] Second, increases in highway capacity that lower travel times can facilitate changes in urban development that are associated with longer trips and thus more VMT (see, e.g., Noland and Lem (2000); Downs (1996); Hills (1996)). The focus of this report is on the second class of behavioral changes of induced travel, caused by increased highway capacity, i.e. the link between highways and urban development. Specifically, this paper is a "before and after" study of the impact on house prices of the construction of toll roads in Orange County, California.

[1] Downs (1962, 1992) also discusses how increases in highway capacity can induce shifts in travel from different times of day, routes, and modes. With the exception of changes in mode, it is not clear that changes in trip scheduling or route will increase VMT, even if those shifts contribute to increases in peak period congestion. For that reason, we follow Noland and Lem (2000), who note that the effect of highway capacity on inducing new or longer trips should be a key focus for research on the link between VMT and highway capacity.

B. Empirical study using the Orange County Toll Roads

Since 1993, fifty-one new centerline miles of toll road have opened in Orange County. Collectively, those roads extend the County's relatively dense highway network into the rapidly growing southern part of the County. (See Figure 1 for a depiction of the highway and toll road network in the County.) The San Joaquin Hills, Eastern, and Foothill corridors (California State Routes 73, 241, 261, and portion of 133) have all been in Orange County's Master Plan of Arterial Highways since the 1970s, but planning for the toll roads began in earnest when the Transportation Corridor Agencies (TCAs) were created in 1986.[2] In 1987, the TCAs determined that state and federal funds would not be sufficient to finance the roads and state legislation passed in that year allowed the roads to be built as toll facilities.

The TCA toll roads were chosen because they provide a rare opportunity to examine a significant expansion of highway capicity in a rapidly growing suburban area, and to test, using readily available data, growth pattern before and after the highways were built. The fact that the TCA highways are toll facilities has some impact on both induced travel and the link between the roads and urban growth. The argument for induced travel in many ways hinges on the fact that virtually all highway construction in the United States for the past several decades has been for roads that do not charge tolls. Highway travel is thus unpriced in the sense that drivers do not pay for the additional congestion that they cause during peak period. Induced demand, as originally popularized by Downs (1962, 1992) is intimately linked to the theoretical proposition that persons will increase their driving on free highways in response to increases in capacity that reduce congestion. A commonly proposed policy solution to the problem of induced demand is to charge for highway travel during peak times – i.e. to impose toll that vary with congestion levels (e.g. Vickrey, 1963; Small, Winston, and Evans, 1989). While the TCA toll roads do not vary the toll with either the time of day or congestion levels, one could argue that the existence of even a flat toll should attenuate the induced demand effect which has been documented in studies (e.g. Hansen and Huang, 1997; Noland, 1998) of free highway capacity.

That argument is well taken, and our response is threefold. First, while the ideal case study for this research would be highways built in growing suburban areas, such cases are rare, and the Orange County case study brings countervailing advantages in data availability and model calibration. The data for much of the empirical work needed for the Orange County case were readily available. Also the population and employment growth model had been tested on Orange County data, such that much work on model validity had been completed in Orange County. Second, there are few suburban areas

[2] A detailed case study of the toll roads, conducted as separate research, revealed that few persons in the County regarded the roads as likely to be built before the creation of the TCAs (Boarnet, DiMento, and Macey, 2002). It is unlikely that land development would have anticipated the roads before the formation of the TCAs in 1986, and more generally the early 1990s, when construction began on the toll road network, is the earliest time that development would likely have anticipated the roads. For a discussion of the history of the toll roads, drawn from archival documents and expert interviews, see Boarnet, DiMento, and Macey (2002).

with current highway investment program's that are comparable in size to Orange County's.

Third, recent theoretical research (Arnott, 1998) suggests that even congestion tolled highway capacity is likely to influence urban growth patterns, although the influence might not be as strong as if the new capacity were unpriced. The implication for this research is that links between highways and urban growth are likely to persist even if the capacity is congestion tolled, and would likely be even more apparent in the case of the flat tolls used by the TCAs.

In the first part of this report, we employ both hedonic regression analysis and multiple sales techniques to examine how the opening of the toll road network alters house prices in nearby corridors. In the second part, we use a census tract population and employment growth model to examine impact of the toll roads on urban development patterns.

Urban economic theory posits that the influence of highway improvements on urban growth patterns acts through land prices. If highways improve accessibility, that accessibility premium will be reflected in higher land prices (and *ceteris paribus*, higher house prices), and higher priced land will be developed more densely. As a first step in better understanding the link between highways and urban development, we examine how the construction of the Orange County toll road network altered house prices in nearby corridors. Understanding the link between house prices, development patterns, and induced travel requires first understanding those related literatures, which we summarize below.

II. Literature Review

A. Induced Travel

Downs (1962) offered one of the earliest theoretical justifications for induced travel, stating the improvements in highway capacity lower the cost of peak hour travel, and thus can create additional peak hour traffic. More recent research has focused on the link between VMT and highway capacity, rather than peak hour traffic. The empirical literature, especially works that have been influential in policy circles, is quite new. Important recent empirical research on induced travel includes the research of Goodwin (1996), Hansen and Huang (1997), and the report of the Special Advisory Commission on Truck Road Assessment (1994). The SACTRA (1994) report examined traffic growth in corridors that had increases in capacity, and also compared actual and forecast travel along new and improved corridors. Both pieces of evidence led SACTRA (1994) to conclude that induced travel is a real phenomenon, concluding that, on average, traffic increased by 77% due to capacity expansion.

Hansen and Huang (1997) used panel data for California counties to examine statistically how VMT is influenced by state highway lane miles, controlling for other factors such as county population and per capita income. They concluded that the elasticity of VMT with respect to lane miles ranged from 0.3 to 0.7 for counties and 0.5 to 0.9 for metropolitan areas. Virtually all elasticity point estimates were significant at conventional (5% or better) levels. Noland (forthcoming) found similar results using the same methodology with data for U.S. states, and Noland and Cowart (forthcoming) also found similar results with data on metropolitan areas from the mid-Atlantic region of the United States. The results have provided support for the idea that induced travel is an important transportation phenomenon, but the issue of causality remains a point of some controversy. As Noland and Lem (2000) note, the research to date provides little information on the underlying behavioral foundations of whether and how increases in highway capacity cause increases in VMT. To increase our understanding of the behavioral links between highway construction and induced travel, this paper focuses on the link between highways and urban growth patterns.

B. Highways and Urban Development

The literature on highways and urban development has focused largely on the question of whether highways contribute to the decentralization of metropolitan areas. The evidence, reviewed by Boarnet and Haughwout (2000), suggests that transportation infrastructure is only one of several factors that influence metropolitan decentralization, although there is debate about the relative importance of transportation versus other factors (see, e.g., the exchange between Cervero and Landis (1995) and Giuliano, (1995)). The empirical literature initially focused on how highways influence the relative

growth of central cities and suburban rings. An often-cited example of this work is the study by Payne-Maxie (1980) that examined the influence of suburban beltways on the growth of suburbs and central cities in fifty-four United States metropolitan areas. The authors conclude that beltways have little impact on overall growth of the metropolitan area, and they also conclude that the intra-metropolitan economic and land use effects that do exist are likely to be transfers from one place to another within the metropolitan area (Payne-Maxie (1980), pp. 114-116). Yet the work by Payne-Maxie (1980), and similar articles on the determinants of decentralization such as Bradford and Kelejian (1973), Mills and Price (1984), and Palumbo, Sacks, and Wasylenko (1990), divided metropolitan areas into two components – central cities and the remaining suburban ring. This geographic focus is relatively crude and allows little analysis of finer scale impacts of highways on metropolitan growth patterns. Partly for that reason, we use data on house sales prices that are matched, via a geographic information system (GIS), to street addresses. This allows a more detailed geographic study of the effect of highways on urban development.

C. Hedonic Price Studies of Highway Access

In the United States, studies of the impact of highways on nearby land and house values date to the beginnings of the Interstate Highway program (e.g. Adkins (1959); Mohring (1961)). The technique of hedonic price analysis was later formalized by Rosen (1974), and there have since been several studies of the impact of highways on house prices. Huang (1994) reviewed the literature on hedonic price studies of the influence of highway access on house prices. He concludes that the early studies, from the 1950s and 1960s, usually showed large land price increases near major highway projects. The later studies, from the 1970s and (less often) the 1980s, typically showed smaller and often statistically insignificant land price effects from highway projects. Giuliano (1989), in reviewing the literature on the effect of transportation infrastructure on urban development, comes to the same conclusion – namely that later studies show a smaller impact of highway access on home values. Both Giuliano (1989) and Huang (1994) argue that, as the highway system was developed in many urban areas, the value of access to any particular highway was reduced because accessibility is now generally good throughout the network in most United States cities. Huang also notes that, for residential properties, noise and other disamenities will reduce the value of locating close to a highway. Langley (1976, 1981), in a study of homes near the Washington Beltway, concluded that house prices increase with distance from the highway out to a distance of 1,125 feet, and then decrease with distance beyond 1,125 feet. Langley interprets this as evidence that the disamenities of highways dominate the value of access for distances of less than 1,125 feet.

The literature on highways and house prices echoes the broader literature on highways and urban growth. Giuliano (1989, 1995), in reviewing both literatures, concluded that the influence of transportation on urban development patterns is growing less important. Yet most of the evidence that led Giuliano to that conclusion is based on data that are aggregated to broad geographic distinctions such as central cities and suburban rings. A more recent hedonic price study, by Voith (1993), found that highway

access (measured by travel time by highway to the downtown) influenced house prices in the Philadelphia area, and that the magnitude of that effect increased during the 1980s. Overall, the literature on house prices and highway access, like the literature on highways and urban development, has often used data that are aggregated to a geographic scale that can obscure fine-grained links between highways and growth patterns. Thus, the link between highways and metropolitan growth, and any ensuing link to induced travel, remains incompletely understood.

D. Population-employment growth model

Population and employment growth models have a long history in regional science and urban economics (Steinnes and Fisher, 1974; Bradford and Kelejian, 1973; Mills and Price, 1984; Carlino and Mills 1987). More recently, the two equation population and employment growth model has been reformulated in an explicitly spatial econometric framework (Boarnet, 1994). The motivation for the spatial treatment is that, within urban areas, the link between population and employment growth extends beyond geographic boundaries. Population changes in a geographic unit depend not only on employment changes within the same jurisdiction, but also on employment changes in a labor market area that typically extends beyond that jurisdiction. Similarly, employment changes depend on population changes in surrounding labor markets. This leads to a spatial structure in the econometric model, and the problem of spatial dependence across observations is more severe for a smaller observations of the sort that are inherent in intra-metropolitan as opposed to inter-metropolitan models.

Boarnet (1994) applied spatial econometrics to a Carlino and Mills (1987) lagged adjustment model of population and employment growth to handle this problem of spatial dependence across observations. The theoretical rationale was that interactions across observations (New Jersey municipalities in the case of Boarnet's 1994 study) are mediated by a commuting relationship. Thus, the link between population and employment is best modeled as a dependence within labor-market areas or commutersheds which, given the small size of New Jersey municipalities, almost certainly were larger than any one municipal observation.

Since then, the model in Boarnet (1994) has been adapted by other authors to study problems that include the employment impacts of urban rail transit (Bollinger and Ihlanfeldt, 1997), the link between urban and rural development (Henry, Barkley, and Bao, 1998), and the influence of highway location on urban growth (Boarnet, 1996). This research is yet another effort to apply the growth model to illuminate another ongoing policy debate – in this case, the chicken and egg problem of highway construction and and urban development. The model is applied to the fast-growing south Orange County, before and after it received a major highway investment in the last decade.

III. Research Strategy

A. House Sales Price Analysis

If the toll roads changed that pattern of accessibility in Orange County, that should be capitalized into house prices. We have data on every home sale in Orange County from 1988 through the early part of 2000. Because these data span a period that ranges from the early planning stages of the toll roads through the opening of most of the network, we expect to see house prices decrease with distance from the toll road in the later years of our data set, but not in the earlier years.

The toll roads are built and operated by the Transportation Corridor Agencies (TCAs), a special purpose government agency formed in 1986 with the sole purpose of building the roads. Portions of the toll road network exist in County planning documents that date to the 1970s. Yet it was not until the TCAs developed a plan to raise money primarily through tolls, first proposed in 1988, that the prospect of the roads became a serious possibility. Even then, construction started on a small, 7.3-mile portion, in 1990, and the rest of the network was built in stages beginning in 1993. The first part of the toll roads, the Foothill Corridor Backbone, was opened in 1993; the San Joaquin Hills Transportation Corridor opened in 1996, and later portions of the Foothill and Eastern Transportation corridors opened in 1999. Figure 1 shows the toll road network. Figure 1 also shows population density (as of 1990) for census block groups in Orange County, so that the toll road and highway networks can be viewed alongside existing development patterns. Table 1 lists each segment with the date that construction started and the date the construction was completed.

Even with some foresight on the part of home buyers, we expect that the market assessment of the likelihood that the roads would be built will rise over the early years of our data, implying that the full value of the toll roads would not be capitalized into house prices in 1988. For example, the San Joaquin Hills corridor was the subject of litigation until 1993. In all, the TCAs have opened fifty-one new centerline miles of toll highway in Orange County. Of those toll roads, the two segments the opened the earliest – the Foothill Corridor Backbone and the San Joaquin Hills Corridor – are the focus of this study, as they were built and opened in essentially the middle of the span of our data, providing a good comparison of accessibility values before and after the segments opened. For those roads, we expect to see no effect of distance to the toll road before some threshold year, but declining house prices with increasing distance from the road after the threshold.[4] Threshold years are chosen to reflect when the housing market most likely viewed the road as being likely to be built. Different threshold years were tested, as is discussed below.

[4] Based on Langley's results (1976, 1981) we exclude homes that are within a 1,125 of the toll road, to avoid confounding the value of access with noise and other disamenities that are experienced close to highways.

B. Population and Employment Growth Model

The second part of the empirical study in this report involves the use of a two-equation population and employment growth regression model to examine the link between highway access and urban growth in south Orange County. The model is briefly reviewed here. (See Boarnet, 1994 for a detailed description.)

The model follows a long tradition of intraurban population and employment location models (e.g. Bradford and Kelejian, 1973; Carlino and Mills, 1987; Mills and Price, 1984; Steinnes and Fisher, 1974). The observations, in the case of the Orange County research are census tracts in the county. The dependent variables are the change in population and employment in each tract.

The independent variables can be grouped into three classes - variables that measure transportation access, variables that measure non-transportation local amenities, and variables that represent the simultaneity between population and employment growth within an urban area. This latter point warrants some further discussion. Population changes within a census tract depend, in part, on employment changes in a surrounding labor market area. Employment changes within a census tract similarly depend on population changes within a surrounding labor market area. Those labor market areas are likely to be larger than census tracts, so that the simultaneity between tract population and employment links tract variables to variables measured over a larger area. The labor market variables are formed by taking weighted sums of values from surrounding census tracts. The formal implementation benefits from the ideas of spatial econometrics pioneered in, e.g., the work of Anselin (1980, 1988).

The motivation for the census tract population and employment growth model has its roots in bid rent theory, as developed, for example, in the well known urban location models of Alonso (1964), Mills (1972), and Muth (1969). For an excellent description, see Fujita (1989). Bid-rent models theorize that persons and firms will choose locations within urban areas based in part on the transportation access and other amenities found at those locations. Population and employment changes are inherently disequilibrium phenomena, as the equilibrium condition in bid-rent models is that persons and firms cannot improve their position by moving. Following Carlino and Mills (1987), the model census tract population and employment growth model links the disequilibrium phenomenon of differential census tract growth to equilibrium bid-rent theory through a lagged adjustment model. The lagged adjustment model assumes that census tracts adjust to equilibrium population and employment levels slowly, and that changes in tract population and employment are adjustments toward equilibrium. See Boarnet (1994) for a full discussion of the development of the model.

The model explains tract population and employment growth as a function of various tract characteristics, including socioeconomic and demographic variables and local amenities. In this research, a major extension from an earlier Orange County case study (Boarnet, 1999) is the inclusion of highway and toll road dummy variables in the transportation access class, which enter both population and employment growth

equations as independent variables in the simultaneous system of equations. The "before/after" test of the impact of toll roads can be constructed by fitting this population and employment growth model on data from two time periods, before and after the opening of the toll roads. The "before" period is defined as the decade from 1980 to 1990, before the toll roads were open and before virtually all of the construction for those toll road began. The "after" period is the years from 1990 to 1997, which saw the development and opening of much of the toll road network. For the "before" period, the toll road dummy variable will measure access to a "phantom" road – a line on a map that represents where each toll road will be built. If the toll roads were built strictly to serve future growth, the toll road dummy variable should behave much the same way in the model in both "before" and "after" period. If, on the other hand, the toll roads alter urban growth patterns, the impact of the toll road should be reflected by changes in toll road dummy variables across the two time periods.

IV. House Sales Price Analysis

A. Data

Dataquick, Inc. provided information about physical characteristics of houses, such as dwelling size, lot size, number of bedrooms, number of bathrooms, and street address, and information on house sales, such as year of sale, price, and loan amount. Geographic Data Technology, Inc. and the California Department of Transportation provided GIS maps of Orange County's street network, which include the center lines of freeways, toll roads, and local roads, as well as the entrance and exit ramps of all grade-separated highways. Two major neighborhood characteristics are used in this study, namely crime rate and school quality. School quality was proxied by average SAT score. Crime rates were calculated based on data from California Department of Justice's Justice Statistics Center (1999) and the California State Department of Finance Demographic Research Unit (1999). SAT scores for Orange County were obtained from the Los Angeles Times (1999).

There are 367,841 records of single-family detached dwelling unit sales in Orange County from 1988 to the first quarter of 2000. We used Arcview-GIS to geocode the home addresses based on the street network map mentioned earlier, and selected only those that were perfectly matched, i.e. the street number is found on a street segment with the exact same name as in the address, and the house is matched to the correct block, side of street, and approximate location within the block. We tested several address matches by comparing the GIS match to published street maps to develop the methods and criteria for an exact GIS address match. See Table 2 for the distribution by year of the number of house transactions and those that were geocoded with a perfect address match. We also used Arcview-GIS to link the locational characteristics to each house. A school district and police department jurisdiction is assigned to each house by joining the house location from the address match to the both the school district and police department jurisdiction base maps. Then, an SAT score and crime rate were assigned to each house transaction based on the year of sale and the school district or police department jurisdiction associated with the house's location.

After the GIS processing of raw data, the data set was filtered for missing data, apparent data entry errors, and non-arms length transactions. We dropped all observations with missing key variables, such as size, lot size, and number of bedrooms and bathrooms. We also dropped observations with inconsistent data, such as a four-bedroom house with floor area less than 500 square feet or houses with more than 10,000 square feet and fewer than 4 bedrooms. As for non-arms length transactions, we dropped all observations with sales price less than $25,000 and observations with loan amounts greater than 125% of the sale price. See Table 2 for the distribution of number of observations by year after the inappropriate data were filtered out. After address matching and filtering inappropriate data, we were left with 275,185 sales in Orange County from 1988 to the first quarter of 2000.

B. Hedonic Price Regressions

We analyzed access to toll roads using a hedonic price analysis for corridors surrounding the two oldest segments of the toll road network – the Foothill Transportation Corridor Backbone (FTCBB) and the San Joaquin Hills Transportation Corridor (SJHTC).[5] The regression specification is shown below.

$$P = \alpha_0 + \alpha_1 SQFT + \alpha_2 Bedroom + \alpha_3 Bath + \alpha_4 Lotsize + \alpha_5 Age + \alpha_6 SATscore + \alpha_7 CrimeRate + a_8 DtrBefore + \alpha_9 DtrAfter \quad (1)$$
$$\sum_{i=1}^{12} \beta_i YEAR_i + \varepsilon$$

Where P = home sales price
SQFT = size of dwelling, in square feet
Bedroom = number of bedrooms
Bath = number of bathrooms
Lotsize = size of lot, in square feet
Age = number of years since residence was constructed
SATscore = average SAT scores for the school district that contains the home
CrimeRate = total violent and property crimes per 1,000 residents in the municipality where home is located
$YEAR_i$ = Dummy variable for year of sale, ranging from 1988 (index "i" = 1) to 1999 (index "i" = 12); 2000 is the omitted year

We measured the effect of distance from the toll road with two variables, *DtrBefore* and *DtrAfter*. Both variables measure the straight-line distance from each house to the nearest toll road on-ramp.[6] *DtrBefore* measures distance to the nearest toll road on-ramp before a threshold year that was chosen to mark when the toll roads became a serious possibility. *DtrAfter* measures distance to the nearest toll road on-ramp in all years during and after the threshold year. Thus, *DtrBefore* and *DtrAfter* are defined as shown below.

DtrBefore = Dtr*(1 – ThresholdDummy)
DtrAfter = Dtr*ThresholdDummy
Where Dtr = straight-line distance from each house to the nearest toll road on-ramp

[5] The corridors now carry the names of routes of the state highway network. The San Joaquin Hills corridor is the southern extension of State Highway 73, the Foothill corridor is State Highway 241, and the Eastern corridor is a combination of an extension of State Highway 133 and portions of State Highways 241 and 261. To avoid confusion with pre-existing portions of the state highway network, we refer to the corridors by name rather than number, and so will use FTCBB and SJHTC to refer to those two corridors, respectively.

[6] Visual examination of GIS maps confirmed that straight-line distance is strongly correlated with street network distance. This is due in part to the relatively dense network of surface streets in the corridors that we studied. Because we are testing the hypothesis that distance from the toll road is reflected in house values, a good proxy for driving distance will suffice if the hypothesis test is accepted. For that reason, and due to the additional computational difficulty of calculating road network distance, straight-line distance was used for this analysis.

ThresholdDummy = 0 for all home sales that occur before the threshold year; 1 for sales in the threshold year and in subsequent years.

Threshold years are defined both on an *a priori* basis and by analyzing which definitions of threshold years yielded regressions with a maximum log-likelihood value.

The variables in the hedonic regression include structure-specific characteristics (*SQFT*, *Bedroom*, *Bath*, *Lotsize*, and *Age*), neighborhood characteristics (*SATscore*, *CrimeRate*), year dummy variables to control for the real estate cycle, and the toll road distance variables that are the focus of this analysis. The structure-specific and neighborhood characteristics are similar to those used in other hedonic studies (e.g. Dipasquale and Wheaton (1996); Haurin and Brasington (1996); Li and Brown (1980)). The structure-specific variables include all variables in the Dataquick data set that were reported with a frequency and reliability that allowed them to be used in this study.[7] The neighborhood variables, *SATscore* and *CrimeRate*, were included to control for two local characteristics that can affect house prices. Homes were address matched to school districts and municipalities, and then the *SATscore* and *CrimeRate* data for the appropriate year was matched to each sale.

We analyzed sales prices in corridors around the FTCBB and SJHTC both to isolate property markets that were internally homogenous and to focus on areas that would be most likely to experience improvements in accessibility from the toll roads. Initial analyses on the full Orange County data set suggested that the hedonics for different sub-markets behave differently. For example, the price of properties within several miles of the coast is strongly affected by distance from the coast. Also, the markets in the northern and southern half of the county behave differently both in relation to the time-series properties and in relation to specific hedonic characteristics. Lastly, we expected accessibility from the toll road to be reflected primarily in prices of homes along the toll road corridors.

The corridor around the FTCBB was chosen to include all homes that were closer to a FTCBB on-ramp than to any other toll road or highway on-ramp. There were only 123 home sales within 1,125 feet of the FTCBB, out of 29,197 sales in the FTCBB corridor, and so whereas for other corridors we explicitly excluded homes with 1,125 feet of an on-ramp we did not exclude those few homes for the FTCBB. Unlike other corridors, we did not impose a maximum distance cutoff for the FTCBB. The FTCBB corridor is somewhat more isolated from the rest of the highway network. Of the sales within the FTCBB corridor, approximately 95% of were within three miles of an on-ramp. The corridor for the SJHTC included all homes more than 1,125 feet from a SJHTC on-ramp and less than two miles from a SJHTC on-ramp. The two mile limit was imposed to isolate areas near the SJHTC and to avoid places that might be close enough to the parallel Interstate 5 that improvements on that highway would confound the

[7] For example, the variables that denote swimming pools, view properties, and garages were missing in well over half of the observations.

analysis.[8] Also, homes that were closer to an on-ramp on Interstate 5 than to a SJHTC on-ramp were excluded from the analysis, to reduce the potentially confounding influence of the parallel Interstate 5 corridor.

C. Structural Tests

The literature on hedonic price analyses includes both linear and log-linear specifications. Huang (1994) concludes that there is no single dominant hedonic price specification, and we followed common practice by using a Box-Cox test to examine the relative performance of linear and log-linear specifications of the regression in Equation (1). In the log-linear specification, the log of all variables was used in the regression. Because the year dummy variables take on a value of zero, the Box-Cox regressions were run separately for each year. Homes with *Age* equal to zero were dropped from the log-linear specifications and thus from the Box-Cox tests.

To compare the performance of linear and log-linear specifications, we normalized the original data by their geometric means. Pindyck and Rubinfeld (1991) showed that MLE and OLS yield the same results with normalized data. The OLS results of the normalized data for linear and log linear forms can therefore be compared directly, and the best-fitting model with the highest adjusted R^2 is chosen as the preferred specification. For the FTCBB, the linear specification is preferred in all years other than 1989. For the SJHTC, the linear specification is preferred in seven of thirteen years – 1991 through 1996 and 1998. Based on these results, we used linear specifications for both the FTCBB and the SJHTC. Because the log-linear specification requires excluding new homes (which have *Age* equal to zero) – and because new homes are approximately one-fifth of all sales in the SJHTC corridor – we felt that the linear specification should be preferred even in the case of the SJHTC, for which the Box-Cox test gave more ambiguous results about the appropriate specification.

We first chose threshold years to reflect the time when the housing market was most likely to view the completion of the two segments of toll road as a certainty. The results are shown in Table 3. For the FTCBB, we chose two thresholds – one year before construction began (1989) and the year construction began (1990). The SJHTC was the subject of litigation until early 1993, and so we chose 1993 as the threshold for that corridor.

D. Regression Results and Discussion

Looking first at the structure-specific variables variables, Table 3 shows that larger homes sold for a higher price, homes with more bedrooms sold for less in both the FTCBB and SJHTC corridors, more bathrooms increased sales price, older homes sold

[8] The Interstate 5 corridor parallel to the SJHTC was improved substantially in the mid-1990s, and thus we wish to attempt to isolate areas where the effect of the SJHTC is likely to dominate the effect of improved accessibility on Interstate 5.

for less near the FTCBB and for more near the SJHTC.[9] Homes in school districts with higher SAT scores sold for more in the SJHTC corridor but for less near the FTCBB. Higher crime rates had no significant impact on sales prices near the FTCBB but were associated with higher sales prices near the SJHTC. Both the SJHTC and the FTCBB corridors are in low-crime, upper income areas with good schools. The "wrong signs" on the *SATscore* and *CrimeRate* variables likely reflect the small variation in those variables in the corridors that we examined and the fact that variations in those variables are correlated with other, unmeasured aspects of geographic desirability. Lastly, distance from the coast (in feet) was included for homes in the SJHTC corridor, and as expected the effect is negative – homes sold for more than $60,000 less with each mile from the coast.

The year dummy variables show the time pattern of home prices in southern California. Home prices appreciate rapidly in the late 1980s, lost value in the recession years of the early 1990s, and began to appreciate again in 1995 for the FTCBB corridor and 1997 for the SJHTC corridor.

The distance variables show the expected pattern – a negative gradient appears after the threshold year for both the FTCBB and the SJHTC. Specifically, the coefficients on *DtrBefore* are insignificant and the coefficients on *DtrAfter* are significantly negative in all three regressions. After the threshold year, home prices decrease, *ceteris paribus*, by approximately $1.30 per foot (almost $7,000 per mile) from the FTCBB, and by approximately $4.50 per foot (or almost $24,000 per mile) from the SJHTC.

E. Selection of Threshold Year

While the results in Table 3 suggest that the toll roads created an accessibility premium, and by inference could have contributed to changing development patterns, we prefer to also analyze different threshold years. We defined threshold years for both the FTCBB and SJHTC that ranged from 1989 to 1998. This allows us to examine every possible threshold year without choosing the endpoints of our data.[10] We ran the regression in equation (1), allowing the threshold year to take on values from 1989 through 1998, and then chose the threshold year that yielded the largest log-likelihood

[9] The negative coefficient on *Bedroom* is indicative of a higher-priced, luxury home market, with larger homes that have relatively few bedrooms. Local real estate experts and persons familiar with the Dataquick data agreed that house prices in south Orange County are more influenced by dwelling size than by the number of bedrooms, and that the negative coefficient on *Bedroom* was not surprising. The positive effect of *Age* near the SJHTC was likely due to the generally young age of homes in the area. For example, real estate experts suggested that new homes, when sold in a resale market, often show price increases due to improvements such as landscaping that are not reflected in the price of the new home.

[10] Choosing endpoint years would create a considerably unbalanced test, as the number of observations in the endpoint year would be substantially smaller than the number of observations in all other years, creating some concern that statistical results could be driven by those differences in the number of observations. Also note that, given the span of the data, it is unlikely that the effect of the toll roads would be first felt at either endpoint year. Lastly, note that given that the data for 2000 include only the first couple of months, we regard 1999 as the endpoint year for the data for purposes of this analysis.

value. This allows the data to suggest which threshold year gives the best explanatory power. Log-likelihood values for threshold years for the corridors are shown in Table 4.

The log-likelihood surface is quite flat, suggesting that the choice of threshold year has little impact on the overall explanatory power of the hedonic regression. Of course, the choice of threshold year can matter somewhat more for hypothesis tests on the *DtrBefore* and *DtrAfter* variables, and so it is reassuring that the maximum likelihood technique gives results that are generally consistent with the results in Table 3.

For the FTCBB, the maximum log-likelihood value is attained when the threshold year is 1993. Table 5 shows the coefficients and t-statistics for the *DtrBefore* and *DtrAfter* variables for each threshold year, so that one can see how the hypothesis tests are affected by the choice of threshold year. For a threshold year of 1993, the coefficient on *DtrBefore* is insignificant and the coefficient on *DtrAfter* is significantly negative – consistent with the FTCBB creating a negative house price gradient with distance from the toll road. Note that the magnitude of the accessibility affect is larger for a threshold year of 1993 than for threshold years of 1989 or 1990. Also note that, from Table 5, the hypothesis of an insignificant *DtrBefore* coefficient and a negative *DtrAfter* coefficient is confirmed for any threshold year on or before 1993. Construction on the FTCBB began in 1990, and the first segment of that portion of toll road opened in 1993, so the significantly negative coefficient on *DtrBefore* for later threshold years likely reflects that the accessibility of the FTCBB is captured in both the *DtrBefore* and *DtrAfter* variables for years after 1993. Overall, the results in Table 5 strongly support the hypothesis that the FTCBB created an accessibility premium that previously did not exist in that corridor.

For the SJHTC, the results in Table 4 show that 1997 is the threshold year that maximizes the regression log-likelihood value. The SJHTC opened in November of 1996. Looking at the results in Table 5, the coefficients on *DtrBefore* and *DtrAfter* are the opposite of our hypothesis for a 1997 threshold – *DtrBefore* is significantly negative in that year and *DtrAfter* is not significant. Looking at how the coefficients and hypothesis tests vary with different threshold years, the coefficient on *DtrBefore* is generally insignificant for thresholds before 1994, while *DtrAfter* is generally significantly negative. The exception is a significantly negative *DtrBefore* for a 1990 threshold. For 1994 and later threshold years, the pattern is reversed, with *DtrBefore* being significantly negative while *DtrAfter* is not significant. We believe these results reflect, at least in part, the effect of substantial improvements that were completed in the nearby Interstate 5 corridor in the mid-1990s.

The interchange between Interstates 5 and 405 – a major peak hour traffic bottleneck in this region – was substantially improved and capacity in the interchange was increased during the mid-1990s. The Interstate 5 corridor is an alternative commute route for many residents in the SJHTC corridor. To the north and east of the SJHTC corridor, homes further from the SJHTC are closer to Interstate 5. Thus one explanation for the insignificant coefficient on *DtrAfter* for later threshold years is that the expected negative price gradient with distance from the SJHTC is confounded with the negative price gradient, in the opposite direction, from the improved Interstate 5 corridor. Overall,

the approximately contemporaneous improvements in the parallel Interstate 5 corridor make it more difficult to isolate an accessibility premium associated with the SJHTC than with the FTCBB. Also, the improvements in the Interstate 5 corridor suggest that earlier threshold years, before the Interstate 5 improvements were completed, might better isolate the premium from the SJHTC. Lastly, if home buyers anticipated the completion of the SJHTC, a threshold as late as 1997 could include some portion of the accessibility premium in the *DtrBefore* coefficient. For all these reasons, we believe earlier threshold years give more reliable information on the effect of the SJHTC, and for threshold years before 1994 the results are generally consistent with what was found for the FTCBB.

F. State Route 22: The Controlled Corridor

Lastly, to verify our method, we use our technique to examine a corridor that had no substantial capacity improvements during this time period. We chose the State Route (SR) 22 corridor in northern Orange County. According to Caltrans, the SR-22 had no important increases in capacity during the study period. We ran the regression in equation (1) on sales farther than 1,125 feet from the SR-22, but less than two miles from SR-22, defining *DtrBefore* and *DtrAfter* based on threshold years as was done for the FTCBB and SJHTC. Of course the threshold years do not reflect real changes in capacity, and so we expect there to be no meaningful difference in the coefficients on *DtrBefore* and *DtrAfter*. We examined the SR-22 to verify that the "before and after" test does not generate differences in price gradients for corridors where no difference should exist.

In Table 3, we chose 1993 as a threshold year for the SR-22, as that year is approximately in the middle of the data. The coefficients on *DtrBefore* and *DtrAfter* are both insignificant, implying no difference in the effect of distance from the highway before and after the admittedly arbitrarily chosen threshold year. In Table 5, we show the coefficients and t-statistics for *DtrBefore* and *DtrAfter* for threshold years that range from 1989 through 1998. The coefficients on both distance variables are insignificant for all threshold years, providing robust evidence that the "before and after" test gives no evidence of a change in price gradient for an unimproved corridor. This provides some reassurance that the changes in price gradient for the FTCBB and the SJHTC are associated with the construction of those toll road segments, and not with any statistical artifact of the analytical technique.

G. Multiple Sales Price Analysis

An alternative method of analyzing house price changes is to develop indices based on multiple sales of the same property (e.g. Bailey, Muth, and Nourse (1963); Case, Pollakowski, and Wachter (1991)). The advantage of this technique is that it controls for any time-invariant characteristics of the property or location, including characteristics that cannot be measured in the data set. When applied to an event study such as the construction of the toll roads, it is typical to develop multiple sales price indices for two areas – an area near the toll road (a treatment group, borrowing terminology from standard research design literatures) and an area more distant from the

toll road (a control group). For an example of this technique applied to the Miami rail transit system, see Gatzlaff and Smith (1993).

The treatment and control groups must be chosen by the researcher, and should be as similar as possible for all characteristics other than the event being examined. For our purposes, this implies choosing areas near the toll road corridor and more distant from the corridor that are otherwise similar. Choosing areas near and very distant from the toll road, while that clearly creates a stark difference in toll road accessibility across the two groups, also risks comparing areas that are not otherwise similar. In particular, the toll road corridors generally run through middle and upper income areas in the rapidly growing suburban fringe of south Orange County. Past research has demonstrated that prices indices in different locales appreciate differently, in ways that appear to be linked to characteristics of the neighborhood (Case and Mayer (1996); Case and Shiller (1994); Mayer (1993); Smith and Tesarek (1991)). For example, preliminary analysis of our data suggested that south Orange County emerged earlier and more strongly from the depressed real estate market of the early and mid-1990s. For those and other reasons, we chose control and treatment groups that are relatively close to each other, so that the two groups would likely differ only in access to the toll roads.

For both the FTCBB and the SJHTC, the treatment group is homes between 1,125 feet and one mile from the nearest toll road on-ramp. The control group is homes between two and three miles from the nearest toll road on-ramp. More dramatic variation in distance from the toll road, and thus toll road access, would have allowed a more stark comparison, but given the development patterns in Orange County we felt that choosing homes further than three miles from the toll road risked comparing control and treatment groups that were not sufficiently similar.

For both the FTCBB and SJHTC, we developed multiple sales price indices for homes in the nearby (1,125 feet to one mile) and more distant (two to three miles) corridors. Given that the FTCBB and SJHTC were constructed and opened during the span of our data, we expect nearby homes to get a larger accessibility premium and thus appreciate faster than homes in the more distant corridor.

Following Gatzlaff and Smith (*33*), the regression for developing the sales price index is shown below.

$$\ln(P2_i/P1_i) = \beta_1(Y88_i) + \beta_2(Y89_i) + \ldots + \beta_3(Y00_i) + \epsilon \qquad (2)$$

where P1 = first sale for the same property
P2 = second sale for the same property
Y88 = dummy variable equal to –1 if first sales was in 1988,
1 if second sale was in 1988,
0 otherwise
dummy variables for Y89 through Y00 correspond to the years 1989 through 2000, and are defined similarly to Y88
ϵ = regression error term

Sales price indices for the nearby (1,125 feet to one mile) and more distant (two to three miles) corridors around the FTCBB are shown in Table 6. The indices for the FTCBB are graphed in Figure 2. Note that the nearby index appreciates more rapidly during the last few years of our study period. This is consistent with the toll road creating an accessibility premium that caused nearby houses to appreciate more rapidly during the study period.

The price indices in Table 6 are derived from the regression coefficients, shown in Appendix 1. Because the coefficients are point estimates, the price indices and similarly the change in price indices for the nearby and more distant corridors are also estimated from the data. We examined whether the change in the regression coefficients from 1988 through 2000 was significantly different across the two corridors. In Table 7, we show the change in the regression coefficient from 1988 to 2000 (the coefficient on the 2000 dummy variable minus the coefficient on the 1988 dummy variable) and the standard error of that change. We also show the 90 percent and 95 percent confidence intervals for the change in coefficients from 1988 to 2000 for both the nearby and the more distant corridors. Note that the 90% confidence intervals for the change in year coefficients do not overlap, implying that the changes in the year coefficients, and hence house price appreciation, is significantly different for the nearby and more distant FTCBB corridors at the 90 percent confidence level.

Also in Table 6, we show the price indices for the nearby (1,125 feet to one mile) and more distant (two to three miles) corridors around the SJHTC toll road. A graph of those price indices is shown in Figure 3, and the coefficients from the estimating equation for the nearby and more distant SJHTC corridors are shown in Appendix 2. Note from Table 6 and Figure 3 that the index for the nearby corridor is higher than the index for the more distant corridor until 1996. In 1996 and later years, the more distant corridor has a higher price index. In Table 7, we show the change in the regression coefficient from 1988 to 2000 for both the nearby and more distant corridors, the standard error of that change, and the 90 and 95 percent confidence intervals for the change in year coefficients over the study period. The 90 percent confidence intervals for the nearby and more distant corridors for the SJHTC overlap, implying that there is no statistically significant difference in appreciation of homes across the nearby (1,125 feet to one mile) and more distant (two to three miles) corridors around the SJHTC from 1988 to 2000.

Overall, the results from the multiple sales price method show evidence that the FTCBB positively influenced the appreciation of nearby homes, but give no similar evidence for an effect of the SJHTC on home price appreciation. It is important to note that the multiple sales price method is especially limited when applied to the SJHTC corridor. The multiple sales price technique requires that the two corridors (nearby and more distant) be identical on all characteristics other than access to the toll road. For the SJHTC that assumption is problematic. The SJHTC is approximately four to five miles from the Coast, such that homes south of the SJHTC are almost certainly influenced by the desirability of Coastal locations. Similarly, homes in the "more distant" corridor to

the north of the SJHTC are within a few miles of the I-5 corridor, and could have benefited from the improvements in capacity on that corridor that occurred at roughly the same time that the SJHTC opened. Overall, we find it very difficult to believe that the nearby and more distant corridors around the SJHTC provide a good "controlled experiment" that holds factors other than toll road access constant. In that regard, the FTCBB provides a more clean experiment, and we also prefer to give more weight to the hedonic regressions for both the FTCBB and the SJHTC, since the hedonic analysis allows some ability to control for potentially confounding factors. We conclude that the multiple sales price technique for the SJHTC illustrates the difficulty of finding good "control" and "experimental" corridors around that toll road, and we are persuaded by the evidence from the cross-sectional regressions and the multiple sales price technique for the FTCBB that the toll roads created an accessibility premium that is reflected in home sales prices beginning approximately in the mid-1990s.[11]

[11] As in the cross-sectional regression analysis, we also used the multiple sales price technique to examine price indices in nearby (1,125 feet to one mile) and more distant (two to three mile) corridors around the SR-22. As we expected, the price indices for the nearby and more distant corridor for the SR-22 tracked each other very closely and the change in the year dummy variables for the nearby and more distant corridors were not statistically significantly different from each other. The SR-22 does not have the confounding influences of coastal access and proximity to other parallel and improved corridors, and so the results of the multiple sales price technique applied to the SR-22 suggest that there is no change in accessibility premium associated with that road during the study period, as expected since that corridor had no important capacity improvements from 1988 to 2000.

V. Population and Employment Growth Model

The second component of the empirical study in this report involves the simultaneous population and employment growth regression model that was developed by the principal investigator (Boarnet, 1994 and 1999). The model and the empirical study based upon it have been extended to examine the link between highway access and urban growth in south Orange County by expanding the period of study to cover the period after the toll roads were opened and including highway access variables as explanatory variables for growth. We also improved the performance of the original model by testing various alternative specifications as well as by improving the definitions of the variables. The results of this case study can provide additional evidence to buttress our conclusion about induced travel demand that we have drawn in the previous sections.

We review the original model in the next section. Then, we describe extensions and changes that we made to the model in section B. Data sources are discussed in section C, and econometric results in section D. Finally, we conclude with a discussion of the results in section E.

A. Overview of Population and Employment Growth Model

The derivation of the two-equation population and employment growth model can be found in Boarnet (1994 and 1999). The original system of population and employment growth equations is given by.

$$\Delta\mathbf{POP}_t = \mathbf{X}_{t-1}\boldsymbol{\beta}_1 + \alpha_1(\mathbf{I}+\mathbf{W})\mathbf{EMP}_{t-1} + \frac{\alpha_1}{\lambda_e}(\mathbf{I}+\mathbf{W})\Delta\mathbf{EMP}_t - \lambda_p\mathbf{POP}_{t-1} + \mathbf{u} \tag{3}$$

$$\Delta\mathbf{EMP}_t = \mathbf{Y}_{t-1}\boldsymbol{\beta}_2 + \alpha_2(\mathbf{I}+\mathbf{W})\mathbf{POP}_{t-1} + \frac{\alpha_2}{\lambda_p}(\mathbf{I}+\mathbf{W})\Delta\mathbf{POP}_t - \lambda_e\mathbf{EMP}_{t-1} + \mathbf{v} \tag{4}$$

where
$\Delta\mathbf{POP}_t$ = population growth from time period *t-1* to *t*
$\Delta\mathbf{EMP}_t$ = employment growth from time period *t-1* to *t*
$\mathbf{POP}_t$ = population in time period *t*
$\mathbf{EMP}_t$ = employment in time period *t*
X = a matrix of location characteristics that affect population growth
Y = a matrix of location characteristics that affect employment growth
I = (n x n) identity matrix
W = (n x n) weight matrix
u and **v** = a vector of i.i.d. normal disturbances

In both equations, the subscripts *i*, referring to a census tract on which a labor market is centered, are suppressed. The matrices **X** and **Y** capture various characteristics of census tracts at the beginning of the period of study. These include variables that may affect population and employment growth, such as demographic characteristics, housing stock, location-specific amenities, etc. In addition, the land use variables, such as amount of residential land, commercial and office, etc., were included to reflect such location characteristics as constraints imposed by local government's zoning regulations. Lastly,

places dummy variables were used to control unobserved characteristics of municipalities and census defined places. Together, these variables determine how persons and firms locate within a metropolitan area. The lists of variables are given in Tables 8 to 10.

The weight matrix **W** reflects the relationship between a census tract on which the labor market is centered and neighboring census tracts, determined to be within the same labor market. The five specifications of **W** are described briefly here. See Boarnet, Chalermpong, and Geho (2002) for more detailed discussion.

(0, 1) neighbor matrix
Element w_{ij} equals one if tracts i and j border each other and zero otherwise.

(0, 1) neighbor matrix (normalized)
Similar to (0, 1) neighbor matrix but the elements are row normalized

(0, 1) distance-based matrix
Element w_{ij} equals one if the distance between the centroid of tracts i and j is less than 10 miles and zero otherwise

Weighted inverse distance-based matrix
Element w_{ij} equals $(d_{ij})^{-\alpha}$, where d_{ij} is the distance between tracts i and j, and α is set equal to 0.67 as was used in Boarnet (1992).

Tract-to-tract flow matrix.
Element w_{ij} equals the commute (journey-to-work) flows between tracts i and j. The tract-to-tract flows data were obtained from the STP154 from the Bureau of Census.

Given the definition of **W**, population (employment) growth can be explained, partly, by the initial level of population (employment) in the labor market, defined by **W**.

B. Specification Issues

Periods of analysis

To examine the growth impact of toll roads, we applied the population and employment growth model reviewed in the previous section to the periods "before" and "after" the toll roads were opened. The years between 1980 and 1990 are the "before" period, and the years from 1990 to 1997 are the "after" period for purposes of fitting the population-employment growth model. Note that there is little reason to suspect that land markets anticipated the construction of the toll roads much before 1990, since the TCAs had no viable funding mechanism until 1988, and the house price analysis in the previous section shows no evidence of the roads producing an accessibility premium that is reflected in house prices until, at the earliest, 1990. In the house price analysis, the evidence for an accessibility premium is not consistent until 1994.

Highway access dummy variables

To explicitly account for the impact of highway accessibility on population and employment growth, we included a dummy variable that reflects the presence of highways as an additional independent variable in the matrices of location characteristics (X and Y) in both equations. More importantly, we also included a similar dummy variable for toll roads. These dummy variables take a value of one if a census tract contains (at least) one centerline of highway (or toll road), and zero otherwise. As mentioned earlier, the toll road dummy variable, which is the key to the empirical test, is included in both "before" and "after" growth model even though the toll roads exist only in the "after" period. The statistical significance of the toll road dummy variable in each period from these estimations reflects the impact of the new highways on development patterns in southern Orange County. If, for example, the coefficient of the toll road dummy variable is statistically and positively significant in both periods, we may interpret this result as evidence that the toll roads were constructed in anticipation of the growth. On the other hand, if the coefficient is not significant in the "before" period, but becomes significant in the "after" period, we may conclude that the toll roads trigger the growth. The empirical results will be discussed more fully in section D.

Land use variables

We used measures of land use as independent variables in the regression, in part to proxy for local attitudes toward development. These variables are based on the 1990 land use classification developed by Aerial Information Systems, Inc. Ideally, the land use variables should reflect the initial development condition of census tracts. Therefore, the 1990 data may not be suitable for the "before" period of study, which began in 1980. However, we used these variables in some of our specifications in the "before" period as the proxy for the land use variables in the desirable year that we lack.

In the original specification, we use the amount of land devoted to certain uses as explanatory variables. For example, an amount of agricultural and vacant land may reflect the potential for development and population and employment growth. A large amount of land occupied by single-family detached housing units may signify residential zoning, and therefore may indicate an openness to further population growth. Reasoning that the *amount* of land devoted to certain activities may not fully capture development potential, we explored another specification of these variables, i.e., the ratio of the amount of land devoted to certain uses relative to the total land area in a given census tract. In this way, a census tract with a large fraction of vacant land may be more likely to experience faster growth. A census with high fraction of commercial or retail land use may have strong agglomeration economies and may therefore experience higher employment growth.

In the other strand of specifications, we omitted the land use variables altogether. This specification is used to test the explanatory power of the land use variables.

Additional explanatory variables

We attempt to explain the impact of agglomeration benefits on employment growth with the proportion of employment by industrial sector in each tract. However, the data on employment at such a disaggregate level is quite limited, and we could only acquire the retail employment data by census tract. Yet, we feel that it is important to include some proxy for agglomeration in the growth equations. Therefore, the ratio of retail employment to total employment in the initial year of each period (1980 in the "before" and 1990 in the "after" periods) was included as an exogenous variable in the employment equation's location characteristics matrix, **Y**.

Alternative definitions of dependent and explanatory variables

We also estimated a version of the model using population and employment densities. Reasoning that the growth relationship may be in the form of density, we hypothesized that the change of population (employment) density in a given tract depends on the initial population (employment) density of the labor market, and so on. However, the results obtained when using this definition of dependent and explanatory variables yielded poor results, prompting us to abandon this specification.

Improving the performance of the model

Following earlier studies (Boarnet, 1994, 1999), we employed several demographic, socioeconomic, and housing variables, to construct the location characteristics matrices, **X** and **Y**. These include proportion Hispanic and Black persons, percentage of housing stock built prior to 1940 and 1960, and several land use variables, defined as total tract area in a given use. We also included dummy variables for census places to control unobserved characteristics within places, such as crime, property tax rates, and school quality. See Tables 8 through 10 for the list of variables. In addition to these variables, we made several changes to the specification of the model to improve its performance. These are discussed below.

In the original specification, we attempt to explain the growth of dependent variables (population and employment) by the level of those variables at the beginning of the study period. This is according to the theoretical model discussed earlier. In this case, the dependent variable is an absolute growth over the period, i.e., population (employment) growth between 1980 and 1990 for the "before" period and 1990 and 1997 for the "after" period. The independent variables are the initial level of the dependent variables for each period, i.e., population (employment) in 1980 for the "before" period and 1990 for the "after" period.

To control for the impact of regional economy, we also examined an alternative definition of dependent variables that we call "growth fraction". Growth fraction is defined as the share of total growth in the county and is therefore a relative measure of growth that isolates the county-wide trend. For example, the population growth fraction is defined as population change in a census tract divided by total population change in the

county over a study period. If the toll road has no impact on population and employment growth, we should not be able to explain the variation of growth fraction by the presence of the toll road.

C. Data

The data that we used to estimate the population-employment growth equations include employment and population, housing stock age, demographic and land use data, as well as the five specifications of weight matrices. The entire analysis is based on 1980 census tracts; for the "after" period (1990 to 1997), the 1990 tract definitions were converted to 1980 tract definitions, to allow consistency in the model specification across time periods. Since we used the same geographic unit of observation, i.e., the 1980 census tract, the weight matrices that reflect spatial relationship between census tracts are the same in both "before" and "after" periods.

We obtained additional data that were used to estimate the population-employment growth equations for both periods from two different sources. First, the Southern California Association of Governments (SCAG) provided employment and population data for 1997 as well as 1980 and 1990 retail employment. Since the data are available by 1990 census tract, similar procedures as those in the original case study were used to convert the data into 1980 census tract for consistency and comparability between the 1980-1990 and 1990-1997 analyses. Second, GDT, Inc. provided GIS maps (similar to the one used in previous sections) for ArcView spatial analysis. The procedure yielded highway and toll road dummy variables. Of the 415 census tracts in Orange County, 162 tracts contain at least one highway centerline and 16 tracts, mostly in the southern part of the County, contain at least one toll road centerline.

D. Regression Results and Discussions

The estimation results of population-employment growth equations are presented in Tables 11 through 26. There are four tables for each specification. The first two tables are a system of population-employment growth equations for the "before" period (1980-1990) and the second two are for the "after" period (1990-1997). In each table, there are five columns, each one for a specification of the neighbor weight matrix, **W**.

Without Land Use Variables Specification

Tables 11 through 14 show the regression results of the specification, in which land use variables were not used. We used the original definition of the variables, i.e., the level of population and employment. Due to the poor performance of this specification (without land use variables), especially in the employment equations, we decided to use land use variables in the rest of our specifications.

Level I Specification

In the regression results reported in Tables 15 through 18, population and employment variables are in levels or absolute changes. This specification is called

"Level I". Land use variables are in the absolute amount of land devoted to certain activities. The major differences are the inclusions of percentage of retail employment, toll road and highway dummy variables. These are the key difference from the original work that will be present in the rest of the specifications. Another difference is the exclusion of residential land use variables (lu1110, lu1120, and lu1140) from the population equation. We reasoned that since the land use data is from 1990 (the last year of the "before" period), the amount of residential land at the end year may not be a good explanatory variable over the ten year period prior to that year.

In general, the performance of this family of specifications is good. Note the substantial improvement over the "without land use" specification in employment equations. In both systems of equations (before and after), land use variables are generally highly significant in all equations. In the 1980's system, the coefficient of 1980 population has the wrong sign, as the lagged adjustment model requires a negative coefficient on that variable for the system to be dynamically stable. The issue of stability in lagged adjustment models has received considerable attention, much of which is beyond the scope of this research. Various studies have found coefficients that do not imply dynamic stability, but the robust results reported in this study for coefficients on the toll road variable provide reason to believe that issues of model specification will not influence the conclusions of this research. For a further discussion of stability in population and employment growth models, see Boarnet, Chalermpong, and Geho (2002).

The coefficient on the toll road dummy variable in the population equation is positively significant at a 95% significance level for all specifications of **W**. This coefficient, however, is negatively significant in the family of employment equations. The coefficients on the highway dummy variable are not statistically significant in both the population and employment equations for any specifications of **W**. Turning to the 1990's system, we found the general pattern of coefficients similar to the 1980's period. An important difference is that the coefficient on the toll road dummy variable switched sign in all employment equations except for the flow matrix specification for **W**. The statistical significance of this variable, however, decreased. On the other hand, the coefficients on the toll road dummy variable are still positive and statistically significant in all specifications of **W**. The significance level of this variable also increased in all population equations.

Level II and Level III Specifications

We report the estimation results of two alternative specifications, closely related to the previous one, in Tables 19 through 26. In the first alternative specification – Level II, reported in Tables 19 through 22, the only difference is that we left out all land use variables but the ones that reflect the amount of developable land – agriculture and vacant land. In the other specification – Level III, reported in Tables 23 through 26, we included commercial and industrial land use variables (lu1210 through lu1340) as a ratio of land devoted to those uses divided by total land in the census tract. The estimation of both of

these specifications, Level II in particular, produced poor fit in the employment equations.

E. Interpretation of the Regression Results

We originally intended to choose a preferred specification from the four different specifications in Tables 11-26. A decision about which specification should be preferred can be based on various regression diagnostics, including the R-squared, the signs of the coefficients on the lagged values of population and employment (which relate to the structure of a lagged adjustment model that forms the basis for equations 3 and 4, as discussed in Boarnet, 1994 and Boarnet, Chalermpong, and Geho, 2002), the performance of the different W matrices, and other diagnostics that can be applied to the regressions. Preliminary analyses suggested that determining a preferred specification would be complicated, and more detailed analysis was beyond the scope of this research. Thus, the interpretations offered here are based on all the regression results.[12]

The coefficients on the toll road variables display a remarkably stable pattern across all four specifications. Hence, a decision about preferred specification is unlikely to affect the interpretation offered here. Summarized briefly, the coefficient on the toll road dummy variable in the population change regression is typically positive and significant in both the "before" (1980-1990) and "after" (1990-1997) time periods. The coefficient on the toll road dummy variable in the employment change equation is typically negative and significant in the "before" (1980-1990) time period, but that same coefficient is typically insignificant in the "after" (1990-1997) time period. The toll road corridors were, *ceteris paribus*, areas of high population growth both before and after the toll roads were built. Yet the corridors were areas of low employment growth before the toll roads were built, while those same corridors showed employment growth that, controlling for other factors, did not differ from the county average after the toll roads were built.

This provides evidence that the toll roads changed the pattern of employment growth in Orange County. Note that the model in equations (3) and (4) is a simultaneous model, such that employment growth is estimated based on, among other things, population growth in a surrounding labor market area. Thus the finding that the toll roads influenced employment growth holds while controlling for the pattern of population growth. The influence of the toll roads on employment growth which can be inferred from the regression results is not simply due to the fact that employment followed population to the growing corridor areas. The influence inferred from the changing sign and significance on the toll road dummy variable in the employment equation can be credited to the toll roads even after controlling for contemporaneous population growth.

Interpreting further, one might conclude that the toll roads were located in areas of pre-existing high population growth, which suggests that the roads were placed where growth would occur in the future. Yet once the roads were built, there is evidence that

[12] In later work, we have examined in more detail various specification issues related to the model in equations (3) and (4). See Boarnet, Chalermpong, and Geho (2002).

the existence of the toll roads exerted an independent effect on employment growth in the census tracts that contained the toll highways. Thus even if, as the regressions suggest, the toll roads were built in areas that were growing rapidly for other reasons, the construction of the roads appears to have altered the growth pattern, and in particular the employment growth pattern, in the toll road corridors.

VI. Conclusion

The empirical analysis of house sale prices provides evidence that the construction of the first two portions of the Orange County toll road network created accessibility premia that are reflected in home sales prices analyses. The evidence is especially strong in that regard for the FTCBB, and the evidence suggests that the accessibility premium for that road shows up with increasingly large magnitudes up until the time that the first portion of the FTCBB opened. This is consistent with what standard urban and land use theory would predict. While the evidence of an accessibility premium is less strong for the SJHTC, we conclude that much of the ambiguity in the statistical results for that corridor is caused by other confounding factors that are correlated with distance from the SJHTC toll road. It is encouraging that the hedonic regressions, which allow some ability to control for confounding influences, give evidence of the appearance of an accessibility premium after the litigation over the SJHTC had concluded.

The population-employment growth regressions provide evidence that the toll roads altered the pattern of employment growth nearby. The toll road corridors were, controlling for other factors, low employment growth areas before the roads were built, while employment growth in the corridors typically did not differ from other areas in the county (again controlling for other factors) after the toll roads were built. Coupled with the evidence from the house price analysis, this is strong support for the hypothesis that the toll roads altered urban growth patterns in Orange County.

The implication for induced travel is that the evidence from Orange County suggests rather strongly that new highways change the geographic pattern of accessibility. Overall, our results are consistent with recent research that has suggested that induced travel is a real phenomenon, and our results are consistent with the hypothesis that changes in development patterns are one cause of induced travel.

Acknowledgements
This research was supported by grants from United States Environmental Protection Agency and the University of California Transportation Center. The University of California Transportation Center is funded by the United States and California Departments of Transportation. Participants at a symposium on induced travel held at UC-Berkeley in June of 2000 provided helpful comments on this research. Michael Greenwald, Lewison Lem and Robert Noland, in particular, provided helpful insights throughout the course of this research. The house price data used in this analysis were graciously provided by Dataquick, Inc., and the California Department of Transportation and Geographic Data Technology, Inc., provided GIS maps for the highway and toll road network. The authors alone are responsible for the analysis and interpretations.

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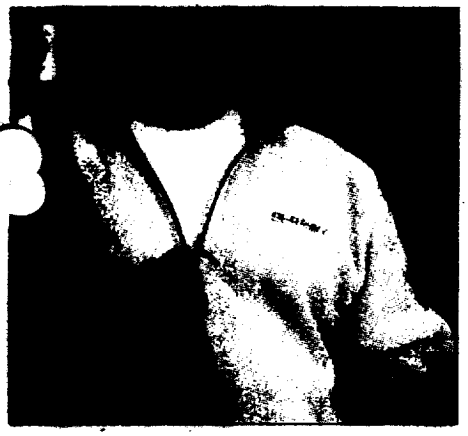
Exhibit

4



night's four-alarm blaze. Seven businesses in the Mesa West Building Park were destroyed. Investigators were trying to determine the cause. At left, Helen Burger of Huntington Beach wipes away tears after viewing the wreckage. Burger was the office manager of Burger Quality Upholstery, where she has worked for 25 years. The business, which was founded in 1948, was destroyed in the fire. It had been located in the building since 1985. David Estrada, right, of Fullerton, is the company's shop foreman • Photos: Bruce Chambers / The Register

MORE INSIDE » Employees wonder what's next. Local 2

Bell site of farm protest

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FLORIDA FARM LABORERS and supporters protest for higher wages from Taco Bell suppliers Monday in Santa Ana • Photo: Jebb Harris / The Register

Taco Bell agreed to meet with a delegation from the Coalition of Immokalee Workers. Immokalee is the area in southern Florida where most of the tomato pickers work.

Despite the promise of a meeting, Taco Bell spokeswoman Laurie Gannon said the company's position would not change.

"We do not get involved in another company's labor disputes," Gannon said.

Labor experts say Taco Bell and other corporations should heed such protests. The proliferation of e-mail, cell phones and the Internet means 18- to 24-year-olds – Taco Bell's target market – who are interested in fair working conditions can be connected.

"I've been impressed," said Kent Wong, director of the UCLA Center for Labor Research and Education. "This particular campaign seems to have developed significant momentum over the last several months."

Student and labor-rights groups helped curtail Nike's use of low-paid labor recently. Locally last year, Justice for Janitors won better contracts for maintenance

PROTEST • PAGE 2

OCTA OKs $123 million in freeway betterment

By HEATHER LOURIE
The Orange County Register

The county's transportation agency gave the go-ahead Monday to $123.1 million in freeway improvements to unclog bottlenecks across Orange County.

The dozen projects include one on the San Diego (I-405) Freeway that falls within a controversial tollway non-competition zone. They range from new auxiliary lanes to improved ramps. One project calls for a newly configured interchange connecting the Garden Grove (22) Freeway to the Orange (57) Freeway. Another calls for restoring a lane on the Riverside (91) Freeway.

Much of the work is expected to begin next year.

"That would make a huge difference," said motorist Brenda Champlin, 40, of La Habra, who crisscrosses Orange County each week for her vending-machine business. "I can't find any time of day where there isn't a con-

OCTA • PAGE 2

22, 24, 25, 28, 46; Mega 19
5 of 5 + Mega: No winners. Wednesday's jackpot is $54 million.
5 of 5: 11 tickets ($22,641 each)
4 of 5 + Mega: 83 tickets ($1,500 each)
4 of 5: 2,182 tickets ($95 each)
3 of 5 + Mega: 3,208 tickets ($58 each)
3 of 5: 85,466 tickets ($10 each)
2 of 5 + Mega: 43,629 tickets ($11 each)
1 of 5 + Mega: 220,096 tickets ($2 each)
Mega only: 344,247 tickets ($1 each)

March 6: 2, 3, 10, 27, 46; Mega 1
March 2: 13, 28, 34, 43, 44; Mega
Feb. 27: 13, 26, 29, 37, 42; Mega
Feb. 23: 6, 27, 38, 39, 41; Mega

FANTASY 5
Jackpot: $50,000
March 11: 7, 13, 14, 16, 24
March 10: 8, 11, 13, 18, 35
March 9: 11, 13, 16, 23, 37

DAILY 3 Monday: 3, 0, 5

DAILY DERBY Monday
Jackpot: $To be announced
1st Place: 9, Winning Spirit
2nd Place: 12, Lucky Charms
3rd Place: 11, Money Bags
Time: 1:42.53

Register InfoLine: (714) 550-4636, x.550
24-hour Calif. lottery (800) 568-8379
Past results: (900) 776-4000 (30¢ a mi

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OPINION

Bargain rents in high-rent district

Editorial • Residents of a Newport Beach trailer pa run out of long-running good luck. **Local 6**

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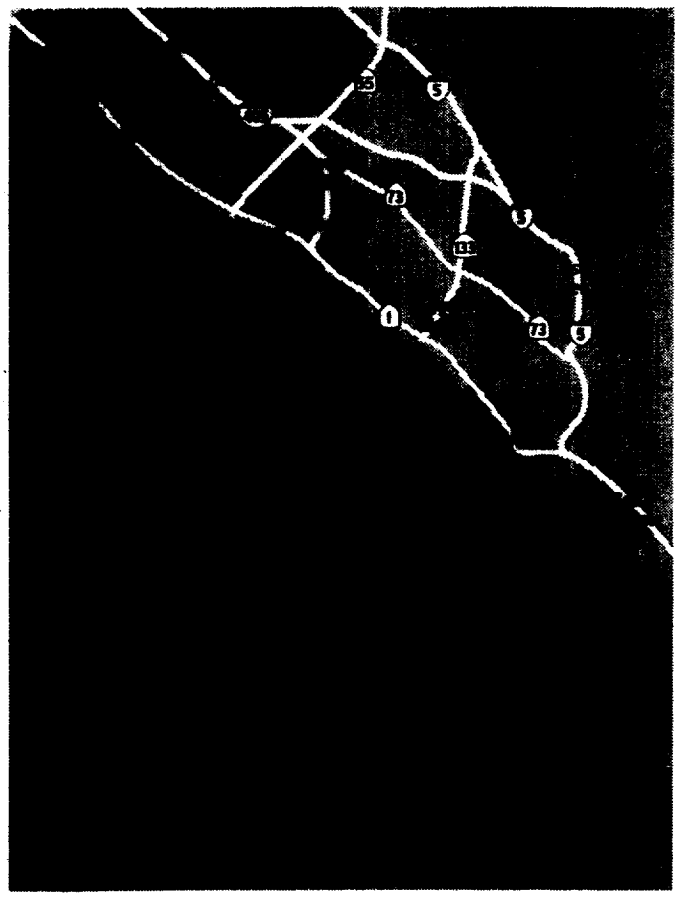
OC Reg 3-12-02

Beach watch

A health advisory is issued when bacteria levels exceed state standards. Swimmers and surfers are urged to stay out of the water in the posted areas. The ocean is closed to water-contact activity when sewage is present. A list of current bacteria-related ocean health advisories:



Source: Orange County Health Care Agency, Environmental Health Division — The Register

OCTA

FROM PAGE 1

gestion problem."

The Orange County Transportation Authority also agreed to pay the operators of the San Joaquin Hills (73) Toll Road $40,000 a year so it can make improvements to the San Diego (I-405) Freeway from Sand Canyon Avenue to Jeffrey Road.

That agreement is a result of a controversial contract with the state. To protect toll revenue, state officials agreed not to widen freeways near toll roads – unless they compensate the tollways for lost revenue.

"We brought together a regional solution," said Supervisor Todd Spitzer, also chairman of the Orange County Transportation Authority. "The taxpayers were well served."

The payout would only be triggered, though, if the operators of the 73 could not meet their bond payments and show the improvements pulled riders off their road.

Added Susan Withrow, also an OCTA director: "It's not immediate and may not happen at all."

PROTEST

FROM PAGE 1

workers by going directly to building owners, bypassing labor contractors.

"The fast-food industry has never been held responsible for the conditions in the field; this is a new way to get into the farm-worker problem by going to consumers," said protest organizer Greg Asbed.

The average farm worker earns about $7,500 a year, according to the U.S. Department of Labor.

Tomato workers are paid

tion is a first, said organizer Laura Germino.

Taco Bell could help by urging growers to pay 1 cent more per pound and provide medical insurance and sick days, she said.

Along the 13 stops so far – they go to Flagstaff today – the group has been joined by union, minority and civil-rights groups, including the United Auto Workers, the Service Employees International Union, the Korean Immigrants Workers Association, the United Farm Workers and Justice for Janitors.

Taco Bell purchases toma-

encourage a resolution of the labor dispute because the protests are affecting Taco Bell's image and disrupting restaurant operations, Gannon said.

The campaign hasn't had much impact on sales, however. After three years of mostly declining sales at Taco Bell restaurants open for more than a year, they have risen each month since October 2001.

Asbed said he thinks the increase in sales since October resulted from consumers looking for bargains during a recession and after September's terrorist attacks.

Students were out in force

LATimes OC 3-12-02

OCTA to Pay Tollway for Right to Add Freeway Lanes

Transit: Stipend to San Joaquin Hills operators would compensate for any motorists who move to San Diego Freeway.

By DAN WEIKEL
TIMES STAFF WRITER

For the second time in recent months, Orange County transportation leaders have agreed to pay a toll road operator for the right to improve a public freeway.

The payment—potentially $40,000 a year—would compensate operators of the San Joaquin Hills tollway for any customers it might lose if a major bottleneck along the San Diego Freeway is eliminated.

The push to relieve severe congestion at Jeffrey Road in Irvine on the San Diego Freeway is one of 12 freeway choke points that the Orange County Transportation Authority hopes to fix in $123-million improvement efforts.

The San Joaquin Hills tollway is covered by an agreement that requires public highway projects to compensate it under certain circumstances for any loss of business.

OCTA officials had feared that eight of 12 pending choke-point projects along the Santa Ana and San Diego freeways might be subject to the requirement. But negotiations with the Transportation Corridor Agencies, the tollway's operator, eliminated all the proposals except one.

"For $40,000 we avoided a lawsuit to stop the bottleneck project," said Supervisor Todd Spitzer, chairman of the OCTA board.

The San Joaquin Hills tollway, which runs from Newport Beach to San Juan Capistrano, is part of a 51-mile network of turnpikes operated by the Irvine-based agencies. The others are the Foothill, the Eastern, and a short stretch of Highway California 133 (Laguna Freeway).

All the routes are covered by protection agreements that require public highway projects within five miles of the toll roads to reimburse for losses of motorists if the agency cannot pay the interest on its bonds.

Such noncompetition clauses have become controversial in Orange County, especially the pact between Caltrans and the California Private Transportation Co., which operates the 91 Express Lanes on the Riverside Freeway. The private lanes run along the middle of the freeway.

Critics say the Express Lanes deal can stand in the way of any major improvements to the Riverside Freeway, one of the most congested highways in Southern California.

Recently, OCTA agreed to pay $4 million to California Private Transportation just to add a 1,000-yard westbound access lane.

Toll officials say their noncompetition agreements are more flexible than the Express Lanes' pact and allow competing projects to proceed as long as they pay the toll agency for losses.

Of the choke-point projects, the toll agency concluded that a lane addition on the northbound side of the San Diego Freeway between Sand Canyon Avenue and Jeffrey Road might decrease traffic by about 60 motorists a day, a tiny fraction of the 80,000 trips made daily on the tollway. The agreement requires OCTA to compensate the agency for the loss of tolls if it cannot meet its debt payments and if a decrease in motorists occurs on the 16-mile toll road through west Orange County. The tollway board is expected to approve the deal Thursday.

"We came to an agreement that will improve traffic and protect our bondholders," said Clare Climaco, a Transportation Corridor Agencies spokeswoman. "The noncompetition clause doesn't stop improvement projects from happening."

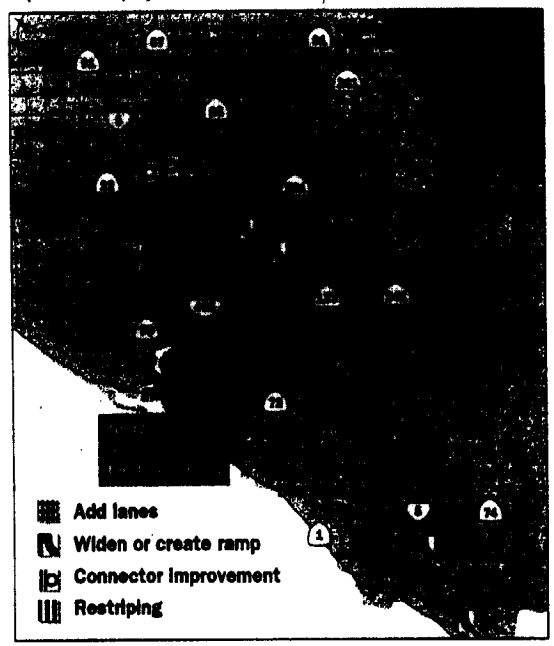
Monday's action is part of an effort by OCTA to remove 12 bottlenecks on the Santa Ana, San Diego, Riverside and the Garden Grove freeways. Ultimately, the authority wants to eliminate 30 choke points it has identified.

In addition to the tollway compensation plan, OCTA approved $8.3 million for preliminary design, engineering and environmental assessments for five of the 12 projects. The proposals include ramp widenings and new lanes.

The five choke points are on the southbound Interstate 5 at Culver Drive in Irvine, Oso Parkway in Mission Viejo, Camino Capistrano in San Juan Capistrano, and Avenida Pico in San Clemente.

Paying a Price to Pave

The Orange County Transportation Authority has agreed to pay the San Joaquin Hills toll road operators up to $40,000 a year for the right to make improvements to the nearby San Diego Freeway. Transportation officials had feared noncompete clauses in toll road contracts would affect more of OCTA's choke-point improvement projects.



Source: Orange County Transportation Authority

Los Angeles Times

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Lottery Results

For Monday, March 11, 2002

Fantasy Five: 7-13-14-16-24

Daily Three: 3-0-5

Daily Derby:
(9) Winning Spirit
(12) Lucky Charms
(11) Money Bags
Race Time: 1:42.53

Results on the Internet:
www.latimes.com/lottery
General Information:
(800) 568-8379
(Results not available at this number)

It took about 100 nearly four hours to bri the under control. The flames we ported at 6:58 p.m. at 1012 1 Lane, in the southwest cor the city.

"The heat of this fire wa tremely intense. Nobody even get in," said Capt. Kirk nic, a spokesman for the Mesa Fire Department.

The walls of the structure to be braced so investigators work inside. Arson investi have also been asked to inspe building.

COUNTYWIDE

Engineering Contrac OKd for CenterLine

Transportation leaders adv the CenterLine project Mond awarding a $38-million contr preliminary engineering wo the proposed light-rail systen Irvine to Santa Ana.

The board of the Orange C Transportation Authority Parsons Brinckerhoff, a So California engineering firm, work on the 15-mile rail lin sons was among three finalis

"This is a milestone in the ess," said Tim Keenan, vice man of the OCTA board. "Th begin to put the lines on th It is an important first step."

FOUNTAIN VALLEY

Open House Set on Sewage-Recycling Pl

An open house tonight wi residents a chance to learn about the Orange County District's $600-million grou ter replenishment project, will turn sewage into drinki ter.

District staff will give de the purification technolog about district construction, ing adding a traffic light on Street at the south entrance district headquarters.

The open house, which clude exhibits, is from 5:30 p.m. at the headquarters, Ellis Ave.

LATimes
12-22-02

mo[illegible]gram costs $400, but because of the Winona Factor. The thieves — 90% of them women — easily could have afforded the stolen items. They stole not for greed but because of a dark need within.

How can you tell the difference? Nancy Clark, director of the program, says shoplifters whose problems are psychological rather than financial react to their crimes with shock and shame. They're apt to steal things they can't use, such as too-big clothes.

What Clark's clients don't do is deny they committed the crime. That would eliminate Ryder. Clark said she also doesn't admit people who have drug or alcohol problems. In addition to 400 hours of volunteer work, Ryder was sentenced to drug counseling after sentencing. The women in C[illegible]rogram steal because of the thrill of [illegible]tting something for nothing. But that doesn't make their crime any less serious. There are no equivalent programs for people who steal out of need.

Progressive as the program is, it also needs to build a track record. Several hundred clients have passed through the shoplifters group during the last five years, but no one has kept statistics on whether it reduces repeat crimes.

It's time to develop some data. Kleptomania can be as tough to beat as alcoholism, Clark said, especially since it's hard to avoid tempting situations. Almost everybody has to go shopping sometime.

Familiar Clause Takes a Toll

It takes a big magnifying glass to go over toll-road agreements. That's what Riverside County officials discovered recently when they fine-combed a deal that would allow the Orange County Transportation Authority to buy the 91 Express Lanes.

There in the small print appeared language similar to an egregious clause in an earlier agreement involving the toll lanes. That clause can prevent any public improvements to the Riverside Freeway that might affect the toll lanes. In other words, it commits the travesty of tying the public's hands so taxpayers can't improve their own transportation system.

The ironic part is that OCTA wants to buy the lanes to overcome the old clause that Caltrans agreed to several years ago, so Orange and Riverside counties can make the needed improvements. The legislation allowing the purchase actually bans non-compete clauses.

So what's this wording in the new purchase deal that would keep Caltrans from interfering with OCTA's ability to bring in toll revenue? Though OCTA denies it, this clearly looks like non-compete language. Caltrans improvements to nearby roadways could pull people off the toll roads and thus interfere with OCTA's income.

What happened is that the OCTA ran into the same problems other toll-road owners have experienced: Investors want some guarantees the toll road will bring them good returns. They don't want better freeways for the public interfering with revenue.

That's an understandable way to get toll roads financed, but it's not good public policy. Even the less-restrictive non-compete clauses for Orange County's other toll roads fail to serve the public's best interest. Those clauses would force the state to repay toll-road agencies for any losses incurred because of publicly financed freeway improvements. It's not the job of California motorists and taxpayers to provide warranties for bond investors.

Riverside County officials want anything that looks like a non-compete clause removed from the purchase deal. If not, they'll stall the buyout.

That no-improvements clause created hellish conditions for Riverside County commuters. If roads between the two counties aren't improved, the Orange County economy will pay a steep price as well, as employers move plants closer to their workers.

Both sides want this to work out and probably will find a solution. But it took Riverside County's careful look at the deal to uncover the troubling language, and that shouldn't have happened. Good for them for getting out that magnifying glass.

Exhibit

5

generated by construction from the ordinance standards during the hours between 7 a.m. and 8 p.m. on weekdays and Saturdays; this exemption does not include Sundays or holidays.

4.8.2 METHODOLOGY

The noise measurement survey prepared for this Program EIR to determine existing noise levels used a Brüel & Kjær 2236 automated digital noise data acquisition system for short-term (15 minutes) readings. This instrument automatically calculates both the Equivalent Noise Level (LEQ) and Percent Noise Level (L%) for any specific time period. The noise monitor was equipped with a Brüel & Kjær 1/2-inch electric microphone and was calibrated with a Brüel & Kjær calibrator with calibrations traceable to the National Bureau of Standards. Calibration for the instruments is performed annually and is certified through the duration of the measurements. This measurement system satisfies the ANSI (American National Standards Institute) Standards 1.4 for Type 1 precision noise measurement instrumentation.

Existing roadway noise levels, in terms of CNEL, for the roadways anticipated to be affected by project-related traffic were calculated using a computation of highway noise. In preparing these computations, the Highway Noise Model published by the Federal Highway Administration (*FHWA Highway Traffic Noise Prediction Model*, FHWA-RD-77-108, December, 1978) was used. The CALVINO noise emission curves developed by Caltrans were used with the FHWA model because these curves better model the California vehicle mix. The FHWA Model uses traffic volume, vehicle mix, vehicle speed, and roadway geometry to compute the "equivalent noise level." A computer code has been written which computes equivalent noise levels for each of the time periods used in the calculation of CNEL. Weighting these noise levels and adding them together results in the CNEL for the traffic projections used.

4.8.3 EXISTING CONDITIONS

The project study area is defined as the Ranch Plan project site and the immediately contiguous properties. To determine the existing noise environment at the proposed project site, ambient noise measurements were taken on January 28, 2004 at one location (Site 5) and on March 29, 2004 at four locations (Sites 1 through 4). The locations of the noise measurement sites are depicted in Exhibit 4.8-3. Noise levels were measured for 15 minutes at each location with the exception of Site 5 where a 30-minute measurement was performed. The measurement results are presented in Table 4.8-3 in terms of equivalent noise levels (LEQ), maximum noise levels, minimum noise levels, and percentile noise levels (L%). The L(50) percentile level, for example, represents the noise levels exceeded 50 percent of the time, and represents the median ambient noise level. The L(90) noise levels represent the background noise levels that are exceeded 90 percent of the time.

TABLE 4.8-3
EXISTING NOISE MEASUREMENTS

Site	Start Time	Sound Level (in dBA)					
		LEQ	Lmax	L(10)	L(50)	L(90)	L(min)
1	12:13 p.m.	51	72	44	38	33	29
1[a]	12.13 p.m.	39	49	43	38	32	29
2	1:08 p.m.	45	54	47	44	41	37
3	1:50 p.m.	42	53	45	41	39	37
4	2:34 p.m.	41	53	44	34	31	30
5	8:16 p.m.	44	56	47	42	38	35

[a]. Effects of vehicles entering the Northrop Grumman TRW Capistrano Test Site removed.
Source: Mestre Greve Associates, June 2004

The noise measurement sites were near the western perimeter of the proposed project. The measured noise levels show that even at the perimeter of this primarily undeveloped area, noise levels are relatively low. Noise levels further inside and along the eastern perimeter of the project site are likely slightly lower as they are removed from areas of activity. In general, the sources of noise affecting the site consisted of birds, wind blowing through vegetation, and distant traffic, in addition to local sources of noise described below.

Site 1 is located near the current terminus of Avenida Pico off of the entry road to the Northrop Grumman TRW Capistrano Test Site. The primary source of noise affecting the recorded noise levels was six vehicles entering the TRW site. Background noise included birdcalls and distant traffic. Table 4.8-3 presents the recorded noise levels during the entire measurement period along with an edited version of the measurement that removed the periods when vehicles passed by the site entering the TRW site. The results of the measurements show very low noise levels when the effect of the vehicles is removed. Background sources of noise included bird and distant traffic noise. The average noise level would not be expected to drop much below the 40 dBA level during the daytime. Nighttime noise levels would be lower as wildlife activity ceased along with levels of traffic on roadways in the vicinity of the site.

Site 2 is located just beyond the end of San Juan Creek Road. The primary sources of noise at Site 2 were distant traffic and noise generated by activities in the nearby residential areas. The noise environment around Site 2 would be characterized as quiet, with an average noise level of 45 dBA.

Site 3 is located approximately 1,000 feet north of Ortega Highway in the existing agricultural operations. The primary source of noise at Site 3 was truck traffic associated with the agricultural operations. Background noise sources included birds, distant traffic, and distant agricultural operation activities.

Site 4 is located near the Santa Margarita Water District Chiquita Water Reclamation Plant. Noise sources affecting Site 4 included overhead aircraft, birds, and wind through vegetation. No discernable noise from the Water Reclamation Plant was detected. No discernable noise from the Water Reclamation Plant was detected which is reflective of ongoing conditions at the plant. These types of facilities do not generate significant noise levels.

Site 5 is located near the south end of Tesoro High School. Noise experienced at Site 5 included activities at the high school, traffic on Oso Parkway, birds, and distant traffic.

Existing Roadway Noise Levels

The distances to the existing 60, 65, and 70 CNEL contours for selected roadways in the vicinity of the project are identified in Table 4.8-4. The CNEL at 100 feet from the roadway centerline is also presented. These represent the distance from the centerline of the road to the contour value shown. The values represent existing noise levels and do not take into account the effect of any existing noise barriers or topography that may affect ambient noise levels. Where the line of sight between an observer and a roadway is blocked by a substantial object (e.g., a berm, block wall, or building), the traffic noise levels are reduced by a minimum of approximately 5 dB.

The roadway segments presented in the table are those that are projected to experience a 0.5 dB or greater traffic noise CNEL increase due to the development of the project, or are projected to experience a 1.5 dB or greater traffic noise CNEL increase over existing conditions in the future with the project. Existing traffic noise levels along all roadways assessed in the traffic study prepared for the project are presented in Appendix F.

TABLE 4.8-4[a]
EXISTING ROADWAY TRAFFIC NOISE LEVELS

Roadway Segment	CNEL at 100 ft.	Distance to CNEL Contour[b] (feet)		
		70 CNEL	65 CNEL	60 CNEL
I-5				
Avery Parkway to Junipero Serra	80.5	499	1,075	2,315
Junipero Serra to Ortega Highway	80.4	490	1,056	2,275
Ortega Highway to San Juan Creek	80.0	465	1,003	2,160
San Juan Creek to Stonehill	80.0	462	996	2,147
Stonehill to Camino Las Ramblas	79.7	445	958	2,063
Camino Las Ramblas to Camino de Los Mares	80.0	465	1,003	2,160
Camino de Los Mares to Avenida Vista Hermosa	79.8	454	977	2,105
Avenida Vista Hermosa to Avenida Pico	79.5	432	931	2,007
SR-73				
Oso Parkway to Crown Valley Parkway	72.5	147	317	684
Crown Valley Parkway to I-5	72.4	145	313	673
SR-241				
North of Antonio Parkway	69.6	94	204	438
Antonio Parkway to Oso Parkway	66.1	55	119	255
Oso Parkway				
East of I-5	70.7	111	240	517
West of Marguerite Parkway	69.1	88	189	406
Marguerite Parkway to Felipe Road	69.1	88	189	406
Felipe Road to Antonio Parkway	69.1	88	189	406
East of Antonio Parkway	67.8	72	155	333
West of SR-241	67.4	67	144	310
East of SR-241	66.2	56	121	260
Crown Valley Parkway				
West of Marguerite Parkway	69.1	88	189	406
East of Marguerite Parkway	68.9	84	182	392
West of Antonio Parkway	67.0	63	136	294
Junipero Serra				
West of I-5	63.5	RW	80	171
Ortega Highway				
I-5 to Rancho Viejo	72.8	154	332	715
West of La Novia	71.6	128	275	593
East of La Novia	70.7	112	242	521
West of La Pata	69.9	98	212	457
East of New Ortega Highway	65.5	50	108	233
San Juan Creek Road				
West of La Novia	62.0	RW	64	137
East of La Novia	61.1	RW	55	118
Avenida Vista Hermosa				
East of I-5	66.2	56	121	260

TABLE 4.8 4[a] (Continued)
EXISTING ROADWAY TRAFFIC NOISE LEVELS

Roadway Segment	CNEL at 100 ft.	Distance to CNEL Contour[b] (feet)		
		70 CNEL	65 CNEL	60 CNEL
Avenida Pico				
East of I-5	69.0	86	185	399
West of La Pata	66.8	62	133	286
La Pata to Avenida Vista Hermosa	63.6	RW	81	175
East of Avenida Vista Hermosa	61.0	RW	54	117
Camino Capistrano				
South of Paseo de Colinas	59.0	RW	40	86
North of Junipero Serra	59.0	RW	40	86
Junipero Serra to Roso	62.5	RW	68	146
Antonio Parkway				
North of SR-241	67.8	72	155	333
Empresa to SR-241	67.2	65	140	302
Empresa to Banderas	67.4	67	144	310
Oso Parkway to Crown Valley Parkway	67.8	72	155	333
South of Crown Valley Parkway	65.3	48	104	224
North of New Ortega Highway	64.0	RW	86	185
North of Ortega Highway	64.0	RW	86	185
Avenida La Pata				
South of Ortega Highway	58.0	RW	RW	73
South of Avenida Pico	60.2	RW	48	103
Camino Vera Cruz				
Camino de Los Mares to Vista Hermosa	61.6	RW	59	128
Avenida Talega				
East of Avenida Vista Hermosa	52.0	RW	RW	RW

[a] Modeled
[b] From roadway centerline
RW: Contour does not extend beyond roadway right-of-way

Source: Mestre Greve Associates, June 2004

The table shows that high traffic noise levels are generated along I-5 and SR-73 (i.e., 72.4 to 80.5 dB CNEL. Considerable noise levels are generated along SR-241, Oso Parkway, Crown Valley Parkway, Ortega Highway, Avenida Pico, and Antonio Parkway (i.e., 61.0 to 72.8 dB CNEL). Moderate noise levels are experienced along Junipero Serra, San Juan Creek, Avenida Vista Hermosa, Camino Capistrano, and Camino Vera Cruz (i.e., 59.0 to 66.2 dB CNEL). Noise levels along Avenida La Pata and Avenida Talega are minor (i.e., 52.0 to 60.2 dB CNEL).

Existing Aircraft Noise Levels

Airport Operations. The project site is not located in the immediate vicinity of any airfield and is not directly impacted by noise generated by any airport operations. Enroute aircraft overfly the project site and are audible at times. However, because of the relatively low aircraft noise levels experienced on the site and the limited time that this occurs, aircraft do not generate noise levels on the project site that approach the County's noise standards.

4.12 RECREATION

4.12.1 INTRODUCTION

This section discusses the potential park and recreation impacts associated with the proposed project. It examines the existing and future parks and recreation opportunities in the project vicinity and the potential impacts of the proposed project on these resources.

Methodology

The information in this section is based on the Recreation Element, the Resources Element, and the Transportation Element of the Orange County General Plan. Information concerning off-site recreational facilities involved a review of the City of San Juan Capistrano General Plan, Recreation Element; the City of San Clemente website; the San Onofre State Beach Revised General Plan; internet research relating to the various private and public recreational facilities in the project area; and personal communication with various state, county and city personnel.

Study Area

Parks and recreational facilities within a two-mile radius of the proposed project were included for review in this EIR.

4.12.2 EXISTING CONDITIONS

Offsite Recreational Uses

There are over 11,000 acres of County regional parks, a number of public parks, and recreation areas surrounding the project area. A variety of parks are located within a two-mile radius of the project site. In addition to these nearby park sites, residents can enjoy a variety of other recreational opportunities within a two-mile radius, such as hiking and golfing on both public and private courses. These facilities are discussed below and their location depicted in Exhibit 4.12-1.

Parklands

State Parks

San Onofre State Beach

San Onofre State Beach is located within the County of San Diego on MCB Camp Pendleton property; the Orange/San Diego County line serves as its western and northern boundary. The City of San Clemente (in Orange County) lies immediately to the west.

- The California Department of Parks and Recreation prepared a Revised General Plan for the San Onofre State Beach in June 1984. The 1984 Revised General Plan is the most current, and it is not in the process of being updated at this time (personal communication, C. Valdez). It identifies four distinct areas within the park boundaries: Cristianitos, Trestles Beach (also known as the San Mateo Creek), Surfers Beach, and San Onofre Bluffs. Only Cristianitos and Trestles Beach would be potentially affected by the Ranch Plan project.

San Onofre State Beach is a state beach operated by the California Department of Parks and Recreation under a lease agreement with the United States of America, specifically the

Department of the Navy. The 50-year lease agreement was signed in 1971 and is set to expire in 2021. The following provisions regarding state beaches, as found in Section 5019.56c of the Public Resources Code (PRC) include the following guidance pertinent in plan formulation for resource management and recreational development:

> "State beaches...consist...of areas with frontage on the ocean, or bays designed to provide swimming, boating, fishing, and other beach-oriented recreational activities. Coastal areas containing ecological, geological, scenic, or cultural resources of significant value shall be preserved within state wildernesses, state reserves, state parks, or natural or cultural preserves..."

San Onofre State Beach was established to make available to the public the natural beach, bluffs, and related geological, ecological, and cultural features along the northern coast of San Diego County, including important uplands east of the I-5 freeway in the valley of San Mateo Creek; and to provide for the enjoyment and use of these areas in ways that take full advantage of the recreational opportunities thus afforded, while protecting the natural and cultural values of the region (Department of Parks and Recreation, 1984).

The portion of San Onofre State Beach northeast of I-5 is composed of the Cristianitos area. Cristianitos lies immediately adjacent (approximately 500 feet) to the southern boundary of the Ranch Plan. It is the only area within a two-mile radius of the proposed project, and as such, the focus of this evaluation. As described in the Revised General Plan, approximately 1,000 acres of scenic open space at the northwest end of Cristianitos were recommended for development with hiking trails, primitive camps, a primitive group camp, and a natural preserve. Currently, in the northern portion of Cristianitos, the hiking trails have been constructed, though the rest of the facilities have not yet been developed. The San Mateo Campground is located approximately one-third mile from the beach and 3.3 miles from the Ranch Plan boundary. The campground offers facilities for tent and recreational vehicles.

San Mateo Canyon, where San Onofre State Beach is located, is the last remaining undeveloped coastal canyon southerly of Crystal Cove State Park available for public recreational use. Its value as a recreational resource stems from the relative lack of urban development. The undeveloped nature of the State Beach, and especially Cristianitos, which is the largest parcel (1,182.7 acres), provides for a variety of recreational experiences. Cristianitos offers the public access to undisturbed natural resources, including biological resources, which they can enjoy as part of nature study programs or while hiking or bike riding. The topography surrounding the State Beach provides a natural barrier to much of the urbanized areas in the adjacent City of San Clemente.

Existing Regional Parks

The countywide system of regional parks provides about 16,000 acres of land dedicated to park and recreation uses in Orange County. Three regional parks, General Thomas F. Riley Wilderness Park, Caspers Wilderness Park and O'Neill Regional Park, fall within a two-mile radius of the proposed project boundaries. Each of these parks is part of the County's overall park system and provides large expanses of area for active and passive recreational uses. Although facilities are planned as part of the County of Orange Master Plan of Riding and Hiking Trails, there are no existing trails that link these regional parks. These parks are discussed below.

General Thomas F. Riley Wilderness Park

The General Thomas F. Riley Wilderness Park is located in unincorporated Orange County south and west of the community of Coto de Caza and east of the communities of Rancho Santa Margarita, Las Flores, and Wagon Wheel Canyon. The entrance of the park is located at the corner of Oso Parkway and Coto de Caza Drive. The park boundary is adjacent to Planning Area 12 of the Ranch Plan.

In January 1983, 524 acres for the park were irrevocably offered by the Coto de Caza Development Corporation to the County of Orange and accepted the same day. The property was offered for public park and recreational purposes and was named Wagon Wheel Canyon Wilderness Park. This park is a regional wilderness park that is defined in the Recreation Element of the Orange County General Plan as:

> "A regional park in which the land retains its primeval character with minimal improvements and which is managed and protected to preserve natural processes. The park (1) generally appears to have been affected primarily by forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude of a primitive and unconfined type of recreation; (3) is sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic or historical value." (Section VII)

The Wagon Wheel Canyon Wilderness Park, which was renamed the General Thomas F. Riley Wilderness Park, was formally opened to the public and dedicated to Supervisor Riley on December 10, 1994. The park covers an area of mostly rolling hills and major oak groves. There is no General Development Plan (GDP) for the park; however, the Orange County Board of Supervisors approved an interim operations plan on September 27, 1994. This interim operations plan currently remains in place (personal communication, H. Huggins). As part of the interim phase, the park offers low impact recreational activities including hiking, mountain biking and horseback riding. There are also two vista points within the park. The County also offers a variety of programs to the public including, but not limited to: junior ranger, college internships, programs for school classes, nature/educational hikes, and stargazing. The park is used by the Boy Scouts for completing work associated with earning their badges. Informal picnicking is available.

The natural setting of the park is an important component of this resource. Plant communities known to occur at this park include scrub, grassland, riparian, and woodland. The plant communities present provide suitable habitat for a variety of plant and wildlife species, some of which are considered sensitive by state and federal resource agencies. Sensitive species known to occur within the General Thomas F. Riley Wilderness Park include the orange-throated whiptail, San Diego horned lizard, red diamond rattlesnake, coastal California gnatcatcher, and southern California rufous-crowned sparrow.

The General Thomas F. Riley Wilderness Park is of sufficient size to make practicable its preservation and use in an unimpaired condition; however, it should be noted that urban views and noise are experienced along portions of the trails and vista points. In an effort to preserve natural resources as this park, the County has imposed access restrictions to certain areas of the park that have high quality coastal sage scrub supporting California gnatcatchers (primarily in the north/northwestern portion of the park).

Ronald W. Caspers Wilderness Park

The Ronald W. Caspers Wilderness Park encompasses approximately 8,500 acres. It is immediately adjacent to Planning Area 3 of the Ranch Plan. Existing facilities at the park include various multiple use, pedestrian and equestrian trails; an equestrian day use area; Starr Mesa Equestrian Campground; Live Oak Flats Campground; and a Visitor Center. Existing development at the park is primarily west of Ortega Highway, which bisects the park. Access is provided via Ortega Highway.

In 1973 the Starr Foundation deeded the northern 3,779 acres of the Starr Ranch to the National Audubon Society for use as a wildlife sanctuary. In late 1973 and early 1974 the Orange County Board of Supervisors, under the direction of Chairman Ronald W. Caspers voted to purchase the southern 5,500 acres of the ranch for use as a public recreation facility. On April 12, 1974 the Starr Viejo Regional Park was opened as a primitive, wilderness day use and camping facility. On August 20, 1974 the Orange County Board of Supervisors changed the name of the park to Ronald W. Caspers Wilderness Park in honor and recognition of his foresight in acquiring and preserving this area of quality wilderness. In 1984, an additional 2,100 acres was dedicated by RMV bringing the park's total acreage to 8,500. However, presently not all the park is accessible to the public.

Caspers Wilderness Park provides recreational uses such as camping, picnicking, hiking, horseback riding, mountain biking, photography, nature study and astronomy. The park has campgrounds, restrooms and showers, picnic areas, an equestrian campground, hiking and equestrian trails. Activities include guided nature walks, naturalist programs, and telescope observations.

O'Neill Regional Park

The O'Neill Regional Park encompasses over 3,358 acres of oak/sycamore woodlands, grassy meadows, riparian, chaparral and coastal sage scrub habitats. Located in the foothills of the Santa Ana Mountains, O'Neill Park offers picnic facilities, and overnight camping. At its closest point the park is located approximately one mile west of Planning Area 2.

In 1948, the O'Neill family donated the initial 278 acres of Trabuco Canyon to the County of Orange for use as a regional park. Throughout the years, the O'Neill family donated additional acreage. Other neighboring owners, such as the Ramakrishna Monastery, wishing to preserve native habitat, donated property to the park. In 1982, Rancho Mission Viejo dedicated an additional 935 acres in the Arroyo Trabuco. An additional 735 acres in Tijeras Canyon was dedicated in 1996, and 258 acres were dedicated as mitigation for the Arroyo Trabuco Golf Course. Today O'Neill Regional Park is over 3,358 acres in size.

Recreation opportunities at the park include wildlife observation, bird watching, hiking, mountain biking and horse back riding on park trails. The park is heavily wooded with coast live oak and sycamore trees. The hillsides surrounding the park are filled with cactus, wild buckwheat, sagebrush and chaparral of scrub oak, buckthorn and mountain mahogany.

O'Neill Park offers both day use and overnight camping facilities. The Oak Grove offers a shaded area, a turf area, and a playground for children. The Featherly area stretches along Trabuco Creek, a seasonal waterway that flows from the Trabuco Peak to the Pacific Ocean. The mile long Mesa area includes viewpoints of Trabuco Canyon. The West area presents scenic trails. In each area facilities include picnic tables, barbecues, water and restrooms. Individual tent and R.V. camping is available year round along Trabuco Creek in the main campground. Interpretive programs are frequently conducted Saturdays and Sundays. Ranger

led nature hikes present local history and instruction on native wildlife. Campfires programs are hosted at the amphitheater after sunset throughout the year.

Proposed Regional Park

Proposed Prima Deshecha Regional Park

Prima Deshecha is included on the Orange County General Plan Master Plan of Regional Parks as a planned regional park. Currently, the site is used as a sanitary landfill, with 1,000 acres permitted for refuse disposal. The landfill was opened in 1976 and is scheduled to close in approximately 2067. Although full closure of the landfill is not expected until 2067, portions will be closed prior to 2067. Currently, there are no recreational activities or facilities available at the Prima Deshecha site.

The proposed Prima Deshecha Regional Park is located south of Ortega Highway within the jurisdictional boundaries of the County of Orange, City of San Clemente, and City of San Juan Capistrano. The site encompasses approximately 1,530 acres that includes 570 acres in the City of San Juan Capistrano, 133 acres in the City of San Clemente, and 827 acres in unincorporated Orange County. The landfill is located at the southern terminus of existing La Pata Avenue.

A Supplemental Environmental Impact Report (SEIR) is currently being prepared to address certain modifications to the 2001 GDP needed to ensure physical site stability, required by landfill operations, or needed to ensure the stability and success of the environmental mitigation and restoration components of the overall GDP. At this time, there are no post-use recreation concepts being developed.

Local Parks

Local parks provide active and/or passive open space areas at non-regional levels, specifically neighborhoods and communities. Local parks are further categorized according to area and purpose: community parks, neighborhood parks, view/lookout parks, and mini-parks. The Orange County Recreation Element Master Plan of Local Parks component identifies goals, objectives, and policies, and provides implementation programs to meet the local recreational needs of unincorporated Orange County. The Master Plan of Local Parks, in conjunction with the Local Park Code, is intended to provide for comprehensive local park planning and programming (i.e., acquisition, development, operation, maintenance, and financing). The Local Park Code requires 2.5 acres of land per 1,000 persons when residential dwelling units are proposed. The code also allows for the payment of in lieu fees or a combined provision of parkland and payment of in lieu fees when the community is better served through the provision of parkland outside but near the property served. The County acts as a steward for local parkland dedication, holding the land or in lieu fees until acceptance by individual cities.

Community parks are defined as a 20- to 50-acre local park designed to meet the active recreational needs of several neighborhoods. The following is a list of community parks within a two-mile radius of the proposed project.

Ladera Ranch County Sports Park

The Ladera Ranch Sports Park is located in the Ladera Ranch Planned Community. It is a 24-acre county sports park shared by surrounding Orange County neighborhoods. Activities include four softball and baseball diamonds for youth and adult leagues, six league-standard soccer fields, a tot lot play areas, night lighting at all venues, and group picnic areas,

concessions and restrooms. The County of Orange and DMB Ladera built the Sports Park, which is located on the western edge of Ladera Ranch and is bounded by Crown Valley Parkway to the south, O'Neill Drive to the east and the Arroyo Trabuco to the west.

On December 19, 2000, the Orange County Board of Supervisors approved an agreement between the County and the Saddleback Unified School District Recreation and Community Services Department to provide supervision and scheduling of the sports park. The Harbors, Beaches and Parks Division of the Orange County Resources and Development Management Department is responsible for the overall operation and maintenance of the facility. Building and landscape maintenance is provided through administration of contracted services. The park was designed to meet the needs of residents of Ladera Ranch and the surrounding cities, and is open to the public from 7am to 10pm daily (personal communication, B. Buchman).

C. Russell Cook Park

C. Russell Cook Park is one of two major community parks owned and operated by the City of San Juan Capistrano. Cook Park is linear and consists of three parcels totaling 17 acres. All three phases of development are now complete (personal communication, B. Ramsey). The three parcels comprising C. Russell Cook Park are:

- Cook Park (Cordova) consists of 9.0 acres on the east side of Calle Arroyo between Via Entradero and Via Solana. Park amenities and uses include BBQ and fire rings, bike paths, equestrian/hiking trails, multipurpose fields, grassy area, parking, restrooms, softball and soccer fields and scenic views.

- Cook Park (Del Campo) consists of 1.5 acres on Calle Arroyo and Del Campo. Park amenities and uses include bike paths, children's play area, equestrian/hiking trails, grassy area, and scenic views.

- Cook Park (La Novia) consists of 6.5 acres on the east side of Calle Arroyo between La Novia and Paseo Tirador. Park amenities and uses include automatic irrigation, BBQs and fire rings, basketball courts, bike paths, children's play area, drinking fountains, equestrian/hiking trails, grassy area, multi-purpose fields, parking, picnic areas, restrooms and volleyball courts.

Forster Ranch Community Park

Forster Ranch Community Park is located at 3207 Camino Vera Cruz and 1291 Sarmentoso in the City of San Clemente, California. Currently, the Forster Ranch Community Park contains 8.3 acres of developed park space.

The Master Plan of City Facilities for the City of San Clemente states, "A community center, gymnasium, pool complex is proposed at Forster Ranch Community Park." The Forster Community Park is proposed to include a total of 22.0 acres. The proposed Forster Ranch Community Park Expansion Phase II includes several amenities that will be jointly utilized by the adjacent schools. Amenities will include lighted tennis courts, children's play area, an amphitheater, on-site parking, a maintenance building, lighted soccer fields, restrooms, a group and individual picnic area, lighted sand volleyball courts, and baseball fields.

A neighborhood park ranges from two to 20 acres in size and is intended to serve the active recreation needs of a particular neighborhood within a community. The following is a list of neighborhood parks within a two-mile radius of the proposed project.

- Acu Canyon Park, San Juan Capistrano
- Descanso Park, San Juan Capistrano
- Four Oaks Park, San Juan Capistrano
- Talega Park #1, San Clemente, California
- Talega Park #2, San Clemente, California
- Blufftop Park, Ladera Ranch
- Chaparral Park, Ladera Ranch
- Township Plunge, Ladera Ranch
- Hilltop Park, Ladera Ranch
- Weatherwood Park, Ladera Ranch
- Poet's Park, Ladera Ranch
- Founders Park, Ladera Ranch
- Oso Grande Park, Ladera Ranch
- Creighton Plunge, Ladera Ranch
- Village Green, Ladera Ranch
- Wagsdale Park, Ladera Ranch

Riding and Hiking Trails

The County's regional riding and hiking trails link the harbors, beaches, parks, open space, and recreational areas. The Countywide regional trail network includes 348 miles of existing and proposed trails, including areas regulated by governmental agencies other than the County of Orange. These riding and hiking trails include equestrian, pedestrian, and mountain biking use.

The following is a list of riding and hiking trails either within the project boundary or within a two-mile radius of the proposed project. Their descriptions are illustrated on the Regional Riding and Hiking Trails Maps in the Orange County General Plan, Recreation Element. It should be noted that the following alignments described herein are conceptual. Precise alignments will be determined when the trail is actually developed and factors such as public safety, environmental impacts and development cost are considered. The Regional Riding and Hiking Trail Map is depicted in Exhibit 4.12-2.

San Juan Creek Trail

The San Juan Creek Trail is proposed to commence at the Los Piños Trail, San Juan Trail and Sitton Peak Trail at San Juan Hot Springs. The trail would travel west for approximately one-half mile and extend along San Juan Creek through Ronald W. Caspers Regional Park. The trail would enter the Ranch Plan boundary and continue in a southerly direction running parallel to Ortega Highway until it reaches Antonio Parkway, at which point it crosses under Antonio Parkway and then under Ortega Highway. The trail would travel southwesterly, exiting the Ranch Plan boundary and enter into the City of San Juan Capistrano. The trail would continue to parallel San Juan Creek. At La Novia Bridge the trail would cross at-grade and head south until it crosses under the I-5 Freeway. It would then head southwesterly under the Camino Capistrano Bridge and proceed over the Atchison, Topeka & Santa Fe Railroad tracks. The trail would head south and cross to the east side of San Juan Creek at Descanso Park. The trail would continue downstream on the east levee of the creek to Pacific Coast Highway near Doheny State Beach. The portion that runs through Caspers Regional Park is only accessible to hikers and equestrians. The trail is close to several staging areas and connects to many trails and parks.

The completed trail, which is currently partially developed, is approximately 15 miles long, with 12 miles being located within unincorporated Orange County and three miles within the City of

San Juan Capistrano of which 2.25 miles are complete (personal communication, T. Foster). The San Juan Creek Trail would traverse the Ranch Plan and be contained in the proposed Rancho Mission Viejo Regional Park (Planning Areas 1 and 13). Approximately six miles of the proposed trail would be located within the project boundary.

Trail design provides for the trails to be setback from roads, buildings and walls to allow space for trees and landscaping.

Prima Deshecha Trail

As proposed, the Prima Deshecha Trail would extend northerly from the San Onofre State Park expansion and just south of Avenida Pico where it would connect with the Cristianitos Trail. It would travel in a westerly direction along the Southern California Edison easement. At Avenida Vista Hermosa, the trail would make a proposed at-grade crossing and continue west along the northern side of Avenida Pico. Just east of La Pata, the trail would begin to travel north along the open space to the proposed Prima Deshecha Regional Park. The trail continues through the proposed park and along the northeastern ridgeline to the entrance. At the entrance the trail would cross La Pata and then again follows along the Edison power line easement, heading north to Ortega Highway. The trail would terminate at the highway where it would connect with the San Juan Creek Trail. This trail is approximately six miles long, with the majority of the trail located in unincorporated Orange County.

The 2001 GDP for Prima Deshecha reflects a conceptual alignment for the trail. The precise alignment and timing for implementation of the trail through the landfill would be based on the ability of the trail to open to the public while avoiding conflicts with the on-going landfill operation. An approximately two miles segment of the proposed Prima Deshecha Trail in close proximity to the Talega Planned Community is currently under development (personal communication, L. Bubert). Upon completion, the trail would be located immediately west of Planning Areas 5 and 11 and would enter the Ranch Plan boundary in Planning Area 1. Slightly less than one mile of the proposed trail would be located within the project boundary.

Cristianitos Trail

As proposed, the Cristianitos Trail would commence north of the San Onofre State Park expansion at approximately Avenida Pico and Cristianitos Road. Also at this approximate location, Cristianitos Trail would connect with the Prima Deshecha Trail at the proposed Avenida Pico Undercrossing. It then would travel in a northbound direction, gently winding along the outskirts of the Talega Valley/Rolling Hills Planned Community and along the westerly boundary of the Talega Valley Open Space Reserve until it reaches Cristianitos Road. At Cristianitos Road, the trail would travel north, paralleling the road on the west side for about one-half mile. The trail would then cross Cristianitos Road to the east side and continue traveling north until it terminates at Ortega Highway. At Ortega Highway it is proposed that the Cristianitos Trail connect with the San Juan Creek Trail. Presently, the trail is undeveloped, but 90 percent of the trail has been dedicated. If Cristianitos Road is incorporated as part of the SR-241, there is a possibility of the trail crossing the corridor along the northern part of Cristianitos Road. This trail is approximately five miles long. Approximately two miles of the proposed Cristianitos Trail is currently under development. The portion under construction lies in close proximity to the Talega Planned Community (personal communication, L. Bubert)

As previously indicated, the trail would enter the Ranch Plan boundary in Planning Area 6 and extend north through undeveloped portions of Planning Area 9. Slightly more than four miles of the proposed trail would be located within the project boundary.

Wagon Wheel Trail

Located on the boundary of the project, the Wagon Wheel Trail commence in General Thomas F. Riley Wilderness Park, and follows an existing ranch road south through Wagon Wheel Canyon. The trail crosses Coto de Caza Drive and Vista del Verde, and continues south through a sliver of the park to the southern boundary of Coto de Caza. The trail turns east and follows an existing ranch road along the property line of Coto de Caza for one-half mile. The trail enters Rancho Mission Viejo property and continues east on an existing ranch road. This ranch road ascends to the west ridge of Bell Canyon and connects to the Bell Canyon Trail within Caspers Regional Park. The trail is approximately three miles long.

Other Trails Outside of the Ranch Plan Boundary

Additional trails that fall within two miles of the proposed project include the Arroyo Trabuco Trail and the Bell Canyon Trail. The Bell Canyon Trail runs for approximately four and a half miles in a north-south trending direction through Caspers Wilderness Park and the Arroyo Trabuco Trail extends approximately seven miles along Trabuco Creek.

Staging Locations

Staging areas typically provide parking and amenities such as watering troughs, drinking fountains, horse tie-ups, benches, and shade trees. The General Plan intent is that each staging area will be studied for trail route implementation once planning is accomplished and adjacent land is developed. The following staging areas are shown on the Regional Riding and Hiking Trails Map within the vicinity of the project (see Exhibit 4.12-2):

- At or near San Juan Hot Springs adjacent to the San Juan Creek Trail and other trails leading into the Cleveland National Forest;
- Along the Prima Deshecha Trail near Avenida Pico;
- Near the San Juan Creek Trail junction with the Prima Deshecha Trail.

The staging area proposed near the San Juan Creek Trail junction with the Prima Deshecha Trail would fall within the boundaries of the proposed project. The other two proposed staging areas would not. None of these proposed staging areas are currently under development (personal communication, L. Bubert).

<u>Bikeways</u>

Bicycle routes provide an alternative transportation mode for all trips, including commuting, shopping, school and recreation. The Orange County Bikeways Plan also addresses the recreational objectives of bicycling. This is done in concert with other County-wide recreational programs such as regional parks and riding and hiking trails. The Orange County General Plan identifies three types of bikeways. A Class I bicycle trail is a paved facility, which is physically separated from a roadway and designated primarily for the use of bicycles. Crossflows by pedestrians and motorists are to be minimized. A Class II Bicycle lane is a facility featuring a striped lane on the paved area of a road for preferential use by bicycles. It is located along the edge of the paved area outside the motor vehicle travel lanes. Parking is restricted within a Class II bike lane. Where sufficient pavement width exists, it may be located between a parking lane and the outside motor vehicle travel lane. A Class III bicycle route is a facility typically identified by green and white (Type "G93") "Bike Route" guide signing only. There are usually no special lane designations, and parking may be permitted. Bicycle traffic may share either the roadway with motor vehicles or a sidewalk with pedestrians and, in either case, bicycle usage is considered secondary. Bike routes are a means to connect otherwise discontinuous segments

of Class I or Class II bikeways. A bikeway route designated on the Bikeways Plan map as "undetermined" indicates that the ultimate trail category or classification, and/or its alignment has not yet been determined or officially adopted due to topographical or right-of-way constraints, or other considerations.

Within the project limits, there are two designated bikeways as shown on Exhibit 4.12-3. A Class I Bikeway is designated along San Juan Creek and a Class II bikeway is shown on Antonio Parkway. The San Juan Creek Bikeway is also on the OCTA's *Strategic Plan* for regional bikeways. The San Juan Creek Bikeway is proposed to follow San Juan Creek and connect Caspers Wilderness Park to Doheny State Beach. It is described as a "mountains-to-sea" bikeway.

Golf Courses

The following is a list of public and private golf courses within a two-mile radius of the proposed project.

Arroyo Trabuco Golf Club

Arroyo Trabuco Golf Club is currently under construction and is scheduled to open in mid-2004. The course will be located east of the City of Mission Viejo and west of the community of Ladera Ranch. The course will be an 18-hole daily-fee public golf club.

Coto de Caza Golf & Racquet Club

Coto de Caza Golf & Racquet Club is a private 36-hole country club located in the Coto de Caza private gated community and is open to residents, as well as members from surrounding communities.

Tijeras Creek Golf Club

The Tijeras Creek Golf Club consists of an 18-hole golf course located at 29082 Tijeras Creek, Rancho Santa Margarita. It is open to the public.

Mission Viejo Golf Course

The Mission Viejo Golf Course is a public golf course operated by the City of Mission Viejo. It is located at 26200 Country Club Drive, Mission Viejo, California.

Marbella Golf Course and Country Club

Marbella Golf Course and Country Club is a private club which provides golf, tennis and social facilities. It is located at 300 Golf Club Drive in San Juan Capistrano, California.

Talega Golf Club

The Talega Golf Club is an 18-hole public golf course located at 990 Avenida Talega in San Clemente, California.

Pacific Golf Club and Country Club

The Pacific Golf and County Club is a "three nine's" private golf club located at 200 Avenida La Pata in San Clemente, California.

Ehibit

6

Underestimating Costs in Public Works Projects

Error or Lie?

Bent Flyvbjerg, Mette Skamris Holm, and Søren Buhl

This article presents results from the first statistically significant study of cost escalation in transportation infrastructure projects. Based on a sample of 258 transportation infrastructure projects worth US$90 billion and representing different project types, geographical regions, and historical periods, it is found with overwhelming statistical significance that the cost estimates used to decide whether such projects should be built are highly and systematically misleading. Underestimation cannot be explained by error and is best explained by strategic misrepresentation, that is, lying. The policy implications are clear: legislators, administrators, investors, media representatives, and members of the public who value honest numbers should not trust cost estimates and cost-benefit analyses produced by project promoters and their analysts.

Flyvbjerg is a professor of planning with the Department of Development and Planning, Aalborg University, Denmark. He is founder and director of the university's research program on transportation infrastructure planning and was twice a Visiting Fulbright Scholar to the U.S. His latest books are *Rationality and Power* (University of Chicago Press, 1998) and *Making Social Science Matter* (Cambridge University Press, 2001). He is currently working on a book about megaprojects and risk (Cambridge University Press). **Holm** is an assistant professor of planning with the Department of Development and Planning, Aalborg University, and a research associate with the university's research program on transportation infrastructure planning. Her main interest is economic appraisal of projects. **Buhl** is an associate professor with the Department of Mathematics, Aalborg University, and an associate statistician with the university's research program on transportation infrastructure planning.

Journal of the American Planning Association, Vol. 68, No. 3, Summer 2002. © American Planning Association, Chicago, IL.

Comparative studies of actual and estimated costs in transportation infrastructure development are few. Where such studies exist, they are typically single-case studies or they cover a sample of projects too small to allow systematic, statistical analyses (Bruzelius et al., 1998; Fouracre et al., 1990; Hall, 1980; Nijkamp & Ubbels, 1999; Pickrell, 1990; Skamris & Flyvbjerg, 1997; Szyliowicz & Goetz, 1995; Walmsley & Pickett, 1992). To our knowledge, only one study exists that, with a sample of 66 transportation projects, approaches a large-sample study and takes a first step toward valid statistical analysis (Merewitz, 1973a, 1973b).[1] Despite their many merits in other respects, these studies have not produced statistically valid answers regarding the question of whether one can trust the cost estimates used by decision makers and investors in deciding whether or not to build new transportation infrastructure. Because of the small and uneven samples used in existing studies, different studies even point in opposite directions, and researchers consequently disagree regarding the credibility of cost estimates. Pickrell (1990), for instance, concludes that cost estimates are highly inaccurate, with actual costs being typically much higher than estimated costs, while Nijkamp and Ubbels (1999) claim that cost estimates are rather correct. Below we will see who is right.

The objective of the study reported here was to answer the following questions in a statistically valid manner: How common and how large are differences between actual and estimated costs in transportation infrastructure projects? Are the differences significant? Are they simply random errors? Or is there a statistical pattern to the differences that suggests other explanations? What are the implications for policy and decision making regarding transportation infrastructure development?

Four Steps to Understanding Deceptive Cost Estimation

We see four steps in the evolution of a body of scholarly research aimed at understanding practices of cost underestimation and deception in decision making for transportation infrastructure. The first step was taken by Pickrell (1990) and Fouracre, Allport, and Thomson (1990), who provided sound evidence for a small number of urban rail projects that substantial cost underestimation is a problem, and who implied that such underestimation may be caused by deception on the part of project promoters and forecasters. The second step was taken by Wachs (1990), who established—again for a small sample of urban rail projects—that lying, understood as intentional deception, is, in fact, an important cause of cost underestimation. Wachs began the difficult task of charting who does the lying, why it occurs, what the ethical implications are, etc.

The problem with the research in the first two steps is that it is based on too few cases to be statistically significant; the pattern found may be due to random properties of the small samples involved. This problem is solved in the third step, taken with the work reported in this article. Based on a large sample of transportation infrastructure projects, we show that (1) the pattern of cost underestimation uncovered by Pickrell and others is of general import and is statistically significant, and (2) the pattern holds for different project types, different geographical regions, and different historical periods. We also show that the large-sample pattern of cost underestimation uncovered by us lends statistical support to the conclusions about lying and cost underestimation arrived at by Wachs for his small sample.

The fourth and final step in understanding cost underestimation and deception would be to do for a large sample of different transportation infrastructure projects what Wachs did for his small sample of urban rail projects: establish whether systematic deception actually takes place, who does the deception, why it occurs, etc. This may be done by having a large number of forecasters and project promoters, representing a large number of projects, directly express, in interviews or surveys, their intentions with and reasons for underestimating costs. This is a key topic for further research.

In sum, then, we do not claim with this article to have provided final proof that lying is the main cause of cost underestimation in transportation infrastructure projects. We claim, however, to have taken one significant step in a cumulative research process for testing whether this is the case by establishing the best and largest set of data about cost underestimation in transportation infrastructure planning so far seen, by carrying out the first statistically significant study of the issues involved, and by establishing that our data support and give statistical significance to theses about lying developed in other research for smaller, statistically nonsignificant samples.

As part of further developing our understanding of cost underestimation, it would also be interesting to study the differences between projects that are approved on a competitive basis, by voters at an election, and those that are funded through formula-based allocations. One may speculate that there is an obvious incentive to make a project look better, and hence to underestimate costs, in the campaign leading up to an election. A good single-case study of this is Kain's (1990) article about a rail transit project in Dallas. Votes are cast more often for large rail, bridge, and tunnel projects than for road projects. For example, most U.S. highway funds are distributed to states based on a formula (i.e., there is no competitive process). A state department of transportation (DOT) is likely to have a fixed annual budget for construction. The DOT leadership would presumably want fairly accurate cost estimates before allocating the budget. One may speculate that large cost underestimation is less likely in this situation. There are exceptions to this scenario. Sometimes DOT officials want to persuade state legislators to increase their budget. And states occasionally submit bond issue proposals to voters. In Europe, the situation is similar on important points, although differences also exist. This may explain the result found below, that cost underestimation is substantially lower for roads than for rail, bridges, and tunnels, and that this is the case both in the U.S. and Europe. Needless to say, more research is necessary to substantiate this observation.

Finally, we want to emphasize that although the project sample used in this study is the largest of its kind, it is still too small to allow more than a few subdivisions, if comparative statistical analyses must still be possible. Therefore, in further work on understanding cost underestimation, the sample should be enlarged to better represent different types of projects and different geographical locations. As to project types, data for more private projects would be particularly useful in allowing statistically valid comparisons between public and private sector projects. Such comparisons do not exist today, and nobody knows whether private projects perform better or worse than public ones regarding cost underestimation. The sample should also be enlarged to contain data for more fixed-link and rail projects. Such data would allow a better (i.e., a statistically corroborated) comparative understanding of cost underestimation for more specific subtypes of projects such as bridges, tunnels, high-speed rail, urban rail, and conven-

tional rail. Such an understanding is nonexistent today. As to geography, immediate rewards would be gained from data for projects outside Europe and North America, especially for fixed links and roads. But even for Europe and North America, data on more projects are needed to allow better comparative analysis.

Measuring Cost Inaccuracy

The methods used in our study are described in the Appendix. All costs are construction costs. We follow international convention and measure the inaccuracy of cost estimates as so-called "cost escalation" (often also called "cost overrun"; i.e., actual costs minus estimated costs in percent of estimated costs). Actual costs are defined as real, accounted construction costs determined at the time of project completion. Estimated costs are defined as budgeted, or forecasted, construction costs at the time of decision to build. Although the project planning process varies with project type, country, and time, it is typically possible for any given project to identify a specific point in the process as the time of decision to build. Usually a cost estimate was available at this point in time for the decision makers. If not, then the closest available estimate was used, typically a later estimate resulting in a conservative bias in our measure for inaccuracy (see the Appendix). All costs are calculated in fixed prices in Euros by using the appropriate historical, sectoral, and geographical indices for discounting and the appropriate exchange rates for conversion between currencies.

Project promoters and their analysts sometimes object to this way of measuring cost inaccuracy (Flyvbjerg et al., in press). Various cost estimates are made at different stages of the process: project planning, decision to build, tendering, contracting, and later renegotiations. Cost estimates at each successive stage typically progress toward a smaller number of options, greater detail of designs, greater accuracy of quantities, and better information about unit price. Thus, cost estimates become more accurate over time, and the cost estimate at the time of making the decision to build is far from final. It is only to be expected, therefore, that such an early estimate would be highly inaccurate. And this estimate would be unfair as the basis for assessing the accuracy of cost forecasting, or so the objection against using the time-of-decision-to-build estimate goes (Simon, 1991). We defend this method, however, because when the focus is on decision making, and hence on the accuracy of the information available to decision makers, then it is *exactly* the cost estimate at the time of making the decision to build that is of primary interest. Otherwise it would be impossible to evaluate whether decisions are informed or not. Estimates made after the decision to build are by definition irrelevant to this decision. Whatever the reasons are for cost increases after decision makers give the go-ahead to build a project, or however large such increases are, legislators and citizens—or private investors in the case of privately funded projects—are entitled to know the uncertainty of budgets. Otherwise transparency and accountability suffer. We furthermore observe that if the inaccuracy of early cost estimates were simply a matter of incomplete information and inherent difficulties in predicting a distant future, as project promoters often say it is, then we would expect inaccuracies to be random or close to random. Inaccuracies, however, have a striking and highly interesting bias, as we will see below.

Another objection to using cost at the time of decision to build as a basis of comparison is that this supposedly would entail the classical error of comparing apples and oranges. Projects change over the planning and implementation process. When, for instance, the physical configuration of the original Los Angeles Blue Line Light Rail project was altered at substantial cost to comprise grade-crossing improvements, upgrading of adjacent streets, better sidewalks, new fences, etc., the project was no longer the same. It was, instead, a new and safer project, and comparing the costs of this project with the costs of the older, less safe one would supposedly entail the apples-and-oranges error. A problem with this argument is that existing research indicates that project promoters routinely ignore, hide, or otherwise leave out important project costs and risks in order to make total costs appear low (Flyvbjerg et al., in press; Wachs, 1989, 1990). For instance, environmental and safety concerns may initially be ignored, even though they will have to be taken into account later in the project cycle if the project lives on, and the project is more likely to live on if environmental and safety concerns are initially ignored. Similarly, ignoring or underplaying geological risks may be helpful in getting projects approved, and no other risk is more likely to boomerang back and haunt projects during construction. "Salami tactics" is the popular name used to describe the practice of introducing project components and risks one slice at a time in order to make costs appear low as long as possible. If such tactics are indeed a main mechanism in cost underestimation, as existing research indicates, then, clearly, comparing actual project costs with estimated costs at the time of decision to build does not entail the error of comparing apples and oranges but is simply a way of tracking how what was said to be a small, inexpensive apple turned out to actually be a big, expensive one.

Finally, we observe that if we were to follow the objections against using the cost estimate at the time of de-

cision to build as the basis of tracking cost escalation, it would be impossible to make meaningful comparisons of costs because no common standard of comparison would be available. We also observe that this method is the international standard for measuring inaccuracy of cost estimates (Fouracre et al., 1990; Leavitt et al., 1993; National Audit Office & Department of Transport, 1992; Nijkamp & Ubbels, 1999; Pickrell, 1990; Walmsley & Pickett, 1992; World Bank, 1994). This standard conveniently allows meaningful and consistent comparisons within individual projects and across projects, project types, and geographical areas. This standard, then, is employed below to measure the inaccuracy of cost estimates in 258 transportation infrastructure projects worth US$90 billion.

Inaccuracy of Cost Estimates

Figure 1 shows a histogram with the distribution of inaccuracies of cost estimates. If errors in estimating costs were small, the histogram would be narrowly concentrated around zero. If errors in overestimating costs were of the same size and frequency as errors in underestimating costs, the histogram would be symmetrically distributed around zero. Neither is the case. We make the following observations regarding the distribution of inaccuracies of construction cost estimates:

- Costs are underestimated in almost 9 out of 10 projects. For a randomly selected project, the likelihood of actual costs being larger than estimated costs is 86%. The likelihood of actual costs being lower than or equal to estimated costs is 14%.
- Actual costs are on average 28% higher than estimated costs (sd=39).
- We reject with overwhelming significance the thesis that the error of overestimating costs is as common as the error of underestimating costs ($p<0.001$; two-sided test, using the binomial distribution). Estimated costs are biased, and the bias is caused by systematic underestimation.
- We reject with overwhelming significance the thesis that the numerical size of the error of underestimating costs is the same as the numerical size of the error of overestimating costs ($p<0.001$; nonparametric Mann-Whitney test). Costs are not only underestimated much more often than they are overestimated or correct, costs that have been underestimated are also wrong by a substantially larger margin than costs that have been overestimated.

We conclude that the error of underestimating costs is significantly much more common and much larger than the error of overestimating costs. Underestimation of costs at the time of decision to build is the rule rather than the exception for transportation infrastructure projects. Frequent and substantial cost escalation is the result.

Cost Underestimation by Project Type

In this section, we discuss whether different types of projects perform differently with respect to cost underestimation. Figure 2 shows histograms with inaccuracies of cost estimates for each of the following project types: (1) rail (high-speed; urban; and conventional, inter-city rail), (2) fixed link (bridges and tunnels), and (3) road (highways and freeways). Table 1 shows the expected (average) inaccuracy and standard deviation for each type of project.

Statistical analyses of the data in Table 1 show both means and standard deviations to be different with a high level of significance. Rail projects incur the highest difference between actual and estimated costs, with an average of no less than 44.7%, followed by fixed-link projects averaging 33.8% and roads at 20.4%. An F-test falsifies the null hypothesis at a very high level of statistical significance that type of project has no effect on percentage cost escalation ($p<0.001$). Project type matters. The substantial and significant differences among project types indicate that pooling the three types of projects in statistical analyses, as we did above, is strictly not appropriate. Therefore, in the analyses that follow, each type of project will be considered separately.

Based on the available evidence, we conclude that rail promoters appear to be particularly prone to cost underestimation, followed by promoters of fixed-link projects. Promoters of road projects appear to be relatively less inclined to underestimate costs, although actual costs are higher than estimated costs much more often than not for road projects as well.

Further subdivisions of the sample indicate that high-speed rail tops the list of cost underestimation, followed by urban and conventional rail, in that order. Similarly, cost underestimation appears to be larger for tunnels than for bridges. These results suggest that the complexities of technology and geology might have an effect on cost underestimation. These results are not statistically significant, however. Even if the sample is the largest of its kind, it is too small to allow repeated subdivisions and still produce significant results. This problem can be solved only by further data collection from more projects.

We conclude that the question of whether there are significant differences in the practice of cost underesti-

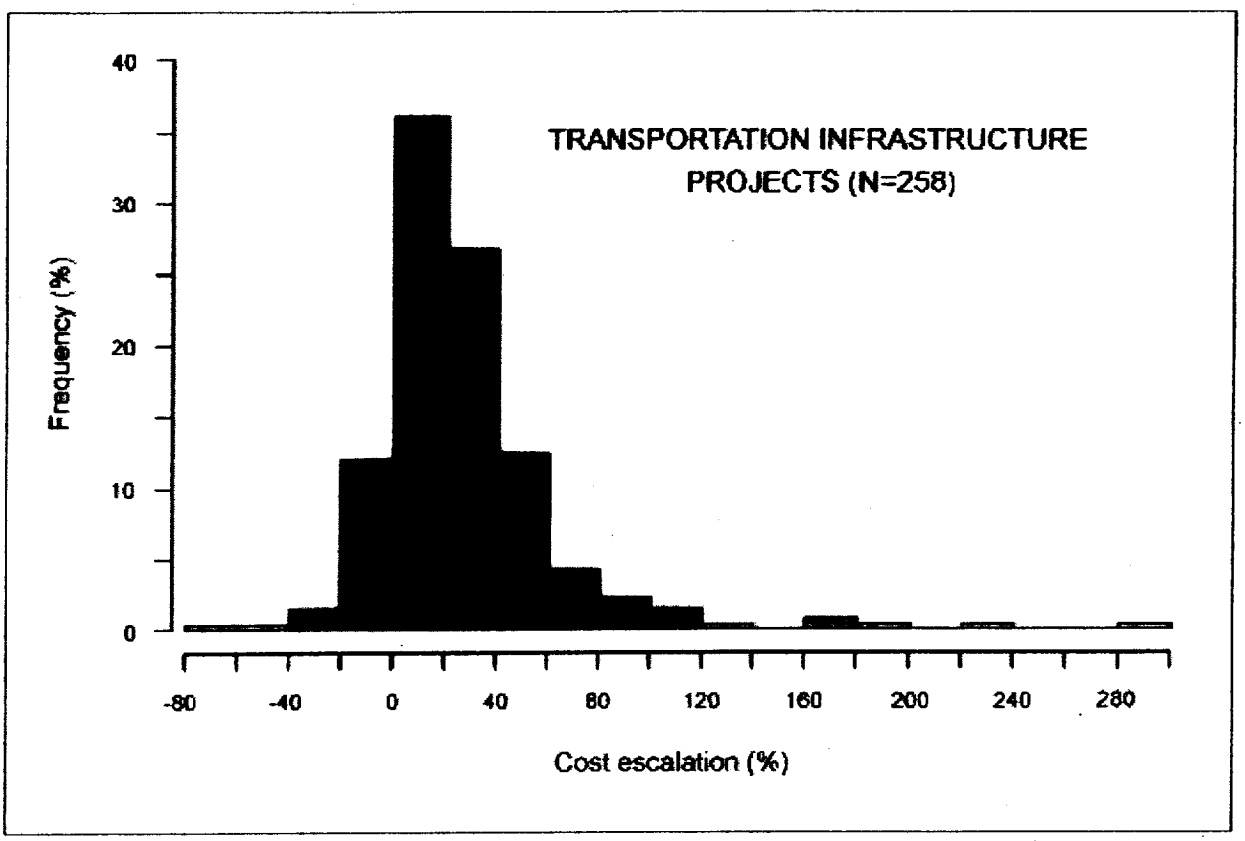

FIGURE 1. Inaccuracy of cost estimates in 258 transportation infrastructure projects (fixed prices).

TABLE 1. Inaccuracy of transportation project cost estimates by type of project (fixed prices).

Project type	Number of cases (N)	Average cost escalation (%)	Standard deviation	Level of significance (p)
Rail	58	44.7	38.4	<0.001
Fixed-link	33	33.8	62.4	<0.004
Road	167	20.4	29.9	<0.001
All projects	258	27.6	38.7	<0.001

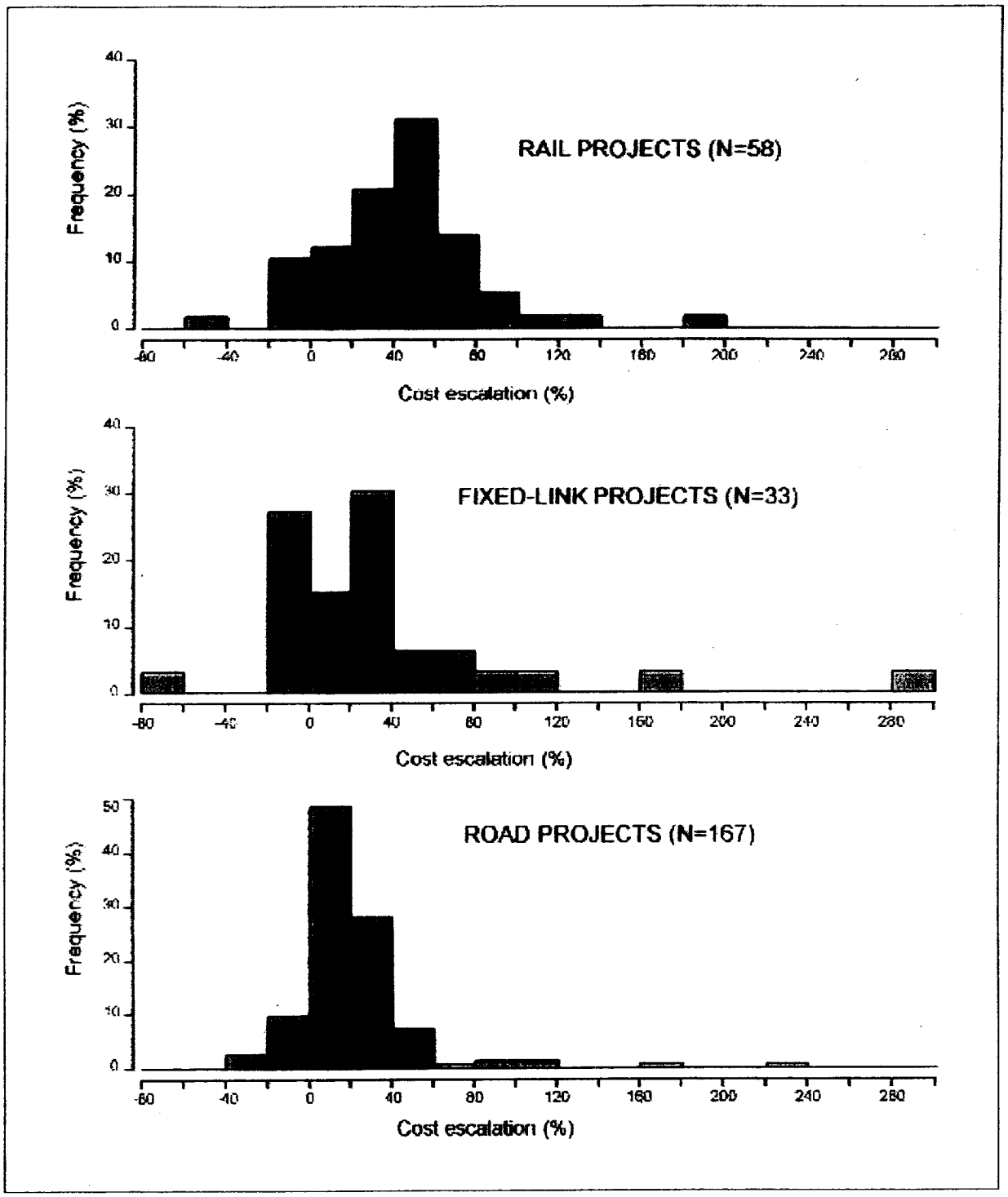

FIGURE 2. Inaccuracy of cost estimates in rail, fixed-link, and road projects (fixed prices).

mation among rail, fixed-link, and road projects must be answered in the affirmative. The average difference between actual and estimated costs for rail projects is substantially and significantly higher than that for roads, with fixed-link projects in a statistically nonsignificant middle position. The average inaccuracy for rail projects is more than twice that for roads, resulting in average cost escalations for rail more than double that for roads. For all three project types, the evidence shows that it is sound advice for policy and decision makers as well as investors, bankers, media, and the public to take any estimate of construction costs with a grain of salt, especially for rail and fixed-link projects.

Cost Underestimation by Geographical Location

In addition to testing whether cost underestimation differs for different kinds of projects, we also tested whether it varies with geographical location among Europe, North America, and "other geographical areas" (a group of 10 developing nations plus Japan). Table 2 shows the differences between actual and estimated costs in these three areas for rail, fixed-link, and road projects. There is no indication of statistical interaction between geographical area and type of project. We therefore consider the effects from these variables on cost underestimation separately. For all projects, we find that the difference between geographical areas in terms of underestimation is highly significant ($p<0.001$). Geography matters to cost underestimation.

If Europe and North America are compared separately, which is compulsory for fixed links and roads because no observations exist for these projects in other geographical areas, comparisons can be made by t-tests (as the standard deviations are rather different, the Welch version is used). For fixed-link projects, the average difference between actual and estimated costs is 43.4% in Europe versus 25.7% North America, but the difference between the two geographical areas is nonsignificant ($p=0.414$). Given the limited number of observations and the large standard deviations for fixed-link projects, we would need to enlarge the sample with more fixed-link projects in Europe and North America in order to test whether the differences might be significant for more observations. For rail projects, the average difference between actual and estimated costs is 34.2% in Europe versus 40.8% in North America. For road projects, the similar numbers are 22.4% versus 8.4%. Again, the differences between geographical areas are nonsignificant ($p=0.510$ and $p=0.184$, respectively).

We conclude, accordingly, that the highly significant differences we found above for geographical location come from projects in the "other geographical areas" category. The average difference between actual and estimated costs in this category is a hefty 64.6%.

Have Estimates Improved Over Time?

In the previous two sections, we saw how cost underestimation varies with project type and geography. In this section, we conclude the statistical analyses by studying how underestimation has varied over time. We ask and answer the question of whether project promoters and forecasters have become more or less inclined over time to underestimate the costs of transportation infrastructure projects. If underestimation were unintentional and related to lack of experience or faulty methods in estimating and forecasting costs, then, a priori, we would expect underestimation to decrease over time as better methods were developed and more experience gained through the planning and implementation of more infrastructure projects.

Figure 3 shows a plot of the differences between actual and estimated costs against year of decision to build

TABLE 2. Inaccuracy of transportation project cost estimates by geographical location (fixed prices).

	Europe			North America			Other geographical areas		
Project type	Number of projects (N)	Average cost escalation (%)	Standard deviation	Number of projects (N)	Average cost escalation (%)	Standard deviation	Number of projects (N)	Average cost escalation (%)	Standard deviation
Rail	23	34.2	25.1	19	40.8	36.8	16	64.6	49.5
Fixed-link	15	43.4	52.0	18	25.7	70.5	0	—	—
Road	143	22.4	24.9	24	8.4	49.4	0	—	—
All projects	181	25.7	28.7	61	23.6	54.2	16	64.6	49.5

for the 111 projects in the sample for which these data are available. The diagram does not seem to indicate an effect from time on cost underestimation. Statistical analyses corroborate this impression. The null hypothesis that year of decision has no effect on the difference between actual and estimated costs cannot be rejected ($p=0.22$, F-test). A test using year of completion instead of year of decision (with data for 246 projects) gives a similar result ($p=0.28$, F-test).

We therefore conclude that cost underestimation has not decreased over time. Underestimation today is in the same order of magnitude as it was 10, 30, and 70 years ago. If techniques and skills for estimating and forecasting costs of transportation infrastructure projects have improved over time, this does not show in the data. No learning seems to take place in this important and highly costly sector of public and private decision making. This seems strange and invites speculation that the persistent existence over time, location, and project type of significant and widespread cost underestimation is a sign that an equilibrium has been reached: Strong incentives and weak disincentives for underestimation may have taught project promoters what there is to learn, namely, that cost underestimation pays off. If this is the case, underestimation must be expected and it must be expected to be intentional. We examine such speculation below. Before doing so, we compare cost underestimation in transportation projects with that in other projects.

Cost Underestimation in Other Infrastructure Projects

In addition to cost data for transportation infrastructure projects, we have reviewed cost data for several hundred other projects including power plants, dams, water distribution, oil and gas extraction, information technology systems, aerospace systems, and weapons systems (Arditi et al., 1985; Blake et al., 1976; Canaday, 1980; Department of Energy Study Group, 1975; Dlakwa & Culpin, 1990; Fraser, 1990; Hall, 1980; Healey, 1964; Henderson, 1977; Hufschmidt & Gerin, 1970; Merewitz, 1973b; Merrow, 1988; Morris & Hough, 1987; World Bank, 1994, n.d.). The data indicate that other types of projects are at least as, if not more, prone to cost underestimation as are transportation infrastructure projects.

Among the more spectacular examples of cost underestimation are the Sydney Opera House, with actual costs approximately 15 times higher than those projected, and the Concorde supersonic airplane, with a cost 12 times higher than predicted (Hall, n.d., p. 3). The data also indicate that cost underestimations for other projects have neither increased nor decreased historically, and that underestimation is common in both First- and Third-World countries. When the Suez canal was completed in 1869, actual construction costs were 20 times higher than the earliest estimated costs and 3 times higher than the cost estimate for the year before construction began. The Panama Canal, which was completed in 1914, had cost escalations in the range of 70 to 200% (Summers, 1967, p. 148).

In sum, the phenomena of cost underestimation and escalation appear to be characteristic not only of transportation projects but of other types of infrastructure projects as well.

Explanations of Underestimation: Error or Lie?

Explanations of cost underestimation come in four types: technical, economic, psychological, and political. In this section, we examine which explanations best fit our data.

Technical Explanations

Most studies that compare actual and estimated costs of infrastructure projects explain what they call "forecasting errors" in technical terms, such as imperfect techniques, inadequate data, honest mistakes, inherent problems in predicting the future, lack of experience on the part of forecasters, etc. (Ascher, 1978; Flyvbjerg et al., in press; Morris & Hough, 1987; Wachs, 1990). Few would dispute that such factors may be important sources of uncertainty and may result in misleading forecasts. And for small-sample studies, which are typical of this research field, technical explanations have gained credence because samples have been too small to allow tests by statistical methods. However, the data and tests presented above, which come from the first large-sample study in the field, lead us to reject technical explanations of forecasting errors. Such explanations simply do not fit the data.

First, if misleading forecasts were truly caused by technical inadequacies, simple mistakes, and inherent problems with predicting the future, we would expect a less biased distribution of errors in cost estimates around zero. In fact, we have found with overwhelming statistical significance ($p<0.001$) that the distribution of such errors has a nonzero mean. Second, if imperfect techniques, inadequate data, and lack of experience were main explanations of the underestimations, we would expect an improvement in forecasting accuracy over time, since errors and their sources would be recognized and addressed through the refinement of data collection, forecasting methods, etc. Substantial resources have

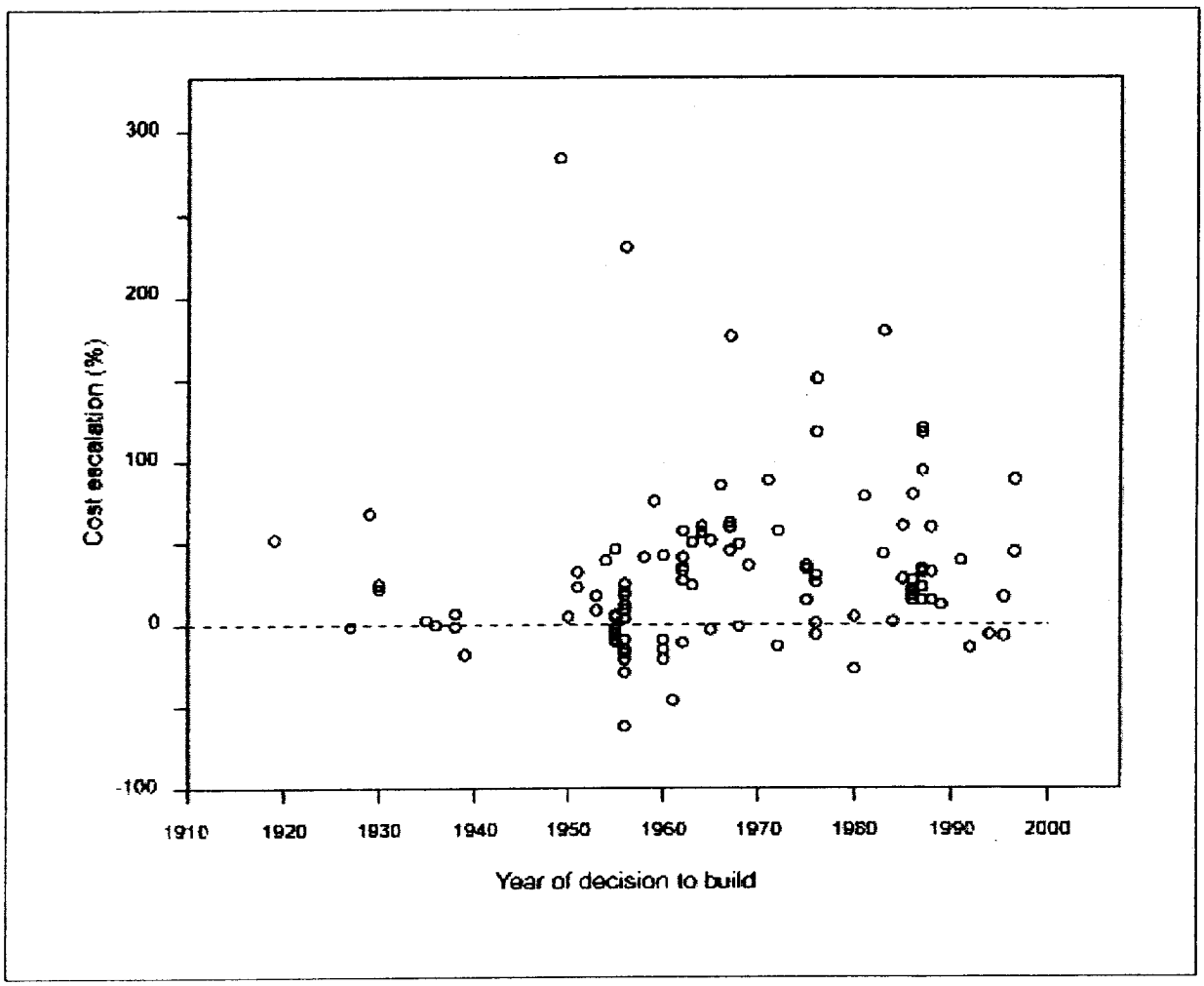

FIGURE 3. Inaccuracy of cost estimates in transportation projects over time, 1910–1998 (fixed prices, 111 projects).

been spent over several decades on improving data and methods. Still our data show that this has had no effect on the accuracy of forecasts. Technical factors, therefore, do not appear to explain the data. It is not so-called forecasting "errors" or cost "escalation" or their causes that need explaining. It is the fact that in 9 out of 10 cases, costs are underestimated.

We may agree with proponents of technical explanations that it is, for example, impossible to predict for the individual project exactly *which* geological, environmental, or safety problems will appear and make costs soar. But we maintain that it is possible to predict the risk, based on experience from other projects, *that* some such problems will haunt a project and how this will affect costs. We also maintain that such risk can and should be accounted for in forecasts of costs, but typically is not. For technical explanations to be valid, they would have to explain why forecasts are so consistent in ignoring cost risks over time, location, and project type.

Economic Explanations

Economic explanations conceive of cost underestimation in terms of economic rationality. Two types of economic explanation exist; one explains in terms of eco-

nomic self-interest, the other in terms of the public interest. As regards self-interest, when a project goes forward, it creates work for engineers and construction firms, and many stakeholders make money. If these stakeholders are involved in or indirectly influence the forecasting process, then this may influence outcomes in ways that make it more likely that the project will be built. Having costs underestimated and benefits overestimated would be economically rational for such stakeholders because it would increase the likelihood of revenues and profits. Economic self-interest also exists at the level of cities and states. Here, too, it may explain cost underestimation. Pickrell (1990, 1992) pointed out that transit capital investment projects in the U.S. compete for discretionary grants from a limited federal budget each year. This creates an incentive for cities to make their projects look better, or else some other city may get the money.

As regards the public interest, project promoters and forecasters may deliberately underestimate costs in order to provide public officials with an incentive to cut costs and thereby to save the public's money. According to this type of explanation, higher cost estimates would be an incentive for wasteful contractors to spend more of the taxpayer's money. Empirical studies have identified promoters and forecasters who say they underestimate costs in this manner and with this purpose (i.e., to save public money; Wachs, 1990). The argument has also been adopted by scholars, for instance Merewitz (1973b), who explicitly concludes that "keeping costs low is more important than estimating costs correctly" (p. 280).

Both types of economic explanation account well for the systematic underestimation of costs found in our data. Both depict such underestimation as deliberate, and as economically rational. If we now define a lie in the conventional fashion as making a statement intended to deceive others (Bok, 1979, p. 14; Cliffe et al., 2000, p. 3), we see that deliberate cost underestimation is lying, and we arrive at one of the most basic explanations of lying, and of cost underestimation, that exists: Lying pays off, or at least economic agents believe it does. Moreover, if such lying is done for the public good (e.g., to save taxpayers' money), political theory would classify it in that special category of lying called the "noble lie," the lie motivated by altruism. According to Bok (1979), this is the "most dangerous body of deceit of all" (p. 175).

In the case of cost underestimation in public works projects, proponents of the noble lie overlook an important fact: Their core argument—that taxpayers' money is saved by cost underestimation—is seriously flawed. Anyone with even the slightest trust in cost-benefit analysis and welfare economics must reject this argument. Underestimating the costs of a given project leads to a falsely high benefit-cost ratio for that project, which in turn leads to two problems. First, the project may be started despite the fact that it is not economically viable. Or, second, it may be started instead of another project that would have yielded higher returns had the actual costs of both projects been known. Both cases result in the inefficient use of resources and therefore in waste of taxpayers' money. Thus, for reasons of economic efficiency alone, the argument that cost underestimation saves money must be rejected; underestimation is more likely to result in waste of taxpayers' money. But the argument must also be rejected for ethical and legal reasons. In most democracies, for project promoters and forecasters to deliberately misinform legislators, administrators, bankers, the public, and the media would not only be considered unethical but in some instances also illegal, for instance where civil servants would misinform cabinet members or cabinet members would misinform the parliament. There is a formal "obligation to truth" built into most democratic constitutions on this point. This obligation would be violated by deliberate underestimation of costs, whatever the reasons may be. Hence, even though economic explanations fit the data and help us understand important aspects of cost underestimation, such explanations cannot be used to justify it.

Psychological Explanations

Psychological explanations attempt to explain biases in forecasts by a bias in the mental makeup of project promoters and forecasters. Politicians may have a "monument complex," engineers like to build things, and local transportation officials sometimes have the mentality of empire builders. The most common psychological explanation is probably "appraisal optimism." According to this explanation, promoters and forecasters are held to be overly optimistic about project outcomes in the appraisal phase, when projects are planned and decided (Fouracre et al., 1990, p. 10; Mackie & Preston, 1998; Walmsley & Pickett, 1992, p. 11; World Bank, 1994, p. 86). An optimistic cost estimate is clearly a low one. The existence of appraisal optimism in promoters and forecasters would result in actual costs being higher than estimated costs. Consequently, the existence of appraisal optimism would be able to account, in whole or in part, for the peculiar bias of cost estimates found in our data, where costs are systematically underestimated. Such optimism, and associated cost underestimation, would not be lying, needless to say, because the deception involved is self-deception and therefore not deliberate. Cost underestimation would be error according to this explanation.

There is a problem with psychological explanations, however. Appraisal optimism would be an important

and credible explanation of underestimated costs if estimates were produced by inexperienced promoters and forecasters, i.e., persons who were estimating costs for the first or second time and who were thus unknowing about the realities of infrastructure building and were not drawing on the knowledge and skills of more experienced colleagues. Such situations may exist and may explain individual cases of cost underestimation. But given the fact that the human psyche is distinguished by a significant ability to learn from experience, it seems unlikely that promoters and forecasters would continue to make the same mistakes decade after decade instead of learning from their actions. It seems even more unlikely that a whole profession of forecasters and promoters would collectively be subject to such a bias and would not learn over time. Learning would result in the reduction, if not elimination, of appraisal optimism, which would then result in cost estimates becoming more accurate over time. But our data clearly shows that this has not happened.

The profession of forecasters would indeed have to be an optimistic group to keep their appraisal optimism throughout the 70-year period our study covers and not learn that they were deceiving themselves and others by underestimating costs. This would account for the data, but is not a credible explanation. As observed elsewhere, the incentive to publish and justify optimistic estimates is very strong, and the penalties for having been overoptimistic are generally insignificant (Davidson & Huot, 1989, p. 137; Flyvbjerg et al., in press). This is a better explanation of the pervasive existence of optimistic estimates than an inherent bias for optimism in the psyche of promoters and forecasters. And "optimism" calculated on the basis of incentives is not optimism, of course; it is deliberate deception. Therefore, on the basis of our data, we reject appraisal optimism as a primary cause of cost underestimation.

Political Explanations

Political explanations construe cost underestimation in terms of interests and power (Flyvbjerg, 1998). Surprisingly little work has been done that explains the pattern of misleading forecasts in such terms (Wachs, 1990, p. 145). A key question for political explanations is whether forecasts are intentionally biased to serve the interests of project promoters in getting projects started. This question again raises the difficult issue of lying. Questions of lying are notoriously hard to answer, because in order to establish whether lying has taken place, one must know the intentions of actors. For legal, economic, moral, and other reasons, if promoters and forecasters have intentionally fabricated a deceptive cost estimate for a project to get it started, they are unlikely to tell researchers or others that this is the case (Flyvbjerg, 1996; Wachs, 1989).

When Eurotunnel, the private company that owns the tunnel under the English Channel, went public in 1987 to raise funds for the project, investors were told that building the tunnel would be relatively straightforward. Regarding risks of cost escalation, the prospectus read:

> Whilst the undertaking of a tunneling project of this nature necessarily involves certain construction risks, the techniques to be used are well proven. . . . The Directors, having consulted the Maître d'Oeuvre, believe that 10% . . . would be a reasonable allowance for the possible impact of unforeseen circumstances on construction costs.[2] ("Under Water," 1989, p. 37)

Two hundred banks communicated these figures for cost and risk to investors, including a large number of small investors. As observed by *The Economist* ("Under Water," 1989), anyone persuaded in this way to buy shares in Eurotunnel in the belief that the cost estimate was the mean of possible outcomes was, in effect, deceived. The cost estimate of the prospectus was a best possible outcome, and the deception consisted in making investors believe in the highly unlikely assumption—disproved in one major construction project after another—that everything would go according to plan, with no delays; no changes in safety and environmental performance specifications; no management problems; no problems with contractual arrangements, new technologies, or geology; no major conflicts; no political promises not kept; etc. The assumptions were, in other words, those of an ideal world. The real risks of cost escalation for the Channel tunnel were many times higher than those communicated to potential investors, as evidenced by the fact that once built, the real costs of the project were higher by a factor of two compared with forecasts.

Flyvbjerg, Bruzelius, and Rothengatter (in press) document for a large number of projects that the Everything-Goes-According-to-Plan type of deception used for the Channel tunnel is common. Such deception is, in fact, so widespread that in a report on infrastructure and development, the World Bank (1994, pp. ii, 22) found reason to coin a special term for it: the "EGAP-principle." Cost estimation following the EGAP-principle simply disregards the risk of cost escalation resulting from delays, accidents, project changes, etc. This is a major problem in project development and appraisal, according to the World Bank.

It is one thing, however, to point out that investors, public or private, were deceived in particular cases. It is

quite another to get those involved in the deceptions to talk about this and to possibly admit that deception was intentional, i.e., that it was lying. We are aware of only one study that actually succeeded in getting those involved in underestimating costs to talk about such issues (Wachs, 1986, 1989, 1990). Wachs interviewed public officials, consultants, and planners who had been involved in transit planning cases in the U.S. He found that a pattern of highly misleading forecasts of costs and patronage could not be explained by technical issues and were best explained by lying. In case after case, planners, engineers, and economists told Wachs that they had had to "cook" forecasts in order to produce numbers that would satisfy their superiors and get projects started, whether or not the numbers could be justified on technical grounds (Wachs, 1990, p. 144). One typical planner admitted that he had repeatedly adjusted the cost figures for a certain project downward and the patronage figures upward to satisfy a local elected official who wanted to maximize the chances of getting the project in question started. Wachs' work is unusually penetrating for a work on forecasting. But again, it is small-sample research, and Wachs acknowledges that most of his evidence is circumstantial (Wachs, 1986, p. 28). The evidence does not allow conclusions regarding the project population. Nevertheless, based on the strong pattern of misrepresentation and lying found in his case studies, Wachs goes on to hypothesize that the type of abuse he has uncovered is "nearly universal" (1990, p. 146; 1986, p. 28) and that it takes place not only in transit planning but also in other sectors of the economy where forecasting routinely plays an important role in policy debates.

Our data give support to Wachs' claim. The pattern of highly underestimated costs is found not only in the small sample of projects Wachs studied; the pattern is statistically significant and holds for the project population mean (i.e., for the majority of transportation infrastructure projects). However, on one point, Wachs (1986) seems to draw a conclusion somewhat stronger than is warranted. "[F]orecasted costs always seem to be *lower* than actual costs" (p. 24) he says (emphasis in original). Our data show that although "always" (100%) may cover the small sample of projects Wachs chose to study, when the sample is enlarged by a factor of 20–30 to a more representative one, "only" in 86% of all cases are forecasted costs lower than actual costs. Such trifles—14 percentage points—apart, the pattern identified by Wachs is a general one, and his explanation of cost underestimation in terms of lying to get projects started fit our data particularly well. Of the existing explanations of cost development in transportation infrastructure projects, we therefore opt for political and economic explanations. The use of deception and lying as tactics in power struggles aimed at getting projects started and at making a profit appear to best explain why costs are highly and systematically underestimated in transportation infrastructure projects.

Summary and Conclusions

The main findings from the study reported in this article—all highly significant and most likely conservative—are as follows:

- In 9 out of 10 transportation infrastructure projects, costs are underestimated.
- For rail projects, actual costs are on average 45% higher than estimated costs (sd=38).
- For fixed-link projects (tunnels and bridges), actual costs are on average 34% higher than estimated costs (sd=62).
- For road projects, actual costs are on average 20% higher than estimated costs (sd=30).
- For all project types, actual costs are on average 28% higher than estimated costs (sd=39).
- Cost underestimation exists across 20 nations and 5 continents; it appears to be a global phenomenon.
- Cost underestimation appears to be more pronounced in developing nations than in North America and Europe (data for rail projects only).
- Cost underestimation has not decreased over the past 70 years. No learning that would improve cost estimate accuracy seems to take place.
- Cost underestimation cannot be explained by error and seems to be best explained by strategic misrepresentation, i.e., lying.
- Transportation infrastructure projects do not appear to be more prone to cost underestimation than are other types of large projects.

We conclude that the cost estimates used in public debates, media coverage, and decision making for transportation infrastructure development are highly, systematically, and significantly deceptive. So are the cost-benefit analyses into which cost estimates are routinely fed to calculate the viability and ranking of projects. The misrepresentation of costs is likely to lead to the misallocation of scarce resources, which, in turn, will produce losers among those financing and using infrastructure, be they taxpayers or private investors.

We emphasize that these conclusions should not be interpreted as an attack on public (vs. private) spending on infrastructure, since the data are insufficient to decide whether private projects perform better or worse

than public ones regarding cost underestimation. Nor do the conclusions warrant an attack on spending on transportation vs. spending on other projects, since other projects appear to be as liable to cost underestimation and escalation as are transportation projects. With transportation projects as an in-depth case study, the conclusions simply establish that significant cost underestimation is a widespread practice in project development and implementation, and that this practice forms a substantial barrier to the effective allocation of scarce resources for building important infrastructure.

The key policy implication for this consequential and highly expensive field of public policy is that those legislators, administrators, bankers, media representatives, and members of the public who value honest numbers should not trust the cost estimates presented by infrastructure promoters and forecasters. Another important implication is that institutional checks and balances—including financial, professional, or even criminal penalties for consistent or foreseeable estimation errors—should be developed to ensure the production of less deceptive cost estimates. The work of designing such checks and balances has been begun elsewhere, with a focus on four basic instruments of accountability: (1) increased transparency, (2) the use of performance specifications, (3) explicit formulation of the regulatory regimes that apply to project development and implementation, and (4) the involvement of private risk capital, even in public projects (Bruzelius et al., 1998; Flyvbjerg et al., in press).

ACKNOWLEDGMENTS

The authors wish to thank Martin Wachs, Don Pickrell, and three anonymous *JAPA* referees for valuable comments on an earlier draft of the article. Research for the article was supported by the Danish Transport Council and Aalborg University, Denmark.

NOTES

1. Merewitz's (1973a, 1973b) study compared cost overrun in urban rapid transit projects, especially the San Francisco Bay Area Rapid Transit (BART) system, with overrun in other types of public works projects. Merewitz's aims were thus different from ours, and his sample of transportation projects was substantially smaller: 17 rapid transit projects and 49 highway projects, compared with our 58 rail projects, 167 highway projects, and 33 bridge or tunnel projects. In addition to issues of a small sample, in our attempt to replicate Merewitz's analysis we found that his handling of data raises a number of other issues. First, Merewitz did not correct his cost data for inflation, i.e., current prices were used instead of fixed ones. This is known to be a major source of error due to varying inflation rates between projects and varying duration of construction periods. Second, in statistical tests, Merewitz compared the mean cost overrun of subgroups of projects (e.g., rapid transit) with the grand mean of overrun for all projects, thus making the error of comparing projects with themselves. Subgroups should be tested directly against other subgroups in deciding whether they differ at all and, if so, which ones differ. Third, Merewitz's two reports (1973a, 1973b) are inconsistent. One (1973a) calculates the grand mean of cost overrun as the average of means for subgroups; that is, the grand mean is unweighted, where common practice is to use the weighted mean, as appears to be the approach taken in the other (1973b). Fourth, due to insufficient information, the p-values calculated by Merewitz are difficult to verify; most likely they are flawed, however, and Merewitz's one-sided p-values are misleading. Finally, Merewitz used a debatable assumption about symmetry, which has more impact for the nonparametric test used than nonnormality has for parametric methods. Despite these shortcomings, the approach taken in Merewitz's study was innovative for its time and in principle pointed in the right direction regarding how to analyze cost escalation in public works projects. The study cannot be said to be a true large-sample study for transportation infrastructure, however, and its statistical significance is unclear.
2. The Maître d'Oeuvre was an organization established to monitor project planning and implementation for the Channel tunnel. It was established in 1985, and until 1988 it represented the owners. In 1988 it was reverted to an impartial position (Major Projects Association, 1994, pp. 151-153).

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APPENDIX

The first task of the research reported in this paper was to establish a sample of infrastructure projects substantially larger than what is common in this area of research, a sample large enough to allow statistical analyses of costs. Here a first problem was that data on actual costs in transportation infrastructure projects are relatively difficult to come by. One reason is that it is quite time consuming to produce such data. For public sector projects, funding and accounting procedures are typically unfit for keeping track of the multiple and complex changes that occur in total project costs over time. For large projects, the relevant time frame may cover 5, 10, or more fiscal years from decision to build, until construction starts, until the project is completed and operations begin. Reconstructing the actual total costs of a public project, therefore, typically entails long and difficult archival work and complex accounting. For private projects, even if funding and accounting practices may be more conducive to producing data on actual total costs, such data are often classified to keep them from the hands of competitors. Unfortunately, this also tends to keep data from the hands of scholars. And for both public and private projects, data on actual costs may be held back by project owners because more often than not, actual costs reveal substantial cost escalation, and cost escalation is normally considered somewhat of an embarrassment to promoters and owners. In sum, establishing reliable data on actual costs for even a single transportation infrastructure project is often highly time consuming or simply impossible.

This state of affairs explains why small-sample studies dominate scholarship in this field of research. But despite the problems mentioned, after 4 years of data collection and refinement, we were able to establish a sample of 258 transportation infrastructure projects with data on both actual construction costs and estimated costs at the time of decision to build. The project portfolio is worth approximately US$90 billion (1995 prices). The project types are bridges, tunnels, highways, freeways, high-speed rail, urban rail, and conventional (interurban) rail. The projects are located in 20 countries on 5 continents, including both developed and developing nations. The projects were completed between 1927 and 1998. Older projects were included in the sample in order to test whether the accuracy of estimated costs improved over time. The construction costs of projects range from US$1.5 million to US$8.5 billion (1995 prices), with the smallest projects typically being stretches of roads in larger road schemes, and the largest projects being rail links, tunnels, and bridges. As far as we know, this is the largest sample of projects with data on cost development that has been established in this field of research.

In statistical analysis, data should be a sample from a larger population, and the sample should represent the population properly. These requirements are ideally satisfied by drawing the sample by randomized lot. Randomization ensures with high probability that factors that cannot be controlled are equalized. A sample should also be designed such that the representation of subgroups corresponds to their occurrence and importance in the population. In studies of human affairs, however, where controlled laboratory experiments often cannot be conducted, it is frequently impossible to meet these ideal conditions. This is also the case for the current study, and we therefore had to take a different approach to sampling and statistical analysis.

We selected the projects for the sample on the basis of data availability. All projects that we knew of for which data on construction cost development were obtainable were considered for inclusion in the sample. Cost development is defined as the difference between actual and estimated costs in percentage of estimated costs, with all costs measured in fixed prices. Actual costs are defined as real, accounted costs determined at the time of completing a project. Estimated costs are defined as budgeted, or forecasted, costs at the time of decision to build. Even if the project planning process varies with project type, country, and time, it is typically possible to locate for any given project a specific point in the process that can be identified as the time of decision to build. Usually a cost estimate was available for this point in time. If not, the closest available estimate was used, typically a later estimate resulting in a conservative bias in our measurement of cost development. Cost data were collected from a variety of sources, including annual project accounts, questionnaires, interviews, and other studies.

Data on cost development were available for 343 projects. We then rejected 85 projects because of insufficient data quality. For instance, for some projects we could not obtain a clear answer regarding what was included in costs, or whether cost data were given in current or fixed prices, or which price level (year) had been used in estimating and discounting costs. More specifically, of those 85 projects, we rejected 27 because we could not establish whether or not cost data were valid and reliable. We rejected 12 projects because they had been completed before 1915 and no reliable indices were available for discounting costs to the present. Finally, we excluded 46 projects because cost development for them turned out to have been calculated before construction was completed and operations begun: therefore, the actual final costs for these projects may be different from the cost estimates used to calculate cost development, and no information was available on actual final costs. In addition to the 85 rejected projects mentioned here, we also rejected a number of projects to avoid double counting of projects. This typically involved projects from other studies that appeared in more than one study or where we had a strong suspicion that this might be the case. In sum, all projects for which data were considered valid and reliable were included in the sample. This covers both projects for which we ourselves collected the data and projects for which other researchers in other studies did the data collection (Fouracre et al., 1990; Hall, 1980; Leavitt et al., 1993; Lewis, 1986; Merewitz, 1973a; National Audit Office, Department of Transport, 1985, 1992; National Audit Office, Department of Transport, Scottish Development Department, & Welsh Office, 1988; Pickrell, 1990; Riksrevisionsverket, 1994; Vejdirektoratet, 1995; Walmsley & Pickett, 1992). Cost data were made comparable across projects by discounting prices to the 1995 level and calculating them in Euros, using the appropriate geographical, sectoral, and historical indices for discounting and the appropriate exchange rates for conversion between currencies.

Our own data collection concentrated on large European projects because too few data existed for this type of project to allow comparative studies. For instance, for projects with actual construction costs larger than 500 million Euros (1995 prices; EUR1=US$1.29 in 1995), we were initially able to identify from other studies only two European projects for which data were available on both actual and estimated costs. If we lowered the project size and looked at projects larger than 100 million Euros, we were able to identify such data for eight European projects. We saw the lack of reliable cost data for European projects as particularly problematic since the Commission of the European Union had just launched its policy for establishing the so-called trans-European transport networks, which would involve the construction of a large number of major transportation infrastructure projects across Europe at an initial cost of 220 billion Euros (Commission of the European Union, 1993, p. 75). As regards costs, we concluded that the knowledge base for the Commission's policy was less than well developed, and we hoped to help remedy this situation through our data collection. Our efforts on this point proved successful. We collected primary data on cost for 37 projects in Denmark, France, Germany, Sweden, and the U.K. and were thus able to greatly increase the number of large European projects with reliable data for both actual and estimated costs, allowing for the first time a comparative study for this type of project in which statistical methods could be applied.

As for any sample, a key question is whether the sample is representative of the population. Here the question is whether the projects included in the sample are representative of the population of transportation infrastructure projects. Since the criterion for sampling was data availability, this question translates into one of whether projects with available data are representative. There are four reasons why this is probably not the case. First, it may be speculated that projects that are managed well with respect to data availability may also be managed well in other respects, resulting in better than average (i.e., nonrepresentative) performance for such projects. Second, it has been argued that the very existence of data that make the evaluation of performance possible may contribute to improved performance when such data are used by project management to monitor projects (World Bank, 1994, p. 17). Again, such projects would not be representative of the project population. Third, we might speculate that managers of projects with a particularly bad track record regarding cost escalation have an interest in not making cost data available, which would then result in underrepresentation of such projects in the sample. Conversely, managers of projects with a good track record for costs might be interested in making this public, resulting in overrepresentation of these projects. Fourth, and finally, even where managers have made cost data available, they may have chosen to give out data that present their projects in as favorable a light as possible. Often there are several estimates of costs to choose from and several calculations of actual costs for a given project at a given time. If researchers collect data by means of survey questionnaires, as is often the case, there might be a temptation for managers to choose the combination of actual and estimated costs that suits them best, possibly a combination that makes their projects look good.

The available data do not allow an exact, empirical assessment of the magnitude of the problem of misrep-

resentation. But the few data that exist that shed light on this problem support the thesis that data are biased. When we compared data from the Swedish Auditor General for a subsample of road projects, for which the problems of misrepresentation did not seem to be an issue, with data for all road projects in our sample, we found that cost escalation in the Swedish subsample is significantly higher than for all projects (Holm, 1999, pp. 11–15). We conclude, for the reasons given above, that most likely the sample is biased and the bias is conservative. In other words, the difference between actual and estimated costs derived from the sample is likely to be lower than the difference in the project population. This should be kept in mind when interpreting the results from statistical analyses of the sample. The sample is not perfect by any means. Still it is the best obtainable sample given the current state of the art in this field of research.

In the statistical analyses, percentage cost development in the sample is considered normally distributed unless otherwise stated. Residual plots, not shown here, indicate that normal distribution might not be completely satisfied, the distributions being somewhat skewed with larger upper tails. However, transformations (e.g., the logarithmic one) do not improve this significantly. For simplicity, therefore, no transformation has been made, unless otherwise stated.

The subdivisions of the sample implemented as part of analyses entail methodological problems of their own. Thus the representation of observations in different combinations of subgroups is quite skewed for the data considered. The analysis would be improved considerably if the representation were more even. Partial and complete confounding occur; that is, if a combination of two or more effects is significant, it is sometimes difficult to decide whether one, the other, or both cause the difference. For interactions, often not all the combinations are represented, or the representations can be quite scarce. We have adapted our interpretations of the data to these limitations, needless to say. If better data could be gathered, sharper conclusions could be made.

The statistical models used are linear normal models (i.e., analysis of variance and regression analysis with the appropriate F-tests and t-tests). The tests of hypotheses concerning mean values are known to be robust to deviations from normality. Also, chi-square tests for independence have been used for count data. For each test, the p-value has been reported. This value is a measure for rareness if identity of groups is assumed. Traditionally, a p-value less than 0.01 is considered highly significant and less than 0.05 significant, whereas a larger p-value means that the deviation could be due to chance.

Ex H

7

Oliver

11-16-02

pitalized in Newport

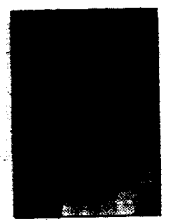
is regarded as one of mier pianists of his on, and regularly sells cert halls where he s. He has played often ge County, but was his first appearances Pacific Symphony.

n described Watts' "extremely unusual," conditions usually re- n accidents or blows ead. The pianist did e a medical history uld forewarn of what d Thursday, the doc-

fortunate he got when he did, and had on for a couple more Dobkin said. Fatalities bdural hematomas are common," he said.

Vatts was being rushed hospital Thursday, the Symphony's principal ns met with music di- Carl St.Clair and Presi- ohn Forsyte to decide do.

vas a quarter to eight, l a packed house, and



André Watts

we had to make some fast decisions," Forsyte said. "We powwowed and decided at that point, probably the most logical thing to do was to go and get the Mozart (Symphony No. 40) in G minor out of the library, because the orchestra had played it about three weeks ago."

The orchestra played the piece, and continued the second half of the concert as planned with Prokofiev's Symphony No. 5.

"Happily, I think it was a successful decision, and the audience was very understanding of the circumstances," Forsyte said.

Watts started his career 40 years ago, when he appeared at age 16 with Leonard Bernstein and the New York Philharmonic on a nationally televised Young People's Concert. Later that same month, he subbed for an ailing Glenn Gould and became an instant star.

The charismatic pianist is known for performing with high energy and dexterity, in the spirit of Bernstein's give-all approach. He resides in Maryland, where he also teaches.

"Let's just hope that he's fully recovered and he can go on with one of the great careers in our art form," Forsyte said.

Watts was also scheduled to perform Brahms' First Piano Concerto with the PSO at 3 p.m. today. Instead, German pianist Markus Groh will play the same piece. Ticket holders for Thursday's performance may exchange tickets for today's concert or for any future PSO event.

For information, call the PSO ticket office at (714) 755-5799.

CONTACT US: (714) 796-6026 or rchang@ocregister.com

BIG SPLASH AT PRO-AM

TOPICS OF INTEREST

COURTS

Construction firm sues tollway agency

FCI Constructors, which built a portion of the Foothill (241) Toll Road, sued Orange County's tollway agency Thursday, alleging that engineers significantly underestimated the amount of soil that had to be removed to complete the project.

The company asserted in court records that the faulty estimates cost the firm and its subcontractors millions of extra dollars to deal with 135,543 cubic yards of excess soil.

Clare Climaco, a spokeswoman for the Transportation Corridor Agencies, said she could not comment on the lawsuit because the agency had not seen the court papers.

– Heather Lourie
(949) 454-7335

COURTS

Hearing in Grove sale canceled

Melodyland Christian Center, the owner of The Grove of Anaheim and Anaheim officials continued working to resolve a lawsuit that has temporarily blocked the sale of The Grove to the city, according to the City Attorney's Office.

Melodyland had sued owner SMG of Philadelphia and Anaheim, seeking to force SMG to honor a purchase agreement it signed with the center.

Anaheim exercised its first right to buy the venue for $6.7 million.

A judge had granted a temporary restraining order, but a preliminary injunction hearing set for Friday was can-

EXH 8

divider

Mitigation Assessment of FTC-South Impacts on San Onofre State Beach

August, 1997

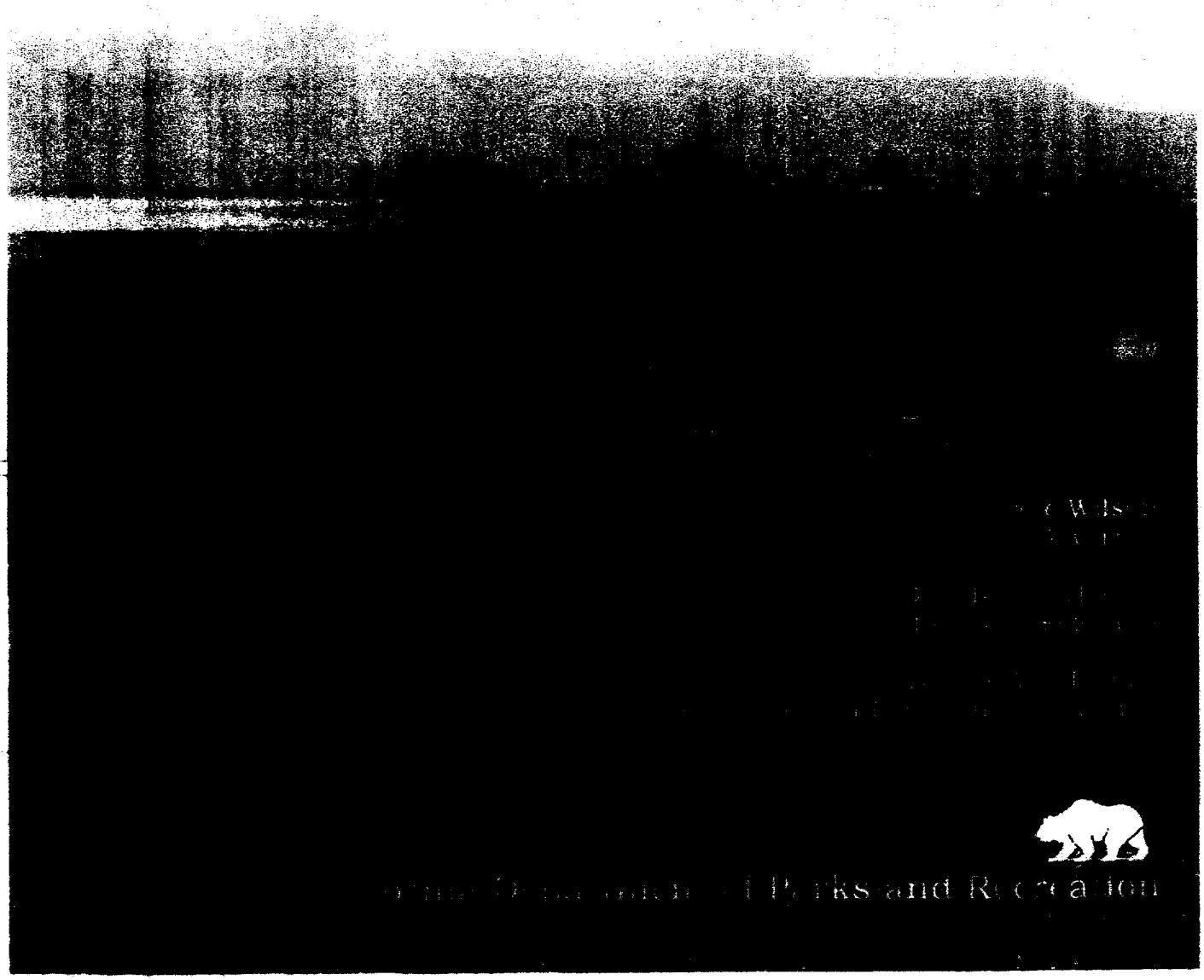


TABLE OF CONTENTS

SUMMARY 1

BACKGROUND 1

San Onofre State Beach 1
Spirit of Place 2
The Project 3
The Impact 3

SCOPE OF WORK 3

METHODOLOGY 4

ANALYSIS 4

LIMITATIONS TO MITIGATION 5

RECOMMENDATION 6

APPENDICES

Appendix A. Spirit of Place

Appendix B. Mitigation Matrix

Appendix C. Selected Impact Analysis
1. Pictorial Visual Simulation
   a. Visual Impact Simulation and Noise Sampling Locations
   b. Pictorial Visual Simulations
2. Noise Analysis

Appendix D. Updated Visitor Attendance for San Onofre State Beach

Appendix E. Authors

MITIGATION ASSESSMENT
OF
FTC-SOUTH IMPACTS ON
SAN ONOFRE STATE BEACH

Summary

The construction of the "CP" alternative of the proposed Foothill Transportation Corridor-South will result in the constructive use of portions of this State Beach, a significant unit of California's State Park System. Currently, San Onofre State Beach is a rare large Southern California scenic coastal-canyon park with high environmental values, recreation use and potential for expanded recreational opportunities. Substantial impairment of these resources will result from implementation of the locally preferred alternative; that of converting subunit #1 of the park to a strip highway corridor with scant cultural, natural, aesthetic and recreational usefulness to the State Park System. Opportunities for on-site mitigation necessary to the public for the loss of this resource are limited by the property's fragmentation resulting from project development and environmental constraints. Following review, a team of park and resource professionals recommend that if subunit #1 is used for the Foothill Transportation Corridor-South, the majority of the inland portion of San Onofre State Beach be relinquished to the underlying property holder, and substantial mitigation in the form of real property, cash and recreational related development be required from the developer and dedicated to the California Department of Parks and Recreation prior to commencement of construction.

Background

San Onofre State Beach: San Onofre State Beach (SOSB) is located within coastal San Diego County at the Orange County line. All but 90 of SOSB's 2028.8 acres are leased from Marine Corps Base Camp Pendleton, under an agreement which will expire in August 2021.[1]

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[1]The granting of right-of-way for the use of a portion of San Onofre State Beach is governed by Section C of the general provisions of lease entered into by the Department of the Navy and California State Parks. Section C (Subjection to Existing and Future Easements and Rights of Way) reads, in part:

> "This lease is subject to all outstanding easements and rights of way for location of any type of facility over, across, in and upon the leased property, or any portion thereof, and to the right of the government, after consultation with lessee as to location, to grant such additional easements and rights of way over, across, in and upon the leased property as it shall determine to be in the public interest; provided, that any such additional easement or right of way shall be located so as not to unreasonably interfere with the use of lessee's improvements erected on the leased property; and provided, further, that any such additional easement or right of way shall be conditioned on the assumption by the grantee thereof of liability to lessee for such damages as lessee shall suffer for property destroyed or property rendered unusable on account of grantee's exercise of its rights thereunder."

The four subunits (three coastal properties with 4.6 miles of beach and an inland parcel of 1182.7 acres) make available to the public the natural beach, bluffs, and related geological, ecological and cultural features of the site and provide for the enjoyment and use of these areas in ways that take advantage of the recreational opportunities while protecting the natural and cultural values of the park. With 1,115,631 visitors in 1995/96, SOSB was the 10th most visited park in California's 264 unit State Park System. Camp Pendleton's twenty miles of coastline represent the largest open space south of Los Angeles. SOSB is the only small portion of the Marine Corps base open to the public. It is generally acknowledged that SOSB's largest parcel, Subunit #1, contains the last remaining undeveloped coastal canyon available for recreational use south of Crystal Cove State Park. Currently, park development includes 382 campsites (221 in subunit #4 and 161 in Subunit #1's San Mateo Campground), 11.3 miles of trail, 6.3 miles of bikeway, parking for 110 cars in a lot supporting the trail to "Trestles" and an amphitheater seating about 100 persons adjacent to and west of the San Mateo Campground.

Spirit of Place: Spirit of place is the distinctive character that a site possesses; this includes all of the elements that determine the uniqueness of its landscape, resources, development, and its history. It also identifies a site's experiential essence (sensory, emotional, intellectual, and spiritual) which sets it apart from all other places. These characteristics are a part of what makes a particular site a worthwhile park unit.

San Onofre State Beach is one of the last remnants of large coastal open space in Southern California. Sea and sky, surf and reef, beach and coastal bluff, wetland and grassland, sycamore groves and scrub, hillsides and arroyos, long coastal strip and broad coastal valley: all are a part of what San Onofre State Beach is. All of this is inhabited with wildlife that make this place vibrant with life. This uniqueness provides to those who visit the park an indispensable respite from the nearby expanding regional urban environment. The quiet rural calm of the valley provides a dramatic counterpoint to the din and urgency of nearby contemporary urban existence. Experiencing the broad natural expanses of San Mateo Valley, the coastline, and the sea reinvigorates the senses and renews the spirit.

The unique coastal conditions at Trestles provide a world renowned surfing experience that cannot be found anywhere else. The long approach walk from a highly urbanized area to the beach through a relatively unspoiled wetlands area provides a sense of transition not experienced at other surfing beaches. The quality, variety, and year round availability of multiple surf breaks helped establish surfing as a recreation, a lifestyle, a culture, and a part of Southern California's identity. It continues to draw thousands to Trestles each year. Trestles is such a vital surfing experience that for many, it is the paragon of surfing destinations and each visit is a pilgrimage.

The existence and convenient availability of such an increasingly rare resource and experience to such a large population makes it essential that the integrity and spirit of place of San Onofre State Beach be preserved. Furthermore, the affordability of this coastal resource for middle and lower income visitors makes it even more important that it be kept

intact and undiminished. As coastal areas in the region continue to become more affluent, the value of this park's resources and affordable recreation opportunities to those of low and moderate income means will also continue to increase.

The Project: The Foothill Transportation Corridor-South (FTC-S) is one of three existing or proposed Orange County toll roads. The subject section will start at I-5 approximately .85 miles north of the San Onofre Nuclear Generation Station and extend through the foothills of the southeastern portion of Orange County where it will connect with an existing segment. Two primary alignments for the FTC-S are under consideration, but only the "CP" alignment traverses state park lands and thus needs to be considered.

The Impact: The CP alignment would be an initial four-lane, and ultimately six-lane arterial, leaving I-5 and turning north through Subunit #1 and exiting approximately four miles later. The wide center median will be able to accommodate a future transit/high occupant vehicle land (HOV) corridor development. In this distance, a total of 323.1 acres (24.5%) of the subunit would be preempted for construction and dedicated right-of-way, while an additional 63 acres would be temporarily lost during construction. Bifurcation of the subunit results in areas of 480 acres on the west and 609 acres on the east. In actuality, the western remainder is effectively further subdivided by the right-of-way and steep topography into northern and southern parcels of 246 and 234 acres respectively. In a similar manner, the existing San Mateo Campground is isolated from the remainder of the eastern remainder. In summary, four distinct and isolated parcels will result from the construction of the FTC-S as proposed. (See Figure 1, Current Land Use & FTC-South right-of-way.)

This proposal will have both direct and indirect impacts to existing and proposed recreational facilities and park resources as enumerated on the accompanying Appendix B and in the Department of Parks and Recreation's comments on the Screen Draft, Foothill Corridor 4(f) Evaluation of February 20, 1997.

Scope of Work

This evaluation of impacts to SOSB of the Foothill Transportation Corridor is prepared under contract number C9617003 with the Foothill/Eastern Transportation Corridor Agency. Under this contract, California Department of Parks and Recreation (CDPR) is to evaluate the impacts to recreation, cultural, natural, and aesthetic resources, the amount of state park lands directly and indirectly lost as a result of the project, and determine the compensation for the identified impacts. A draft evaluation was prepared and submitted May 16. Under the original contract with the Foothill/Eastern Transportation Corridor Agencies, a final draft was to be prepared by June 18, 1997. However, following consultation initiated by the Agencies, it was agreed to set this deadline back to August 29 of this year.

FIGURE 1

CURRENT LAND USE & FTC SOUTH RIGHT-OF-WAY

SCALE IN FEET

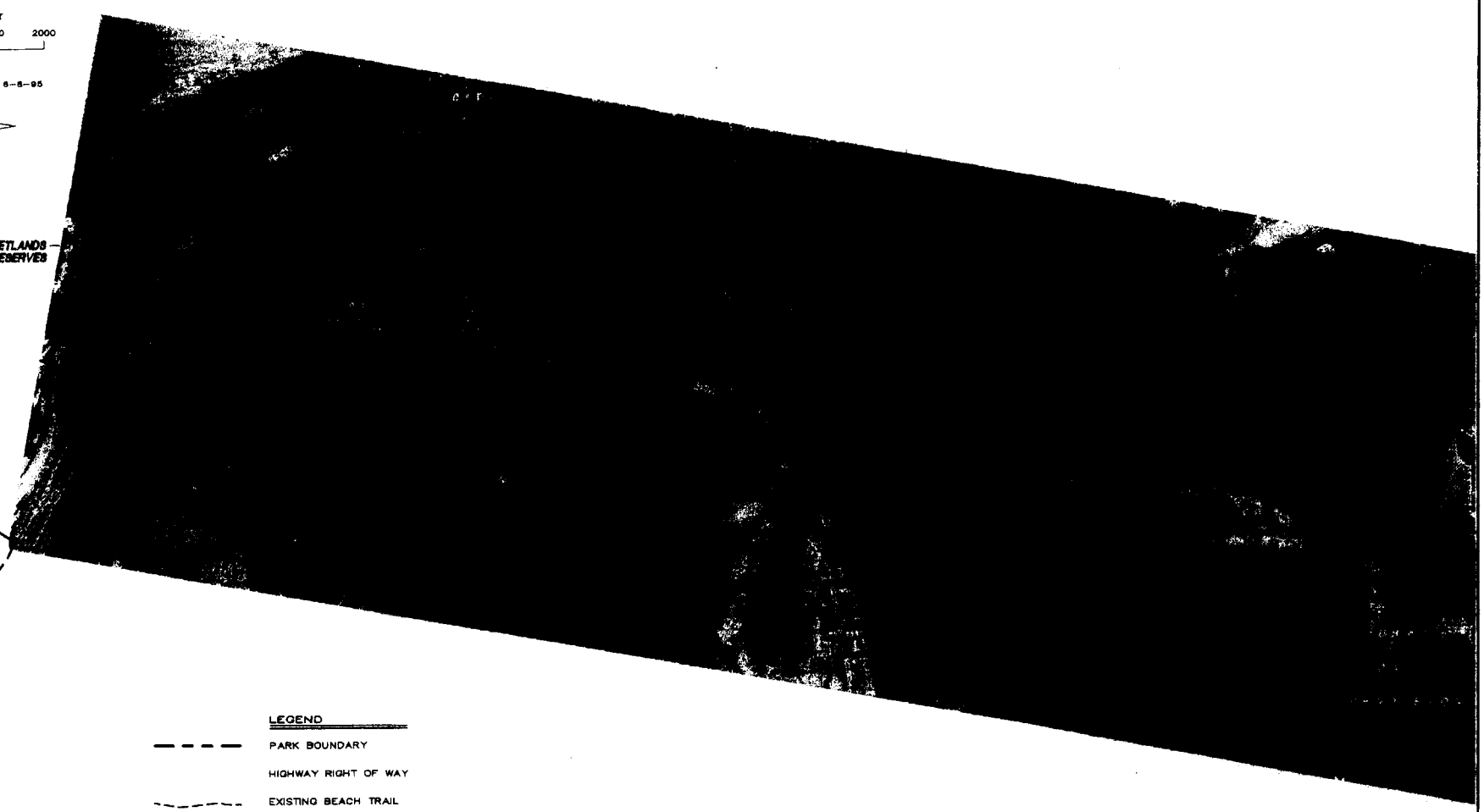
1000 0 1000 2000

AERIAL PHOTO TAKEN 6-6-95

N

TRESTLES WETLANDS NATURAL PRESERVES

SUBUNIT 13



LEGEND

PARK BOUNDARY

HIGHWAY RIGHT OF WAY

EXISTING BEACH TRAIL

path: H:\DATA\SPATIAL\925\663\ACAD\FTCPHOTO.DWG

Methodology

To fulfill the obligations of the contract, CDPR assembled a team consisting of the Chief Ranger and a Resource Ecologist from Orange Coast District, a Landscape Architect from CDPR's Planning, Acquisition and Environmental Design Division, and an Archeologist from the Department's Resource Management Division, under the leadership of a Park and Recreation Specialist who was also provided by the Resource Management Division. The assistance of an environmental acoustics specialist was provided by the FTC-S under separate contract. Additional graphic and property consultation assistance was provided by CDPR's Planning, Acquisition and Environmental Design Division, while a State Park Land Officer from the Department's Southern Service Center provided insight based upon his project experience.

Project descriptions and other background materials were provided to the San Onofre Mitigation Assessment Team (SOMAT) upon its formation and following draft review by the Transportation Corridor Agencies. A number of SOMAT members were already familiar with the project due to their early involvement in the planning, project and environmental review process. SOMAT focus was concentrated upon the proposed "CP" alignment through SOSB subunits #1 and #2 because of its direct impact to those areas. SOMAT initially met and toured the project site in mid-March. Additional site visits were made by individual team members during the preparation of this assessment. Subsequently, through the use of brainstorming techniques, impacts were identified and described. Needs for additional information were also identified and sought or developed. Through the SOMAT meetings which followed, alternative potential mitigations were developed, analyzed and discussed. This information was reduced to a matrix format for management and is presented for information purposes as Appendix B[2]. A consensus recommendation was then developed by SOMAT and presented as the "Draft Mitigation Assessment of FTC Impacts on San Onofre State Beach". Following a review of this draft by representatives of the Foothill/Eastern Transportation Corridor Agencies, clarifying revisions were prepared by the SOMAT Team Leader and presented to the Management of CDPR. Based upon their decisions final revisions were made and presented as "Mitigation Assessment of FTC-South on San Onofre State Beach" in fulfillment of CDPR's contract with the Foothill/Eastern Transportation Corridor Agencies.

Analysis

Units #1 and #2 of SOSB are popular and intensively used park units averaging approximately 354,000 visitors annually over the past four years. In a rapidly urbanizing environment, they offer a unique combination of recreational opportunities and connection between direct coastal activities and large open space inland areas. There is a strong sense of ownership and emotional connection by the users, especially the surfing community. The public awareness of the inland Subunit #1 is continuing to grow, especially with the establishment in 1991 of the San Mateo Campground and its subsequent popularity. This

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[2]Appendix B is presented for information and background purposes, and does not represent the final recommendation of this evaluation.

subunit's potential has clearly not been fully realized. CDPR's *Revised General Plan for the San Onofre State Beach*, adopted in 1984, provides for not only the existing 161 unit San Mateo Campground with its amphitheater and trail to Trestles, but a golf course, a picnic area, a second family campground of about 150 to 200 sites, an interpretive site, an equestrian camp and seven primitive or environmental camp areas of up to 20 sites each. The golf course and the equestrian camp have been proposed for development but have not been authorized, in part due to the uncertainty of the FTC-S right-of-way choice. (See Figure 2, General Plan Land Use & FTC-South right-of-way.)

As currently proposed, the CP alignment will take 24.5% of Subunit #1, with an additional 5.18% to be directly impacted during the construction phase. In the opinion of CDPR, the fragmentation of Subunit #1 by the proposed highway corridor will severely restrict the use of the property for recreation purposes, as well as significantly and irrevocably altering its environmental setting, that of San Mateo Campground, and other recreational opportunities provided for in the unit's General Plan. The linear nature and split elevation of the arterial and any retaining walls, soundwalls and their landscaping will reduce the site's attractiveness to the public, as well as being a wildlife barrier and a management obstacle. These unnatural and discordant visual elements will intrude upon previously open vistas, high volume noise will impose on normal recreation activities, day activities at the campground as well as its existing night quiet, and the amphitheater campfire area will be forever altered and rendered unusable[3]. In addition, recent redesign of the Basilone Road intersection may indicate the use of a portion of the approximately 90 acres of land held in fee by CDPR and consequent use of that property as a bikeway.

In summary, the irrevocable alteration of the setting of Subunit #1, and the elevated "flyway" at Basilone Road intersection to portions of subunit #2, significantly reduce their value as parkland. Potential activities such as environmental and equestrian camping may no longer be feasible uses. Elimination of the sewer station, water supply facility, electrical and telephone services, trailer pump-out holding tank, and corporation yard creates relocation problems which perhaps cannot be resolved on site. Any mitigation proposed on site requires environmental review and concurrence of the lessor and may not be predictably feasible.

SOMAT concluded that the CP alignment will result in a take of the functional use of the majority of Subunit #1 of SOSB and may have significant direct or indirect impacts to park wetland, access and visual resources of Subunit #2.

Limitations to Mitigation

CDPR expects to be made whole from the effects of development of FTC-South. To CDPR, this means the provision of viable replacement and mitigation of recreationally related natural, cultural, and aesthetic values and from the loss of existing facilities and any

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[3]Appendix C-1 presents a photo simulation of the impacts of selected portions of the proposed toll road and Appendix C-2 presents a noise analysis from key locations within San Onofre State Beach, which we believe supports the conclusions of this paragraph.

planned recreational uses[4] Physical mitigations must be in keeping with the existing unit, designed to serve similar user groups, and must be in place prior to the commencement of any tollway construction. It is recognized that the recommendations developed by SOMAT for mitigation are limited by a number of factors. For instance,portions of the analysis are based upon materials supplied by TCA. Design is an on-going process and changes may affect CDPR's recommendation. Secondly, it must be borne in mind that there may well be unforeseen limiting environmental or regulatory factors which could preclude the implementation of certain recommendations. Thirdly, any on-site or near-site mitigation alternative may be limited by decisions of the lessor. Representatives of the lessor have stated upon numerous occasions, as well as in writing, that any environmental mitigation for FTC-S must be accomplished with no new dedication of Camp Pendleton property and that there must be no intrusion on Camp Pendleton's operational flexibility. So, while CDPR recommends the following mitigations in good faith, it can provide no assurance that the lessor will allow all mitigations to proceed, or that all mitigations can be found acceptable by regulatory agencies. Nonetheless, it is CDPR's position that these limitations do not relieve FTC-S of timely mitigation responsibility for all losses incurred by CDPR.

Recommendation

In the event that an alignment through SOSB is selected, CDPR believes that the following mitigation for the recreationally related natural, cultural, and aesthetic impacts, as well as for the loss of the use of recreation facilities and opportunities at SOSB, should be provided by FTC-S based on plans submitted to date.

With the exception of the support parking for the trail to Trestles, all of Subunit #1 be abandoned to the lessor. [This shall require amendment and extension of the current lease.] As mitigation for this action FTC-S should provide, to the satisfaction of CDPR:

1. Full reimbursement for lease renegotiation and the difference to any change of the lease rate.

2. Monetary compensation to CDPR for revenues lost during construction due to closure or disruption of CDPR facilities. Cash to CDPR for revenues lost during the remaining period of the lease for those facilities which cannot be relocated, resited, or used.

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[4]It is the understanding of CDPR that Section 4(f) protects any planned recreational uses. Paragraph (p)(2) states that

> "Constructive use occurs when the transportation project does not incorporate land from a section 4(f) resource, but the project's proximity impacts are so severe that the protected activities, features, or attributes that qualify a resource for protection under section 4(f) are substantially impacted."

This interpretation is bolstered by the analysis of impacts to the Prima Deshecha Landfill resulting from the BX alternative which is addressed in *Screen Draft, Foothill Corridor 4(f) Evaluation*. Although this site is currently operating as a landfill and its use for recreation purposes <u>will not</u> occur for 14 to 39 or more years, its planned recreational uses appear to be given equal weight as the actual recreational uses at SOSB.

3. If necessary due to closure during construction, provide shuttle service from San Mateo Campground and Trestles parking to Trestles Beach.

4. Fund CDPR for restoration to a natural state of the existing recreational facility sites located at Subunit #1.

5. Fund CDPR for inventory and recordation of affected historic structures at San Clemente State Beach. Relocation of structures shall be fully funded.

6. Restoration and redevelopment of CDPR's San Clemente State Beach property with an additional 70 unit R.V. campground with hookups and mature landscaping, coastal access point, 110 seat amphitheater, and soundwall, to partially replace San Mateo Campground.

7. Fund acquisition and conversion of other property in Orange County for Orange Coast District Offices to replace the corporation yard, office space and residential units to be relocated from San Clemente due to conversion of site to additional campground units.

8. Upgrade existing San Onofre State Beach Bluffs Campground (Subunit #4) and add an additional 30 full hook-up campsites to partially replace San Mateo Campground.

9. Acquire for dedication to CDPR, State Park quality coastal and inland sites of sufficient size, within the region, and in the opinion of CDPR, of sufficient potential to replace the recreational values of Subunit #1 and to support:

   - The remaining 61 campground units of the total 161 campsites lost at San Mateo Campground,
   - The 150 to 200 campsites proposed at the second family campground,
   - Seven environmental campgrounds of no less than 20 sites each, and
   - A 25-unit family equestrian camp.

   Preliminary areas of interest shall be mutually determined in advance by TCA and CDPR.

   The acquired sites shall be fully developed for the above described uses to CDPR standards and satisfaction prior to commencement of FTC-S construction.

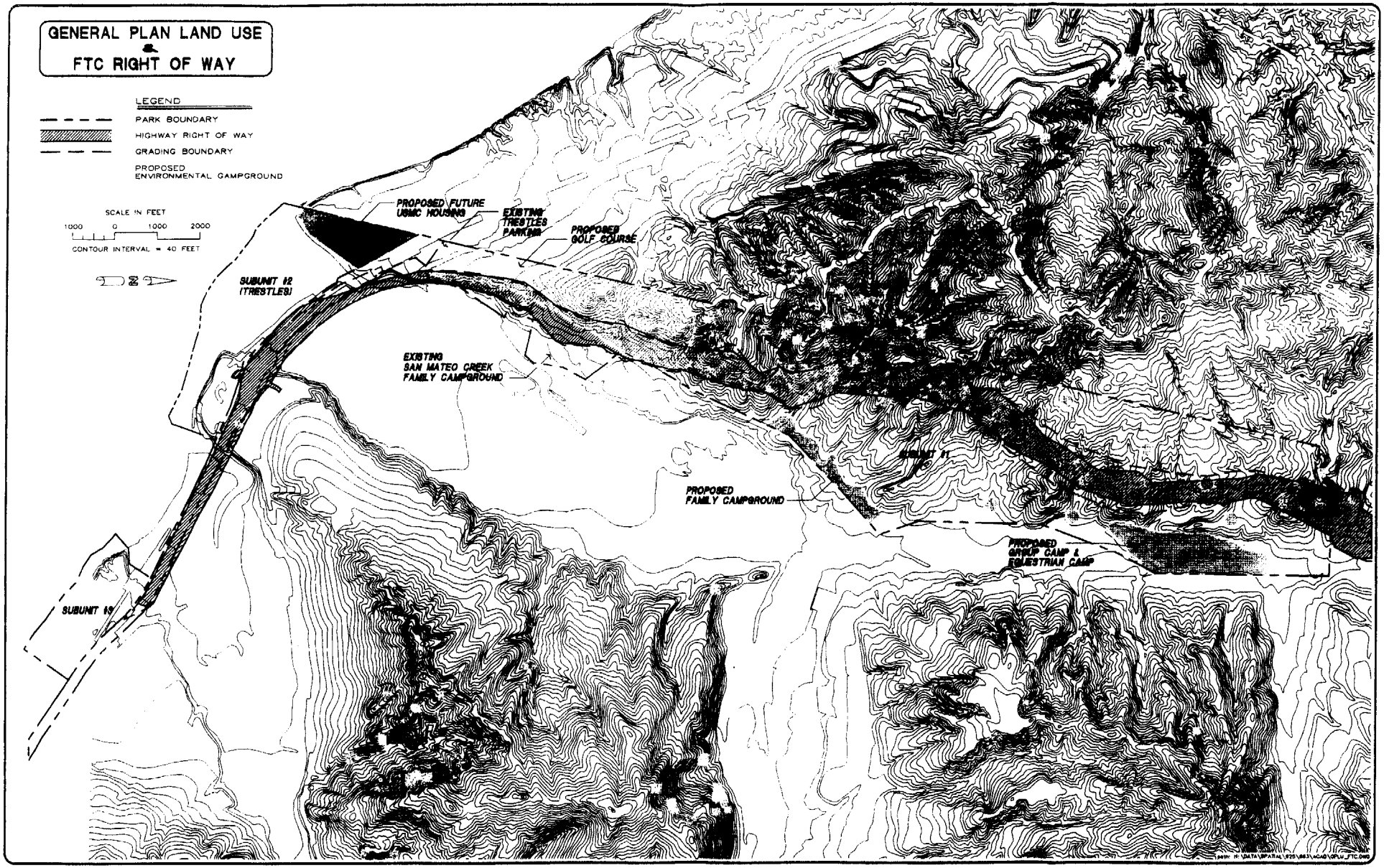
10. Funding for CDPR's preparation of Resource Inventory, General Plan and Management Plan documents on all proposed replacement sites.

11. Full reimbursement for all necessary plans, permits, and associated CDPR staff time.

12. Full market value for real property loss for Basilone Road Intersection and relocation within CDPR ownership of the Class One bikeway.

13. In order to protect the wetland resource of Subunit #2 require best management practices to reduce erosion during construction, including sedimentation basins and their annual maintenance for the life of the development.

14. Redesign and construct I-5 exchange to eliminate the visual impact of the flyover to Trestles.


GENERAL PLAN LAND USE
FTC RIGHT OF WAY
LEGEND
PARK BOUNDARY
HIGHWAY RIGHT OF WAY
GRADING BOUNDARY
PROPOSED ENVIRONMENTAL CAMPGROUND
SCALE IN FEET
1000 0 1000 2000
CONTOUR INTERVAL = 40 FEET
N
PROPOSED FUTURE USMC HOUSING
EXISTING TRESTLES PARKING
PROPOSED GOLF COURSE
SUBUNIT #2 (TRESTLES)
EXISTING SAN MATEO CREEK FAMILY CAMPGROUND
PROPOSED FAMILY CAMPGROUND
PROPOSED GROUP CAMP & EQUESTRIAN CAMP
SUBUNIT #3

APPENDIX A
SAN ONOFRE STATE BEACH
SPIRIT OF PLACE

Spirit of place is a consideration which contributes to determining a specific areas value as parkland, in this instance, Parcel 1 and the beach at Trestles at San Onofre State Beach. Spirit of Place is a term that identifies the intrinsic values that pertain to the essential and inherent nature of a place -- aspects that are not necessarily defined by law, science, or economics. It identifies a site's unique experiential essence (sensory, emotional, intellectual, and spiritual) which sets it apart from all other places. Spirit of Place describes the distinctive characteristics that a site possesses; this includes the elements that determine this uniqueness of its landscape, resources, development, and its history. These characteristics are part of what makes a particular site a worthwhile park unit. Components of this site's identity include:

- Physical features and appearance
  Consists of the actual physical structure, characteristics, and all visible features of a place. This includes physiography, natural features, cultural features, land use, development intensities, visual quality, community character, climate, seasonal changes, etc.
- Observable activities, functions, and events
  How inhabitants or visitors interact with a space, i.e. how the landscape, coast, and the built environment are occupied or used (activity levels and use intensities). This can also include resource activities or events such as whale or bird migrations.
- Meanings and symbols
  Concept of place as a cultural artifact (a place's meaning or value beyond its physical elements. An example would be Trestles Beach's value to the surfing community and its worldwide renown as one of Southern California's premier surfing locations and role in surfing history.) This includes people's experiential responses (emotions, feelings, and physical/intellectual stimulation) when they visit San Onofre State Beach, and what they later remember about their visit.

Further definition of San Onofre State Beach's Spirit of Place includes an understanding of what the site was in the past, what it is now, what it will be in the future, and what it should be.

What it was

Physical features and appearance

- Entire area was rural open space.
- The only development was the railroad tracks and a small community around a railroad stop at San Onofre. This development served as a bedroom community for the surrounding area.

Observable activities, functions, and events

- Area was once a Juaneno village site.
- Area has been sparsely populated, small agricultural and railroad station communities.
- Surfing activity became established in the 1930s and grew steadily up to the late 1950s. During the 1960s, surfing experienced a tremendous growth in popularity due to exposure in media and popular culture (movies, music, and television).

Meanings and symbols

- Former Juaneno village and cemetery site.
- Once part of Rancho Santa Margarita y Las Flores.
- Formerly an agricultural region.
- Surfing activities at this location, beginning in the 1930s, helped establish surfing as a significant recreation, lifestyle, and culture identified with Southern California.
- Due to the quality and variety of surfing experience found at Trestles and San Onofre, this area has developed a worldwide reputation as a premier surfing destination. It is regarded as one of the top three surfing locations along the entire west coast.

What it is

San Onofre State Beach is a popular and intensely used Southern California coastal park unit. Its popularity is due in part to its quiet rural coastal open space character which is accessible to a large urban population. In addition, San Onofre State Beach's natural resources, cultural resources, recreation opportunities, and its importance as a cultural focal point for the surfing community, make San Onofre State Beach an increasingly vital public part of Southern California's coastline. There is a strong sense of ownership and emotional connection by its users. The emotional connection to the beach at Trestles by the surfing community is especially strong. The public awareness and popularity of the inland Subunit #1 is continuing to grow, but the area's full recreational potential has not been realized.

The park is currently confronted with conditions, issues, and problems associated with preserving its open space character and resources; a proposed toll road bisecting and fragmenting the inland Subunit #1; the pressures of adjacent regional urban growth; and preserving and enhancing the quality of the recreation experience. The contemporary issues of regional transportation, regional urban growth, recreation needs, and limited operations resources are cumulatively eroding the quality of visitor experience and the park's spirit of place.

Physical features and appearance

- Lack of urban development, including major roadways.
- One of the last rural coastal canyons in Southern California.
- Large quiet rural/natural open space landscape in Parcel 1 and surrounding region. Large open space panorama views up San Mateo Canyon and conversely out to the ocean are prominent features.

- Subunit #1 provides a large public open space connection to the coast for adjacent inland open space areas.
- San Mateo Campground (good facilities and services).
- Native American religious site is located at the south end of the San Mateo Campground.
- Coastal trail access connection between San Mateo Campground and Trestles Beach.
- Trestles Beach.
- Significant wetlands near Trestles Beach.
- Existing highway and railroad tracks.
- Park corporation yard is located in Parcel #1.
- Agricultural lease lands along San Mateo Creek.
- Generally low ambient noise, except for USMC exercises.
- Numerous overhead power transmission lines cross the property.
- City of San Clemente is located to the west; Marine Corps Camp Pendleton is located to the east.

Observable activities, functions, and events

- Family and group camping at San Mateo Campground.
- Interpretive programs at campfire center in campground.
- Coastal trail access activity between inland area and the beach.
- World class surfing at Trestles Beach.
- Conventional beach recreation along San Onofre coastal areas.
- USMC aircraft participating in training exercises.
- USMC live fire exercises within Camp Pendleton are audible in San Onofre State Beach
- Offshore seasonal grey whale migrations.

Meanings and symbols

- San Onofre State Beach and Camp Pendleton coast comprise one of the last few remnants of coastal rural open space left in Southern California.
- San Mateo Canyon is the last remaining undeveloped coastal canyon south of Crystal Cove State Park available for public recreational use
- Rural camping experience is available and close to the large Southern California urban population.
- Trestles Beach is an important and integral part of the regional surfing community. It is a surfing destination and focal point for surf culture.
- Coastal trail access walk is considered part of Trestles Beach surfing experience.
- Park provides respite from urban environment.

What it will be

San Onofre State Beach will continue to be a popular park because of its location on the Southern California coastline and the coastal recreation opportunities it offers. Current

regional urbanization trends, however, will diminish the existing spirit of place and rural character of the park. The inland Subunit #1 will change from a quiet rural destination park area to a busy scenic highway corridor. Regional urbanization trends and continuing recreation demand will increase visitation to levels that will stress park resources and diminish the quality of park visitor experience.

Physical features and appearance

- New eight-lane toll road will bisect Subunit #1 and fragment that area's integrity as a viable park area.
- Elevated road fill section (Christianitos Road) will be developed adjacent to campground. Large highway retaining wall will be included in part of the elevated road section.
- There will be higher ambient noise due to FTC-S highway traffic.
- FTC-S will fragment natural open space connection between the coast and adjacent public open space areas.

Observable activities, functions, and events

- Continuing recreation demand will exert pressure/stress on current use levels and will threaten/diminish the quality of recreation experience at San Onofre State Beach.
- Completion of the Foothill Transportation Corridor-South will increase traffic levels and associated impacts in the region. FTC-S will provide greater access to the coast and substantially increase park visitation levels.
- Development of the San Mateo Point housing project by Camp Pendleton will introduce an on-site source of new recreation users which might result in establishing a local surfing territoriality that doesn't exist there now. If this occurs, conflicts among different types of surfers or other recreation users may occur as they do now in other areas.

Meanings and symbols

- Parcel 1 is converted from a large scenic rural coastal canyon park to a scenic highway corridor.
- Parcel 1 integrity (physical configuration, habitat, recreation functions and opportunities) is fragmented.
- There will no longer be a rural camping experience at San Mateo Campground.
- The coastal trail access walk which is part of the existing surfing experience will be altered (or eliminated?).
- Trestles Beach will remain an important surfing destination, but existing experience will be degraded because of the project's alteration of the setting, and visitation increases will stress recreation carrying capacity levels.

What it should be

The future existence of San Onofre State Beach should strive to preserve its remaining rural natural open space character as much as possible, within the context of the approved or revised General Plan prepared for this unit. The expansive natural/rural open space setting within this coastal viewshed sets it apart from most other Southern California coastline areas. Visitors should be able to experience coastal recreation in a natural/rural setting as a counterpoint to commonplace daily urban life. This includes existing and proposed camping and trail recreation located in the inland San Mateo Canyon area. The qualities that make San Onofre/Trestles a premier worldwide surfing destination and vital focal point of surf culture should be recognized, respected, and preserved as an important part of Southern California's identity. Visitors should continue to be able to experience the unique surfing opportunities and the associated cultural/social activity found at this location.

Physical features and appearance

- Coastal rural viewshed should be maintained. Urban development should be minimized or screened from view.
- Inland San Mateo Valley should be maintained as rural open space linked with adjacent public regional open space areas. CP alignment should not be implemented.
- Existing habitat areas and corridors are enhanced and expanded.
- Preservation, management, interpretation, and development of the park should be completed in accordance with the revised General Plan (June 1984) for San Onofre State Beach.

Observable activities, functions, and events

- Current public recreation activities (surfing, beach recreation, coastal camping, day use access) should be allowed to continue. Do not revert to Camp Pendleton military use.
- Coastal recreation should remain at current use intensities in order to maintain or improve quality of experience.
- The surfing territoriality that exists in other coastal areas which discourages or excludes non-local recreation users should be avoided.
- Varied camping and regional trail opportunities should be fully implemented.

Meanings and symbols

- San Onofre State Beach and the surrounding area/viewshed should continue to be a remaining remnant and example of coastal rural open space that was once common in Southern California. As urbanization of most of the Southern California coastline approaches completion, the value and uniqueness of this public resource will continue to grow in importance and appreciation by the public. Over time, San Onofre State Beach's natural/rural open space setting will be an increasingly dramatic contrast/ counterpoint to the surrounding urban region.

- San Onofre coastline (Trestles) should be preserved as a world class surfing destination. It is a unique recreation resource of the entire continental west coast due to its variety (five distinct surf break experiences within one location), availability (year round surfing instead of seasonal), and quality of surfing conditions.
- Coastline and adjacent viewshed should be regarded as a cultural landscape exemplifying surfing as a unique Southern California sport, culture, and lifestyle, as well as coastal recreation in general.

APPENDIX B

FTC SOUTH CP ALIGNMENT MITIGATION MATRIX

Topic	Projected Park Impact	Potential Mitigation
VISUAL	CP will bisect Subunit #1 and irrevocably and permanently interrupt park lands setting, being the obvious structure within Subunit #1	-Provide funding to enhance existing parklands quality of Orange Coast District, commensurate with impacts -Provide for perpetual graffiti removal on structures. -Maintain coastal view from southbound I-5 exit at Basilone Road by requiring redesign of structure
	Split elevation toll road and retaining walls will be dominant visual features in Subunit #1	Depress toll road where possible; landscape sound and retaining walls with indigenous native species
	Flyway at Basilone Road will be a dominant visual feature along the Pacific Coast Highway bike trail	Relocate bike trail
	Flyway at Basilone Road will be a prominent visual feature in views from the beach to the north	This cannot be mitigated
	CP alignment will have light sources that intrude into the San Mateo campground.	-Shield all street lights so they do not enter into campground operations or effect sensitive species. -Design alignment and structures so that vehicular lights are prevented from shinning into campground.
NOISE **Short Term**	Significant construction noise	Reduce hours of construction to 7:00 am to 6:00 pm in neighborhood of Campground and use best management practices to reduce noise.
Recreation Areas	Significant additional noise on X distance of Pacific Coast Highway bike trail	Relocate bike trail
	Occasional additional noise on beach south of flyway from Basilone Road	Prohibit trucks on toll road
	Significant additional noise on main access trail to beach	Provide screening soundwall
	Significant additional noise along proposed trails in Subunit #1	Provide similar trails outside of Subunit #1
Campgrounds	Significant additional noise in San Mateo campground	Depress toll road
	Sleep interference in San Mateo campground	Depress toll road
	Speech interference in San Mateo campground outdoor amphitheater	Depress toll road
	Significant additional noise at proposed environmental camping sites	Provide similar sites outside of Subunit #1
	Sleep interference at proposed environmental camping sites	Provide similar sites outside of Subunit #1
	Significant additional noise at	Provide similar site outside of Subunit #1

Topic	Projected Park Impact	Potential Mitigation
	sycamore grove at N. end of Subunit #1	
	Sleep interference at proposed camping sites in sycamore grove	Provide similar site outside of Subunit #1
Wildlife	Increased levels of noise will impact wildlife in open space areas.	Provide replacement area;
NATURAL RESOURCES		
Wildlife	Loss of native migrants, endemics and sensitive species protected by Endangered Species Act, from take and surrounding buffer areas.	-Restore X acres in 2:1 habitat mitigation ratio to provide for upland species use, exotic species removal, habitat, restoration. Fund maintenance program -Provide wildlife crossings at each major drainage (minimum of 6) of sufficient size to accommodate service vehicles and equestrians -Provide an endowment for cowbird trapping.
Plants	Loss of 387 acres of high and low quality Coastal Sage Scrub habitat, and listed rare plants.	-Restore X acres in 2:1 habitat mitigation ratio to provide for upland species use. -Relocate rare plants into suitable locations at a 3:1 ratio and provide for long term protection. -If San Mateo Campground closed, relocate major vegetation to mitigation site at San Clemente
	CP alignment enhances the spread of exotic plant species.	-Provide annual exotic weed control for a 1/2 mile both sides of alignment and through downstream wetlands. -Allow no exotic plant species into restoration plant palettes.
Aquifer	CP alignment will change runoff quality and quantity from project footprint and resultant traffic pollutants and hazmat spills.	-Use best practices to protect the San Mateo/Cristianitos Creek Aquifer from degradation by roadway pollutants and hazmat spills. -Provide clean water on base and elsewhere when aquifer becomes unusable by CP.
Sedimentation	During construction and over the life of the project, changed sedimentation rates will negatively affect the watershed.	-Measure sedimentation transport rate increases and remove excess CP generated material from system. -Long term monitoring of the tidewater goby, arroyo toad, least Bell's vireo, southwest willow flycatcher, Riverside fairy shrimp, California gnatcatcher, and Pacific pocket mouse. -Provide sediment basins and maintenance for maximum storm water management assurance for anticipated 100 year storm water and erosion events. -Provide watershed improvements if sediment changes are significant.
	CP alignment will increase flood stage erosion impacts to existing features.	-Protect streambanks from accelerated erosion episodes. -Maintain at CP design levels focused erosion from culverts, drains, and undercrossings. -Provide sediment basins and maintenance. -Prevent accelerated head-cutting from CP runoff in all drainages large and small.
	Trestles surf breaks will be silted- in	Current sediment transport rates need to be measured

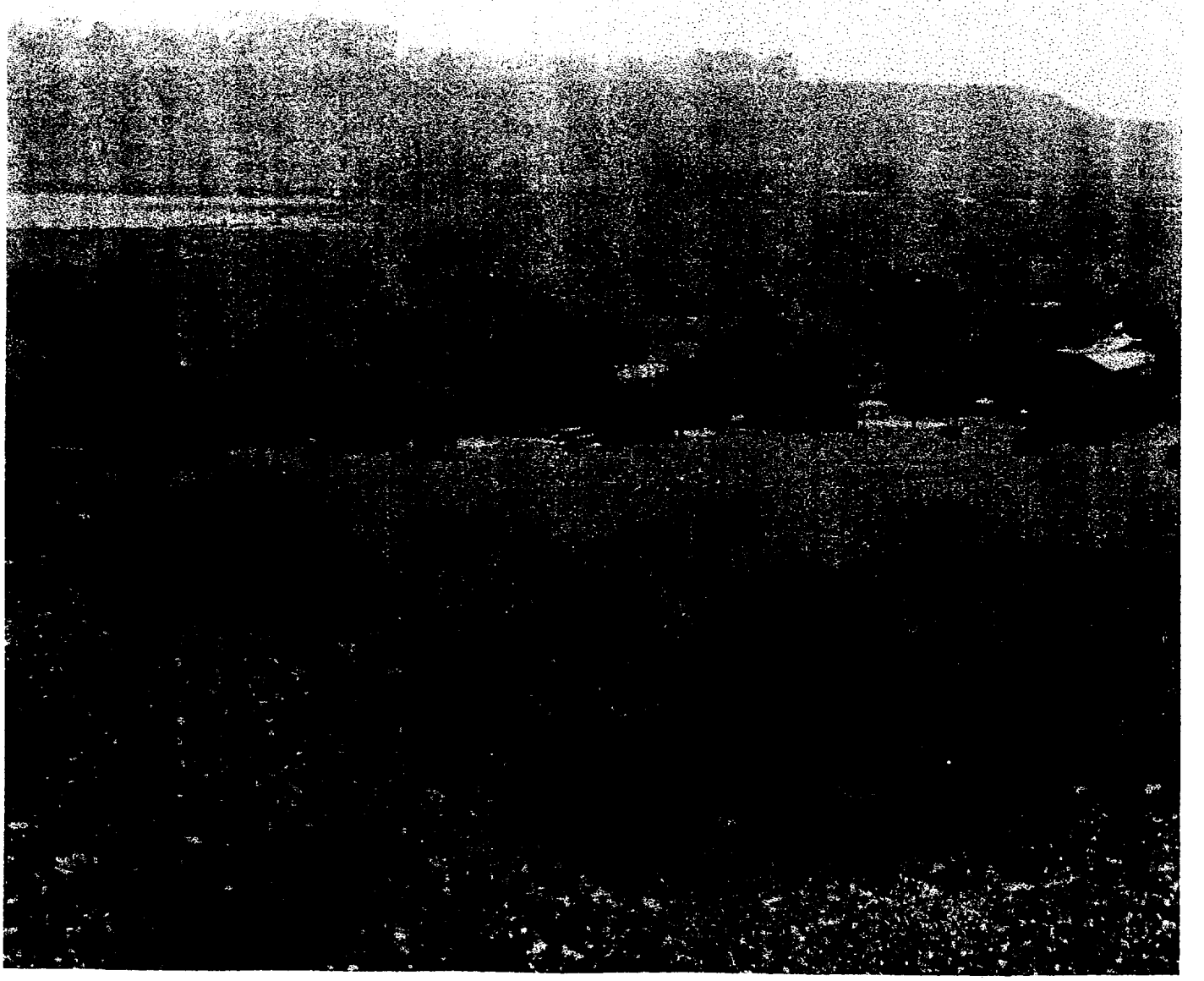
Topic	Projected Park Impact	Potential Mitigation
	and recreational opportunity degraded.	and best management practices employed. Retention basins may be constructed but must be cleared to maintain background flow rates.
CULTURAL	Removal of intact portion of SMAD NR, coastal Juaneno village of *Panhe*	Relocate road alignment further east.
	Impacts to SDI-1075: site of *Hechmai*	-Fund response team to monitor impacts. -Fund full recovery of discovered material
	Direct impact to site of Forster	Fund response team to monitor impacts. Fund for recovery
	Direct impact to Historic El Camino Real	Relocate CP alignment further to the east.
	Indirect impact to "Trestles" surfing beach	As an historic landscape, this cannot be mitigated
OPERATIONAL IMPACTS **Beach Access** Short term	CP Alignment may cause temporary closure of beach access trail from San Mateo Campground and severely impact access from Trestles parking lot.	Maintain beach access from trestles parking lot during construction and improve pedestrian access to Trestles Beach..
Long term	CP Alignment may reroute beach access trail from San Mateo Campground and severely impact access from Trestles Parking lot.	-Construct multi-use trails from campground to beach and regional inland trails. -Reimburse for necessary lease changes -Construct pedestrian overpass connecting Trestles parking to subunit #2
Other Trails	Of 11.5 miles of existing trails in subunit #1, 1.5 will be lost to alignment.	Replace trails and provide undercrossing connectors
Interpretive	CP alignment will cause direct loss of interpretive opportunities and natural area for use in Subunit #1.	-Replace and improve existing nature trail that starts at the San Mateo Campground. -Provide for development of interpretive programs and structures in the local district operation.
Fire Protection & Public Safety	CP alignment will bisect Subunit #1, preventing current fire protection and patrol activities	-Redesign fire and patrol roads and ensure access to both sides of CP alignment to allow efficient management of property. -Improve coastal trails at San Onofre SB to compensate for lost trail access during development.
Barriers	CP alignment within Subunit #1 creates a potential safety hazard.	-Indemnify DPR from injury to park users caused by CP alignment. -Install and maintain right of way with minimum 6 ft high fencing on both sides of corridor.

Issue	Projected Park Impact	Potential Mitigation
Campground Entrance	Christianitos Road realignment will require modification of existing entrance connection at San Mateo Campground. This raises a safety problem due to decreased sight distances and decelerating traffic.	-If San Mateo Campground is retained, modify (geometrics, elevation, & grade) campground entrance road to match new Christianitos Road alignment. -Provide adequate acceleration-deceleration lanes to allow for sufficient "stack up" space and safe traffic turning movement. -Require traffic signal -Provide new directional signing on tollway and I-5.
Trailer sanitation station	CP alignment eliminates existing trailer sanitation	Identify location; relocate and replace trailer sanitation station for existing San Mateo Campground location.
Operations storage area	CP alignment eliminates existing operations storage area in Subunit #1.	Improve and expand existing Subunit #3 operations and storage area. Improvements to include: vehicle & equipment storage building, vehicle wash down area, paving, security lighting, landscaping, office area and security fencing with gate.
Utilities	CP alignment eliminates utilities for the San Mateo Campground.	Relocate and replace sewer pump station, water supply lines and all other utilities for San Mateo Campground.
Security	Fragmentation of Subunit #1 by CP alignment will make operations patrols and park protection from trespass, illegal dumping and other resource damage very difficult to contain on west and north boundaries.	Install and maintain 5 miles of 6 ft. high steel mesh fencing along west and north boundary of subunits #1 and west boundary of #2 , including a total of 6 gates for operations access points
Fugitive Dust	Particularly during construction phases, impacts to campers, recreational users, and operations	Use best practices to eliminate fugitive dust.
REVENUE LOSSES **Short term**	Construction and its impacts cause reduced Campground use and closure periodically over 3 to 5 years results in lost revenue.	Full reimbursement during closure and pro-rata revenue for reduced use until opening of new campground.
	Curtailment of special events and recreation camps during construction results in lost revenue.	Reimbursement until opening of new campground.
Long Term	Proposed CP alignment takes land dedicated for existing and future recreation facilities.	-Negotiate 50 year lease extension -Revise San Onofre General Plan.
Campgrounds	Closure of existing San Mateo Campground & amphitheater	-Reconstruct campground facilities including amphitheater and construct soundwall at San Clemente. Second family campground and equestrian facilities to be developed on new with environmental campsites and linked trail system to coast and regional trails -Relocate San Clement administrative and operation facilities to south-central Orange County

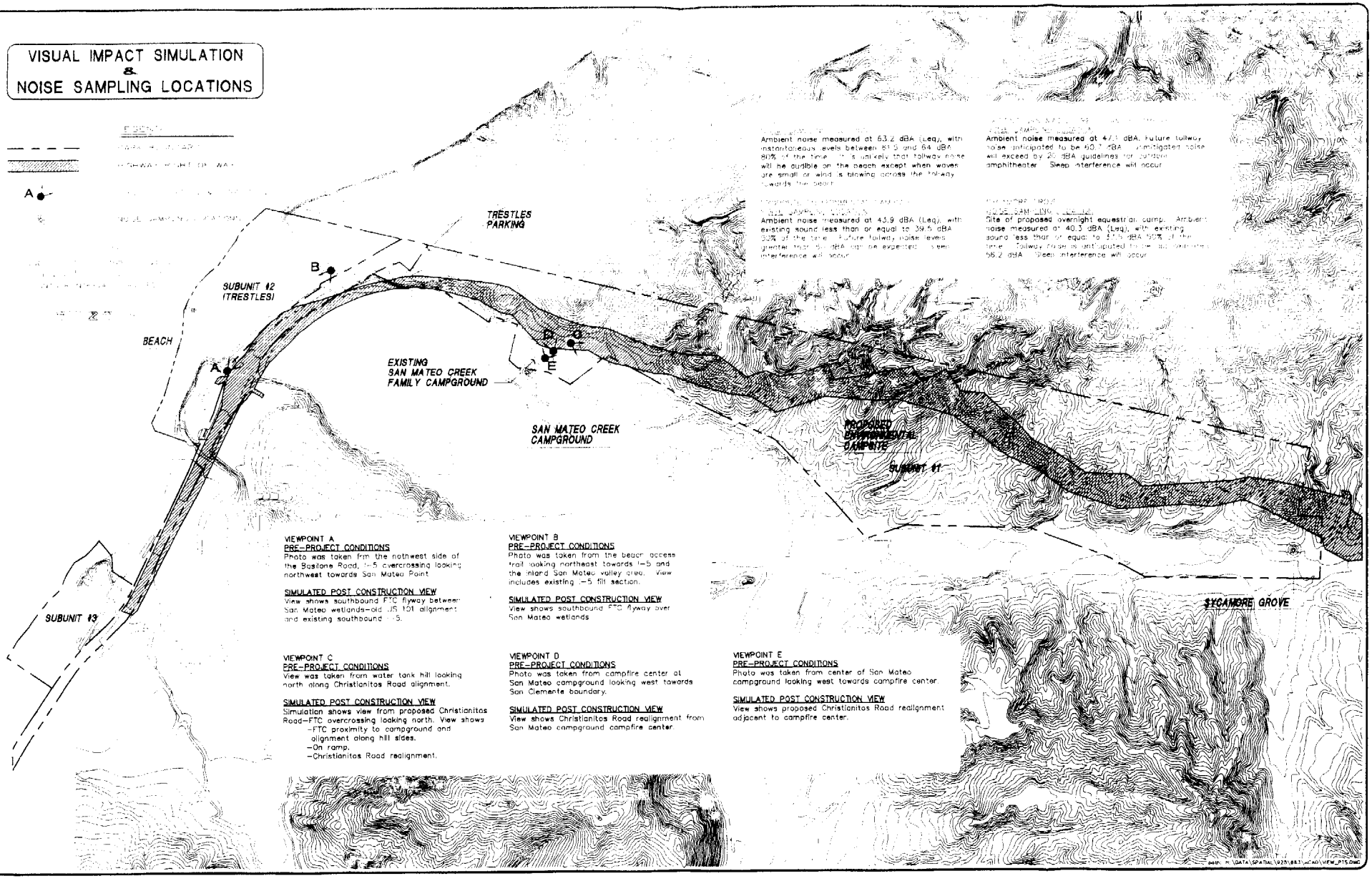
Topic	Projected Park Impact	Potential Mitigation
Future family Campground	General Plan identifies a second family campground north of the existing San Mateo Campground. CP alignment impacts rural setting.	Develop equestrian facilities environmental campsites and linked trail system to coast with regional trails from new acquisition.
Future Environmental Campground	Loss of potential of environmental campsites on Subunit #1 results in lost recreation opportunity and revenues and destroys quiet rural setting.	Develop environmental campsites at new acquisition.
Future Equestrian / group camp	General Plan identifies a Group Camp and an Equestrian Camp at the far north end of Subunit #1. CP alignment impacts rural setting.	Develop Group and Equestrian Facilities new acquisition site along with connections to future regional trails
	CP alignment will prevent development of golf course on Subunit #1 resulting in lost recreational opportunities and concession revenues.	Provide recreational improvements and new facilities, such as visitor center, historical structure improvements, amphitheater center and group picnic facilities at San Clemente State Beach.

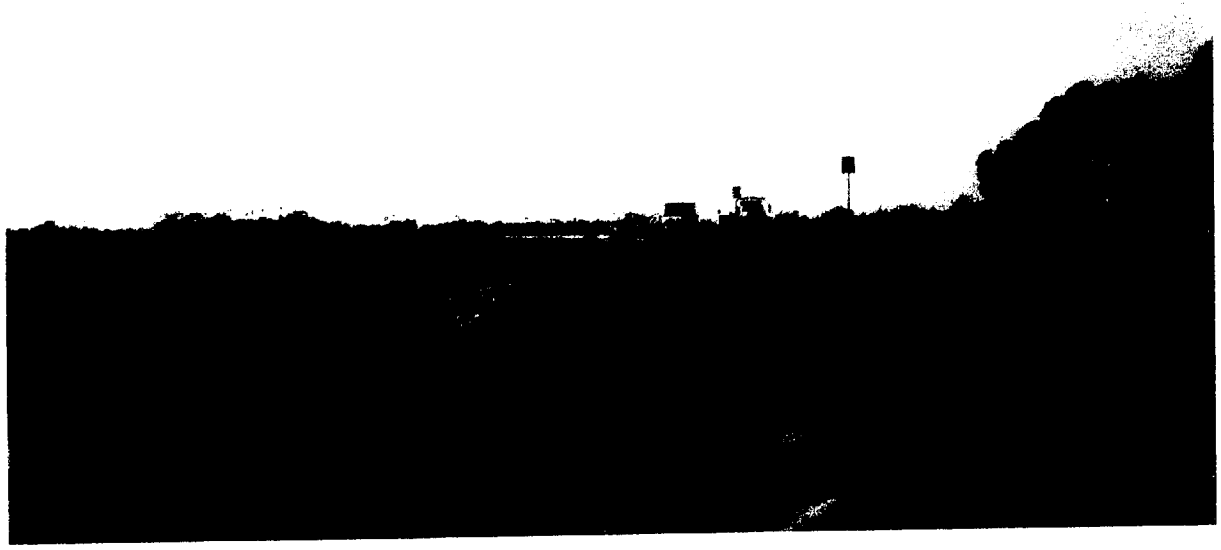
Pictorial Visual Simulation

Appendix C-1.-b.

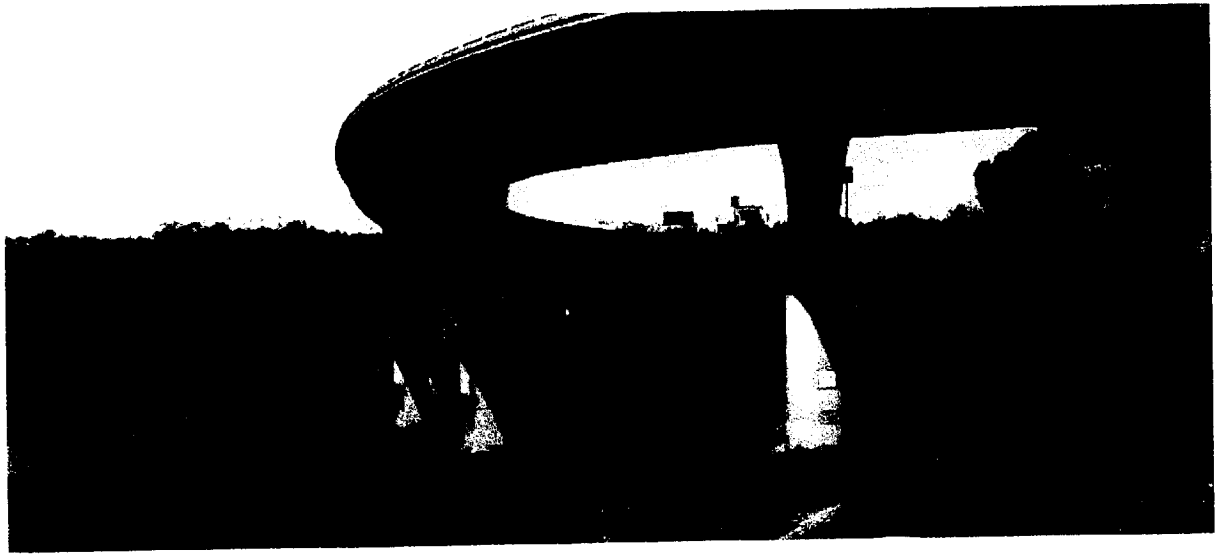


VISUAL IMPACT SIMULATION & NOISE SAMPLING LOCATIONS





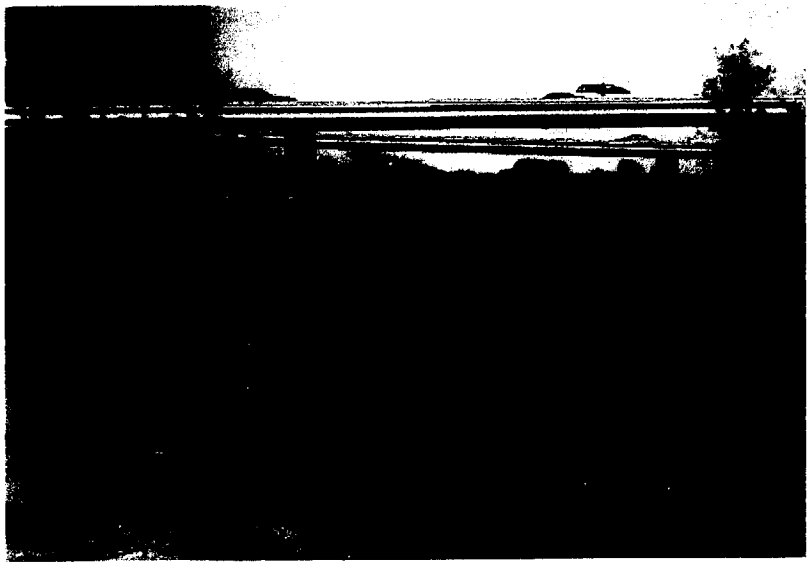
PRE-PROJECT CONDITIONS
Photo was taken from the northwest side of the Basilone Road/I-5 overcrossing looking northwest towards San Mateo Point.



SIMULATED POST CONSTRUCTION VIEW
View shows southbound FTC flyway between San Mateo wetlands old US 101 alignment and existing southbound I-5 fill section.

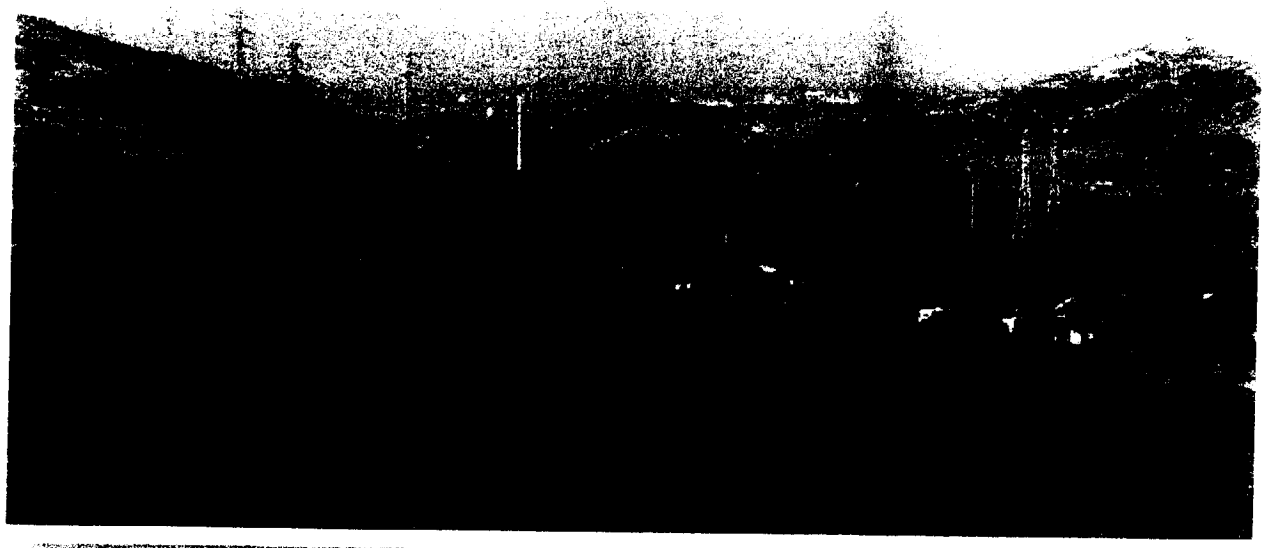
VIEWPOINT A

PRE-PROJECT CONDITIONS
Photo was taken from the Trestles beach access trail looking northeast towards I-5 and the inland San Mateo Valley area.View includes existing I 5 fill section.

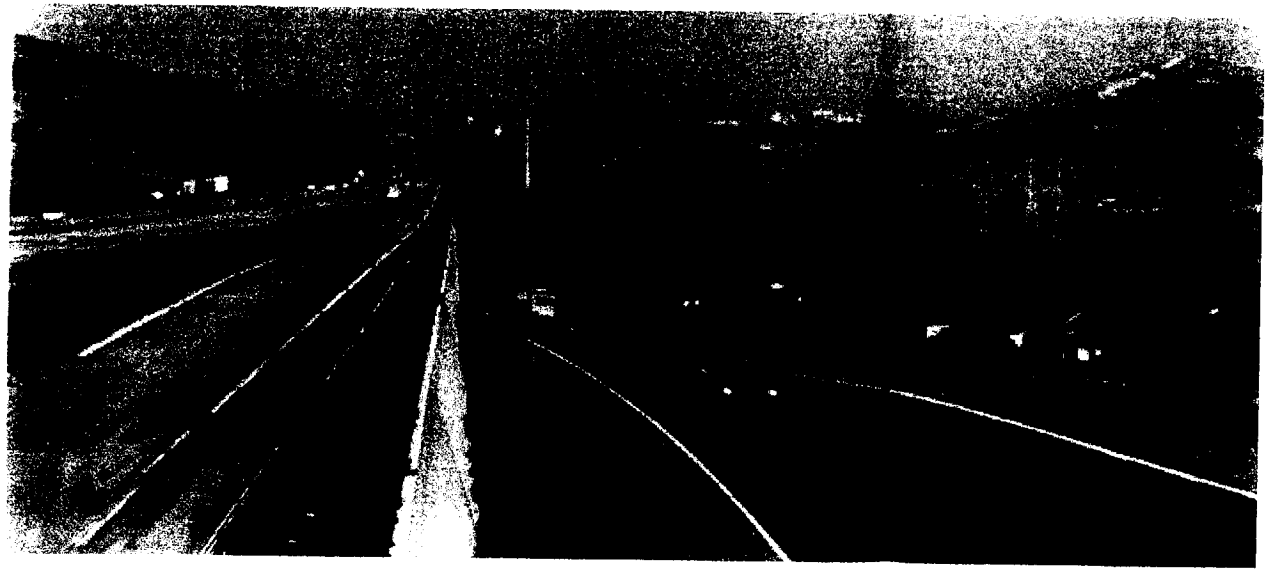


SIMULATED POST CONSTRUCTION VIEW
View shows southbound FTC flyway over San Mateo wetlands.

VIEWPOINT B



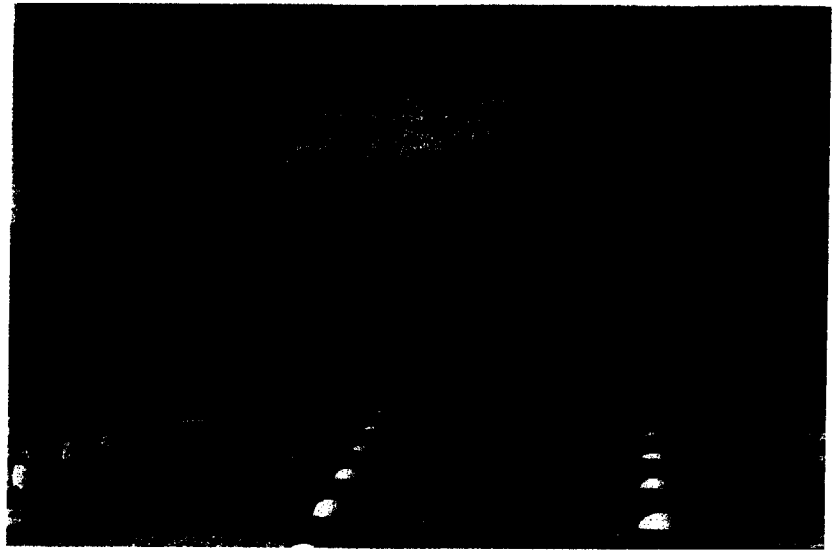
PRE PROJECT CONDITIONS
View was taken from water tank hill looking north along Christianitos Road alignment.



SIMULATED POST CONSTRUCTION VIEW
Simulation shows view from proposed Christianitos Road/FTC overcrossing looking north. View shows:

- FTC proximity to campground and alignment along hillsides.
- On-ramp.
- Christianitos Road realignment.

VIEWPOINT C

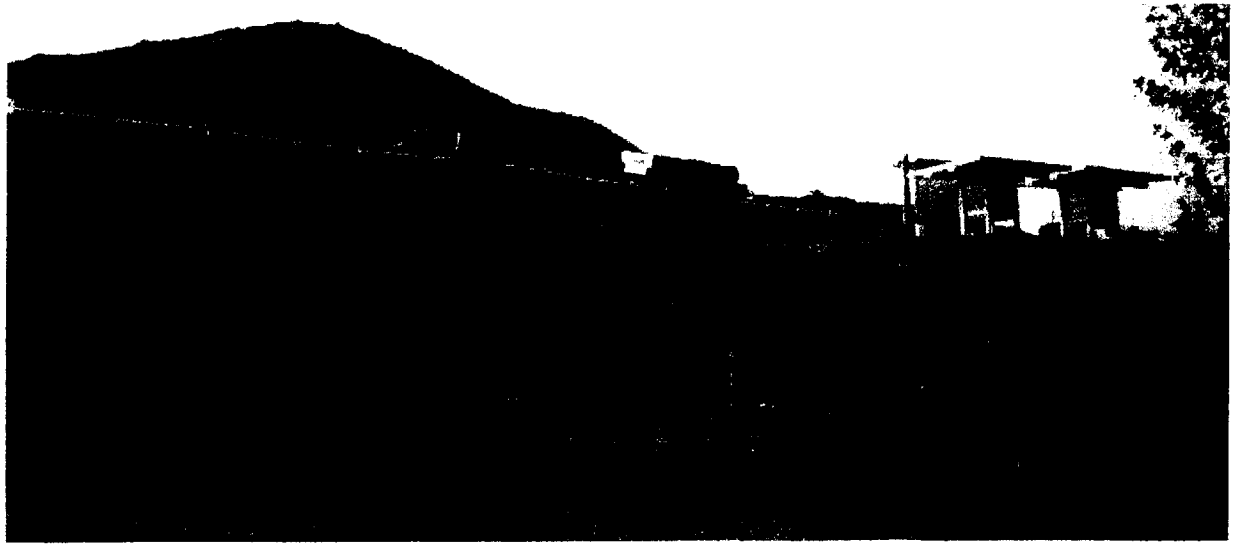


PRE-PROJECT CONDITIONS
Photo was taken from campfire center at San Mateo camp ground looking west towards San Clemente boundary.

SIMULATED POST CONSTRUCTION VIEW
View shows Christianitos Road realignment from San Mateo campground campfire center.

VIEWPOINT D

PRE PROJECT CONDITIONS
Photo was taken from center of San Mateo campground looking west towards campfire center



SIMULATED POST CONSTRUCTION VIEW
View shows proposed Christianitos Road realignment adjacent to campfire center.

VIEWPOINT E

Appendix C2: Noise Analysis

Introduction

San Onofre State Beach (SOSB) is situated just south of San Clemente, along a portion of the Southern California coast that runs west to east, not north to south. It is shaped like a capital L. The horizontal part of the L stretches about a mile along the Pacific Ocean, and is one quarter to one half mile thick. The vertical part of the L stretches inland about five miles, varying in thickness from about one-quarter mile, at the southern end, to about three-quarters of a mile at the northern end. Most of the inland portion is hilly, sloping downward from west to east, with drainages likewise running from west to east. The north faces of the drainages are grassy, the south faces bushy, and there are small trees along the drainage bottoms. There is a delightful sycamore grove along Christianitos Creek at the upper end of the capital L.

The CP alignment of the proposed Foothill Transportation Corridor-South (FTC-S) would enter the inland portion of SOSB at the top of the capital L, and proceed downward, toward the ocean, staying within the inland portion of SOSB for all five miles. It would then swing eastward along the northern edge of the coastal portion of SOSB.

The FTC-S noise consultants have measured existing sound levels at several locations within SOSB, predicted future noise levels from the FTC-S, and applied a criterion which indicates no noise impact requiring mitigation. Any reader who is not deaf will wonder how a major toll road can pass through a long, narrow unit of the State Park System with so little environmental damage. The answer is in the criterion used.

San Mateo Campground

According to the FTC-S noise consultants, existing sound levels (L_{eq}) in the campground are 47.1 dBA, and future tollway noise levels will be 60.7 dBA. Using a Caltrans noise abatement criterion of 67 dBA, they conclude that no mitigation is required. The conclusion is based on multiple errors.

First, it is inappropriate to rely exclusively on L_{eq}, the so-called equivalent level, because it gives disproportionate weight to high sound levels, thereby discounting long periods of relative quiet. Since the existing environment is characterized by such long intervals of relative quiet, use of L_{eq} tends to overstate existing sound levels. It would be much better to include an understandable description such as, "existing sound levels are less than _____ 50% of the time." Such a description would call attention to the fact that the existing environment will be changed greatly, probably by 15 to 20 dBA.

Second, it is inappropriate to rely exclusively on L_{eq} because of the importance of sleep interference. After all, it is a campground, where visitors sleep in tents and thin shelled (and probably open) recreational vehicles. Sound exposure level (SEL) would be preferable (when traffic is not continuous) to gauge sleep interference, because it would be capable of indicating what percentage of visitors would be awakened, and how often they would be awakened. There is no doubt that the tollway, and the displaced Christianitos Road, would lead to much sleep interference.

SEL is a measure of the noise dose from a single event, such as a heavy truck passby. It's numerical magnitude, and sleep disturbing potential, depend on both the maximum sound level of the event, and the duration of the event. SEL is also a basic building block in the Caltrans noise model used by the FTC-S noise consultants. To obtain the peak hour L_{eq} used in the FTC-S noise assessment, the noise consultants have averaged all the individual SEL contributions, one for each vehicle, over the peak hour. This process smears each individual SEL contribution over the hour, even when (as with a heavy truck) the individual event is conspicuously noisy.

Third, the Caltrans criterion does not do justice to the outdoor amphitheater associated with the campground, which seats over 100 persons and is on the west side of the campground, closest to the proposed FTC-S. According to National Academy of Sciences guidelines[5], the intruding noise from the tollway, and from the displaced Christianitos Road, should be 5 dBA less than the existing sound levels in order to avoid speech interference. This guideline codifies what is necessary if listeners are to hear and understand interpretive programs outdoors. It is likely the unmitigated tollway noise will exceed this guideline by 20 dBA.

Fourth, even if L_{eq} were accepted as an adequate descriptor for the existing sounds and future noise, the Caltrans criterion selected by the FTC-S noise consultants is inappropriate. The campground should be protected as an activity category "E", deserving a noise abatement criterion of 52 dBA, even though that criterion applies ostensibly to interior spaces, because of the importance of quiet for sleeping outdoors. The 15 dBA difference between the two criteria equals the amount of noise reduction (from outside to inside) that would be afforded by a frame house with windows open.

Proposed environmental (primitive) campgrounds

The proposed primitive or environmental campgrounds in SOSB are about midway up the capital L, closer to the proposed FTC-S than is the San Mateo Campground. Hence, future tollway noise levels greater than 60 dBA can be expected. In addition, an hour-long sound level measurement at the southernmost proposed environmental campground on March 9, 1997, yielded 43.9 dBA (Leq), with the existing sound levels less than or equal to 39 dBA 50% of the time. Since the existing sound levels here are lower than at the San Mateo campground, and since the predicted future tollway noise levels must be higher, the noise impact will be greater. In particular, the first, second, and fourth criticisms above apply with even greater force here.

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[5]GUIDELINES FOR PREPARING ENVIRONMENTAL IMPACT STATEMENTS ON NOISE (National Academy of Sciences, Washington, DC, 1977), page VI-4.

Sycamore grove

The sycamore grove at the upper (north) end of the capital L is the site of a proposed equestrian camp, where overnight camping would occur. It is approximately twice as far from the proposed tollway as the San Mateo campground. This extra distance will make the future tollway noise approximately 4.5 dBA less, or 56.2 dBA. An hour long measurement in the sycamore grove on March 9, 1997, gave 40.3 dBA (Leq), with existing sound levels less than or equal to 37.5 dBA 50% of the time. In other words, the predicted future tollway noise will constitute a greater increase in the sycamore grove than in the San Mateo campground. Sleep interference will also occur.

Future inland trails

The inland portion of SOSB invites hiking trail development because of the varied habitat and terrain. Views toward the ocean from the higher elevations would probably be especially popular. Were the FTC-S built, however, it would have to provide pedestrian underpasses or overpasses to get to the higher terrain. Hikers approaching the underpasses or overpasses would find their speech interfered with by the tollway noise. For some distance on either side of the tollway, they would be more conscious of tollway noise than of the songbirds and occasional woodpecker which can be heard now. Upon reaching the higher elevations, the hikers would inevitably be cognizant of the prominent visual swath cut through SOSB by the tollway.

Old Pacific Coast Highway bike trail

The old Pacific Coast Highway along the northern edge of the coastal portion of SOSB is now a bikeway. Were the FTC-S to be built, it would be carried on a flyway close to, or directly over, portions of the bikeway. Bicycle riders there, who currently enjoy a sense of openness, would instead experience a sense of massive, overpowering concrete structures. Noise levels near the flyway would probably exceed 65 dBA, interfering with speech and obliterating sounds of wind in the bluff grasses.

Ocean beach

The prevalence of waves at SOSB, which makes it so popular with surfers, can produce relatively high existing sound levels on the beach. For example, on March 9, 1997, with winds from a true bearing of about 325 degrees, existing sound levels were 63.2 dBA (Leq) on the beach, with instantaneous levels between 61.5 and 64.0 dBA 80% of the time. It is unlikely that tollway noise will be audible on the beach, except when waves are small or when wind is blowing across the tollway toward the beach. At all times, however, the elevated flyway will constitute a prominent unnatural feature in views from the beach toward the hills.

Trestles beach access trail

Portions of the Trestles beach access trails, coming from San Clemente and from the San Mateo campground, will probably be exposed to sound levels over 65 dBA, enough to

interfere with some speech. In addition to this degradation of the acoustic environment, the present bucolic stroll near wetlands will become dominated by the proximity of the flyway.

Comparison sound tape

A sound recording illustrating existing ambient noise levels within Subunit #1 with projected noise levels after FTC-S construction has been prepared. This recording provides an audio comparison similar to the pictorial visual simulation and comparison provided in Appendix C2. The sounds in the recording were captured on digital audio tape in San Onofre State Beach on 2/19/97 (San Mateo Campground) and on 3/9/97 (proposed primitive camping site and sycamore grove), and in Danville on 3/28/97 (Iron Horse Trail west of an elevated portion of I-680).

The digital form of the sounds was then transferred (without alteration) into a computer for editing and mixing. Editing consisted of slightly raising or lowering individual segments so that all would have a common reference level. Mixing consisted of superimposing the freeway noise on the last 30 seconds of each segment of San Onofre State Beach sounds. After editing and mixing, the sounds were transferred back (along with the common reference, calibration level) onto clean digital audio tape, and thence to the cassette tape provided to CDPR.

The 30 seconds segment of freeway noise was chosen at random from a half hour recording whose equivalent level was 65.7 dBA. During the half hour, sound levels were between 63.5 and 67.0 dBA 80% of the time.

An improved digital version of the sounds could be provided. All that is required is to use an equalizer to compensate for courtroom sound absorption, and to adjust amplification so that the reference calibration level is heard (and measured in he courtroom) at its proper strength.

APPENDIX D
UPDATED VISITOR ATTENDANCE FOR SAN ONOFRE STATE BEACH
1993 THROUGH 1997

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Totals
San Mateo Campground - Subunit #1													
1993	326	333	497	3,500	10,385	8,549	13,998	10,059	8,920	6,121	2,019	882	65,589
1994	1,155	899	1,369	4,354	7,290	7,087	12,862	10,838	9,744	2,608	3,110	1,022	62,338
1995	896	2,384	1,645	8,379	5,278	5,533	11,067	10,356	6,863	4,361	2,464	5,232	64,458
1996	1,827	3,062	2,656	4,543	3,790	8,017	12,105	14,345	5,447	2,863	2,915	2,181	63,751
1997	1,652	2,716	3,843	6,160	7,131	7,719	14,811	17,266	6,981	5,346	2,833	1,803	78,261
Trestles Beach - Subunit #2													
1993	11,576	17,095	25,070	22,570	16,595	29,205	41,645	40,150	37,631	23,880	16,885	15,200	297,502
1994	13,465	9,230	18,275	18,790	17,400	23,311	28,365	29,227	24,580	21,960	10,905	20,835	236,343
1995	12,060	62,175	12,280	15,700	23,465	21,635	28,845	33,100	48,600	77,017	17,431	19,562	371,870
1996	14,730	10,250	15,915	19,005	24,575	28,790	33,525	28,295	22,790	22,470	17,855	15,370	253,570
1997	16,965	18,685	21,065	17,385	29,050	25,410	41,810	37,310	28,085	23,225	20,440	16,885	296,315
Surf Beach - Subunit #3													
1993	11,607	14,550	20,820	29,605	38,390	47,175	60,216	66,381	38,214	36,405	21,837	21,497	406,697
1994	21,590	19,133	28,488	27,493	30,982	44,115	59,706	61,098	54,504	38,778	23,198	26,273	435,358
1995	7,576	23,320	16,962	34,130	34,576	40,603	56,472	59,465	58,904	36,816	25,484	17,908	412,216
1996	22,556	20,058	31,932	35,763	39,480	49,786	86,607	65,692	52,511	38,527	28,500	9,563	480,975
1997	16,314	23,956	32,014	9,789	58,531	61,580	78,346	87,009	62,438	55,036	32,114	19,625	536,752
Bluffs Campground - Subunit #4													
1993	1,419	4,764	20,181	28,939	34,887	32,393	50,486	48,400	32,561	17,971	14,008	882	286,891
1994	15,216	9,522	17,773	20,163	23,550	39,640	58,780	41,773	24,765	22,765	18,970	10,964	303,881
1995	4,363	13,126	12,924	28,208	21,695	35,416	30,692	61,131	44,410	24,616	11,364	10,818	298,763
1996	6,453	6,598	20,845	28,843	26,514	38,734	39,717	44,333	27,612	13,257	13,657	3,300	269,863
1997	6,230	9,702	19,014	18,992	44,302	33,477	46,331	61,976	25,399	22,157	10,280	4,626	302,486
Total 1993													**1,056,479**
Total 1994													**1,037,920**
Total 1995													**1,147,307**
Total 1996													**1,068,159**
Total 1997													**1,213,814**
Average													**1,104,736**
Source: California Department of Parks and Recreation													

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EXH 9

DIVIDER

Relocation Preplanning Letter Report for San Onofre State Beach

August 31, 1998

Pete Wilson
Governor

Douglas P. Wheeler
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Patricia J. Megason
Interim Director, Department of Parks and Recreation

California Department of Parks and Recreation

RELOCATION PREPLANNING LETTER REPORT
SAN ONOFRE STATE BEACH
FOOTHILL TRANSPORTATION CORRIDOR-SOUTH

August 31, 1998

CONTENTS

INTRODUCTION.....1
SCOPE OF WORK..... 1
RELOCATION CRITERIA..... 1
1. Ownership/legal requirements
2. Location
3. Access
4. Facility and spatial requirements
5. Potential for future expansion
6. Recreation considerations
7. Resource considerations
8. Operational considerations
9. Economic considerations
10. Political considerations
11. CDPR resources required to implement agreed upon

FACILITIES CONSIDERED FOR RELOCATION.....10
1. San Mateo campground
2. Orange Coast District headquarters Office
3. Orange Coast District maintenance facilities
4. Other Facilities: San Clemente staff housing

POTENTIAL RELOCATION SITES.....11
1. Campgrounds
2. District office
3. Maintenance yard
4. Other facilites

PREPLANNING COST ESTIMATES FOR RELOCATION TO CANDIDATE SITES.....13
1. Campgrounds
2. Orange Coast District office and maintenance facilities
3. Other facilities
4. Relocation site mitigation costs
5. General Plan Amendments
6. NEPA/CEQA, agreements, permits, and approvals

ANALYSIS OF POTENTIAL RELOCATION SITES.....15
1. Campground
2. District office
3. Maintenance yard
4. Other facilities: Staff residences

INTRODUCTION

An analysis of the proposed Foothill Transportation's "CP Alignment" impacts on San Onofre State Beach was presented to the Transportation Corridor Agencies (TCA) in August 1997. In summary, that report concluded that this alignment would result in the constructive use of a significant portion of Subunit #1 of San Onofre State Beach. This would impact and fragment it to such a magnitude that this subunit would no longer be of state park quality and should be relinquished to the underlying leaseholder. In order to make the people of California whole for their loss, California State Parks presented a recommendation for real property, cash, and recreational related development to be required of TCA and dedicated to the California Department of Parks and Recreation (CDPR) prior to commencement of project development. (For details and specifics of this referenced assessment, CDPR's August 1997 "Mitigation Assessment of FTC-South Impacts on San Onofre State Beach" along with its "Addendum" of July 6, 1998, and the "Correction and Update of Appendix D" of February 19, 1998 should be consulted.) Subsequent discussions with TCA representatives showed the need for CDPR to provide an additional level of detail in order to facilitate TCA's work in providing a seamless transition for replacement of certain of existing park facilities if the subject alternative were selected. It is the objective of this report to provide this additional level of detail.

SCOPE OF WORK

This report presents preplanning relocation and design criteria and cost estimate information for campground, district office, and maintenance yard relocation at various sites. This includes review of campground areas (including preliminary site evaluations) for at least two locations. The report also includes descriptions of the following: 1. the facilities considered for relocation including San Mateo Campground, CDPR's Orange Coast District office and maintenance yard, 2. potential relocation sites, 3. cost estimates for relocation to candidate sites, 4. constraints analysis for each of the relocation sites (including initial resource impact evaluations), and 5. relocation criteria.

CDPR understands that Transportation Corridor Agencies' (TCA) involvement with this report does not mean acceptance by TCA to provide all the items requested by CDPR as compensation for impacts to CDPR leasehold property.

RELOCATION CRITERIA

General criteria was established to help identify, select, and evaluate relocation alternatives. All criteria are intended to establish a minimum standard of mitigation. Final mitigation should be equal to or better than the existing park facilities that will be impacted by the FTC-South project. The mitigation results should be visible to public park visitors and constituencies. The following is the criteria used in this report:

1. Ownership/Legal Requirements

A. Fee Title

First preference is given to relocating park facilities to sites where CDPR has or may have fee title ownership to the property. In the case of new land acquisitions easements or deed restrictions should be minimized if possible.

B. Lease property

Second preference is given to relocating park facilities to sites where CDPR does not have fee title ownership.

C. Lease Agreement
San Onofre State Beach is located entirely on lands leased from the Department of the Navy. Any relocation sites elsewhere on San Onofre SB must be in compliance with the lease agreement or have the written approval of the Camp Pendleton base commander.

D. California Coastal Commission CDP Requirement
The San Mateo campground was developed as a Coastal Development Permit (CDP) requirement for lost coastal access due to the San Onofre Nuclear Generating Station (SONGS) project. Any relocation or abandonment of San Mateo campground facilities may require review and approval by the Coastal Commission to assure that coastal recreation and access mitigation is still being provided for.

E. Regulatory requirements
Relocation of park or District facilities shall comply with all regulatory requirements of federal, state, or local agencies as applicable as well as any environmental requirements.

2. Location

A. Recreation facilities
All relocated campground facilities shall be sited on coastal park or coastal open space lands with equal value or utility to those found at the San Mateo campground and have direct access to the coast.

B. District administrative and operations facilities
District administration facilities may be relocated off state property if it is necessary to accomplish relocation of San Mateo campground facilities. These facilities should be located on lands purchased for CDPR within four miles of the San Onofre - San Clemente - Dana Point area to maintain district operations effectiveness and accessibility. Some of these existing facilities are located in historic 1930's buildings. These buildings must remain on site but may be readapted to another appropriate use.

C. District maintenance facilities
It would be desirable if District maintenance facilities were at the same location as the District administrative facilities. A separate off-site location will be considered if the district facilities are centrally located to field operations in the Doheny/San Clemente area. Proximity within four miles of the Doheny/San Clemente area is also needed in order to maintain district operations effectiveness and accessibility. Certain specific operations facilities should be located at San Clemente SB or San Onofre SB and they are identified in Relocation Criteria, item 4. "Facility and spatial requirements".

D. San Clemente SB staff residences
CDPR is a participating member of the SONGS emergency plan group. In the event of an emergency at SONGS, it is CDPR's responsibility to evacuate San Onofre SB and San Clemente SB. In order to meet this responsibility, CDPR has established on-site staff residences at San Clemente SB so that CDPR staff will be available to respond to a SONGS emergency event in a timely manner. A minimum of five staff residences must be retained at San Clemente SB in order to meet CDPR's emergency plan responsibilities for SONGS. There are

existing staff residences that are located in five historic 1930's buildings. These buildings must remain on site but may be readapted to another appropriate use.

F. Coastal open space
Replacement of lost open space in Subunit #1 shall be comparable coastal property located in the Orange County coast area.

3. Access

A. Public
There shall be direct public trail access from the relocated campground facilities to the ocean. This would be in-kind replacement for the existing coastal trail access from San Mateo campground to Trestles Beach. Relocated park facilities shall comply with Americans with Disabilities Act (ADA) requirements.

B. Operations
Park roads and multi-use trails should be accessible to maintenance and emergency vehicles (12' minimum width). The District maintenance facility must be able to accommodate access by large tractor-trailer vehicles.

4. Facility And Spatial Requirements

The following spatial and facility criteria is based on existing park facilities at the San Mateo Campground and the Orange Coast District headquarters at San Clemente SB. Relocated facilities should equal or exceed existing facilities.

A. Relocation of San Mateo Campground recreation facilities

Listed in this section are campground elements to be considered for relocation to another state park unit (San Onofre SB, San Clemente SB, Crystal Cove SP, or new state park acquisition).

Certain important development elements have not been quantified because they are dependent on site specific situations. Roads and entrance geometrics have not been quantified since specific site conditions determine circulation configurations and dimensions. Safe entrances should allow for adequate acceleration-deceleration lanes (250' minimum length for each), a minimum 10-vehicle stack up space in front of the entrance station, and a vehicle turnaround loop in front of the entrance station. Utility service (sewer, water, electricity, and telephone) connections also vary according to availability and each site situation. Additional space may also be needed for visual and acoustic buffering from surrounding land use and activities.

Description	Quantity	Unit size	Subtotal area
Campsites (Graded site, table w/ cupboard, stove, fire ring, landscaping, 20' x 40' paved parking spur w/ barriers)	161	1,800 sq. ft.	289,800 sq. ft.
300 series combination buildings (Restrooms w/ showers)	5	800 sq. ft.	4,000 sq. ft.
Entrance station (w/ restroom)	1	180 sq. ft.	180 sq. ft.
Campfire center amphitheater (Stage, screen, fire pit, electrical, lecture podium, 110 person seating capacity, pedestrian access trail, 20 car parking area, lighting, and landscaping)	1		
San Mateo maintenance and storage area with sewer system lift station (see on-site relocation of OCD operations facilities section)	1	48,000 sq. ft.	48,000 sq. ft.

Building area subtotal (sq. ft.)	0.2 acres (4,180 sq. ft.)
Recreation area subtotal (acres)	68.8 acres
Maintenance/storage area subtotal	1.1 acres
Total area (acres)	70.1

B. Relocation of Orange Coast District administration facilities

The following district headquarters facilities may be relocated off state park property (San Clemente SB) if it is necessary for the relocation of campground facilities. These facilities are currently located in several buildings in the District headquarters compound.

Description	Area in sq. ft.	Type of area
District Superintendent	800	Private office
Visitor Services Superintendent	400	Private office
Maintenance Chief	400	Private office
Administrative Chief	400	Private office
Administrative Supervisor	400	Private office
Administrative Support Visitor Services	400	Secured space
Reception Area	520	
Central Files/Archive Storage	1,800	Secured storage
Mail/Copy Room	520	
Conference/Training Room	1,550	Private room
Personnel Functions	1,000	Secured files
Accounting Functions	600	Secured files
Accounting Technician	350	
Property Custodian	350	
Communications/Network Equip. Room	400	Secured room
Restrooms (M/F)	200/200 (each)	
Breakroom/Kitchen	520	
Office space subtotal (sq. ft.)	11,210	
Visitor & Employee Parking (sq. ft.)	8,800	
Total area for District administration (sq. ft)	20,010	

C. Relocation of Orange Coast District operations facilities

The following District maintenance facilities may be relocated off state park property (San Clemente SB) if it is necessary for the relocation of campground facilities. These facilities are currently located in the District headquarters compound. It would be desirable if these district maintenance facilities were at the same location as the District administrative facilities. A separate off-site location will be considered if the following facilities are centrally located to field operations in the Doheny/San Clemente area.

Description	Area in sq. ft.	Type of area
Vehicle service facilities		
Office	400	Indoor secured
Garage bays w/ lifts (2)	1,000	Enclosed
Storage area for tires and parts	1,000	Secured
Wash rack	600	Outdoor
Parking and vehicle storage	5,000	Outdoor
Warehouse/Storage	3,000	Indoor secured
Carpenters shop and lumber storage	1,200	Indoor secured
District storage yard (building materials, portable toilets, park furniture, fire rings, fencing, etc.)	48,000	Outdoor secured
Building area subtotal (sq. ft.)	6,600	
District storage and vehicle yard subtotal (sq. ft.)	53,600	
Total area (sq. ft.)	60,200	

D. Relocation of Orange Coast District operations facilities

The following facilities should be relocated to San Clemente SB or the coastal portion of San Onofre SB.

Description	Area in sq. ft.	Relocation area
Ranger station	1,800	San Clemente/SOSB
Lifeguard headquarters	2,000	San Clemente/SOSB
Secured storage for evidence & ammunition	1,000	San Clemente/SOSB
Landscape Tech. shop & equipment storage	1,000	San Clemente
Maintenance Supervisor's office	900	San Clemente
Corporation yard/fuel facilities/vehicle parking	30,000	San Clemente/SOSB
San Mateo maintenance yard & storage	15,000	SOSB
Building area subtotal (sq. ft.)	6,700	
Yard/storage space subtotal (sq. ft.)	45,000	
Total area (sq. ft.)	51,700	

E. Off-site relocation of San Clemente staff housing

It may be necessary to relocate the mobilehome residences in order to accommodate relocated campground facilities at San Clemente SB. Since the building residences were built by the Civilian Conservation Corps (CCC) in the 1930's, a historical, architectural, and structural assessment of the building

residences is needed to determine continued or alternative use of those structures.
CDPR is a part of the SONGS Emergency Plan. In the event of an emergency, CDPR has required responsibilities for evacuating people out of the San Onofre SB area. To meet this responsibility, CDPR established on-site residences in San Clemente SB (which is within the Emergency Protection Zone) to assure that CDPR staff would be available for SONGS Emergency Plan responsibilities. A minimum of five residences must remain at San Clemente SB to meet this responsibility.

Existing number of staff residences at San Clemente SB
5 building residences
11 mobilehome residences

F. Replacement of Subunit #1 open space
Coastal property acceptable to CDPR of sufficient size, aspect, and recreation potential comparable to the park values lost at parcel #1 shall be acquired in a fee simple dedication to CDPR. It is preferred that a single coastal site that provides these values and opportunities be selected. The replacement property must constitute or be a part of a viable recreation area, be of reasonably equivalent usefulness, location, and serve an existing public outdoor recreation need and community as Subunit #1. The property to be acquired must (following a full market appraisal of the remaining lease at its highest and best use) be of at least equal value and utility. Equivalent public infrastructure including water, sewer, electrical, telephone utility service shall be provided to the site.

5. Potential For Future Expansion
If new land acquisitions are involved, it is desirable that in addition to accommodating the relocation of campground or district facilities, relocation sites have potential areas able to accommodate future expansion in order to meet future recreation or operations needs. This also includes compensation for the Parcel #1 open space lost to the toll road project.
It is preferable that new acquisitions have as few deed restrictions and easements as possible. Furthermore, the desirability of a proposed acquisition will also depend upon how land use and development restrictions (Local Coastal Plans, County General Plans, NCCP jurisdictions, local municipal plans or zoning, etc.) affect CDPR's ability to manage and develop a new land acquisition as a state park unit. Such restrictions or requirements may include permitted building envelopes, land use intensities, circulation or traffic controls, development requirements, etc.

6. Recreation Considerations
Relocation sites should have a rural or natural open space character similar to the San Mateo campground in order to retain a similar recreation experience. This is especially important for interpretive programs and facilities such as the campfire center amphitheater and interpretive nature trail.
If relocation facilities are to be added to an existing state park unit (such as San Onofre SB subunit #3, San Clemente SB, or Crystal Cove SP's El Morro area), the

resulting quantity or intensity of development at the relocation site should not diminish the quality of recreation experience for the visitor. In other words, a certain quantity of recreation facilities (determined by relocation objectives) should not be forced into an available relocation site at the expense of providing a quality recreation experience or facility.

7. **Resource Considerations**

Relocation alternatives shall avoid adverse resource impacts at the relocation sites as much as possible.

A. Cultural resource considerations

Adverse impacts on cultural resources at relocation sites should be avoided or mitigated.

Historic Structures: If a relocation proposal involves historic structures, such as those found at San Clemente SB, a Public Resources Code (PRC) 5024 project evaluation will be required. Structural treatments, mitigation, alternative adaptive uses, site plan restrictions, or additional investigation may be identified in that evaluation. As a part of preparing a 5024 project evaluation, a Historic Structures Recordation Report and a Landscape Survey Report need to be completed. These reports are inventory surveys that identify and describe any historic structure or site features that may be found on a proposed project site.

Archeological/paleological resources: Relocation sites should be surveyed to determine if there are any archeological or paleological resources. Evaluations can then be made on how the feasibility of specific relocation alternatives is affected. Cultural resource investigations or surveys of alternative relocation sites will need a PRC 5024 project evaluation.

B. Natural resource considerations

Relocation sites should have access to coastal natural resources similar to those found at the San Mateo campground and Subunit #1 areas. Visitors to the relocated campground facilities should have access or views of habitat areas, wildlife, and other natural features in the same manner as at San Mateo campground.

Relocation sites should be suitable in terms of site stability (geology, soils, hydrology, etc.). Adverse impacts on natural resources at relocation sites should be avoided or minimized if possible. If habitat mitigation (coastal sage scrub, riparian, etc.) is required at a relocation site, that should be included as a part of relocation costs.

C. Aesthetics, viewsheds, noise, etc.

The previous submitted "Mitigation Assessment of FTC-South Impacts on San Onofre State Beach" report (August 1997) emphasized the uniqueness of the San Mateo campground setting and recreation experience. The search for suitable relocation alternatives should strive to match or surpass the aesthetic values found at Subunit #1. If possible, the relocation sites should have the same expansive quiet rural or natural open space character that is presently found at San Onofre SB, Subunit #1 (see August 1997 Mitigation Assessment Report, Appendix A "Spirit of Place").

8. Operational Considerations

A. Visitor use

There should be no disruption of the availability of public recreation facilities throughout the implementation of the FTC-S project. All relocated or mitigation recreation facilities should be completed and available for use by the public when construction in the San Mateo campground vicinity begins.

B. Park operations and maintenance

District operations: FTC-S implementation activities shall not disrupt District operations and maintenance functions. If relocation of District facilities is required to accomplish recreation facility relocation, there shall be no time gap in the availability or use of District facilities (existing or relocated facilities).

Utilities: Full utility service connections (sewer, water, electrical, and telephone) should be available at all relocation sites. If utility district annexation or buy-in costs are required, those costs should be included as a part of the mitigation. There should be no net increase in utilities service costs at the relocated facilities over what current utilities costs are at the existing park facilities.

Fire protection and mutual aid agreements: The availability of fire protection services at the relocation sites will be a factor in determining their acceptability. This includes the availability of and conditions for mutual aid agreements with fire protection and law enforcement agencies.

Radio communications: The ability to establish radio communications with the rest of district operations will be a consideration. This can be problematic in areas with significant topography (deep coastal canyons, high ridges, etc.). It may be necessary to install a radio repeater station.

9. Economic Considerations

A. Operational costs

If relocation of the District headquarters office and maintenance facilities is required, relocation of those facilities to a site that is central and close to the San Onofre SB, San Clemente SB, and Doheny SB units is essential for cost effective operations.

Municipal sewer connections for any relocation site will reduce park maintenance costs. Currently, there are municipal sewer connections at the San Mateo campground and at San Clemente SB. San Onofre SB's "Bluffs Area" campground facilities use sewer vaults that have to be regularly pumped out.

B. Revenue

If there is a time gap between the closing of the San Mateo campground and the availability of new relocated campground facilities, CDPR should be compensated for lost revenue during the time gap.

10. Political Considerations

As relocation alternatives are more clearly delineated, political factors need to be identified and assessed when determining a relocation proposal's feasibility. Local constituencies, supporters, and special interest groups should be identified in this processed. A project with FTC-South's significance should provide these groups as well as the general public with opportunity for input through hearings, meetings, or

workshops. Any relocation plan must be in compliance with a Local Coastal Plan (LCP) or other local planning (county/city General Plan).

11. **CDPR Resources Required To Implement Agreed Upon Mitigation.**
There should be no net increase in costs to CDPR for planning, coordinating, and responses during the course of future mitigation/negotiations for the FTC-South project proposal. CDPR should be compensated for any reports, studies, surveys, site planning, information gathering, public involvement activities, responses to elected officials, or staff time incurred by the FTC-south project. It may be necessary to fund a CDPR full time limited term position to be able to perform the necessary workload and represent CDPR interests on these issues. CDPR is not requesting funding for actions we undertake as a part of our responsibilities under CEQA or NEPA.

FACILITIES CONSIDERED FOR RELOCATION

The following are descriptions of state park facilities that may be relocated because of direct or indirect impacts from the FTC-South project.

1. **San Mateo Campground**
The 161 unit San Mateo campground is located in Subunit # 1 of San Onofre SB. Facilities include an entrance station, five combination buildings, a campfire center amphitheater, interpretive panels, an interpretive nature trail, trail access to the beach at Trestles, a maintenance/storage area, a sewer lift station for connection to the City of San Clemente, as well as mature campground landscaping. Project cost of the campground (including A & E) in 1989 was approximately $4.8 million. The approximate area of the existing San Mateo campground is 69 acres.

2. **Orange Coast District Headquarters Office**
The existing district headquarters office is located in a rehabilitated historic adobe building at San Clemente SB. In the event that San Mateo campground facilities are moved to San Clemente SB, it may be necessary to relocate the district headquarters offices to a new off-site location in order to accommodate campground relocation plans. Since the building is an historic adobe, it cannot be moved. Adaptive re-use of the building such as a visitor center may be an appropriate action. There are also eight other structures at San Clemente SB that have historic significance. A historical evaluation will be needed to determine how to site relocated campground facilities so that historic structures are not adversely affected.

3. **Orange Coast District Maintenance Facilities**
The existing district maintenance facilities are located adjacent to the current district offices in San Clemente SB. As with the district offices, it may be necessary to relocate the district maintenance facilities to an off-site location in order to accommodate campground relocation plans. Certain maintenance facilities need to remain at San Clemente SB or San Onofre SB to insure their efficient and continued operation (these are listed in "Relocation Criteria, 4D. Facilities And Spatial Requirements, Relocation of Orange Coast District operations facilities").

4. **Other Facilities: San Clemente Staff Housing**
In addition to the existing district office building and maintenance facilities, relocation alternatives may affect other buildings located in the eastern portion of San Clemente SB adjacent to the district office. These buildings are currently used for district functions and staff housing. Several of these buildings were constructed in the 1930's by the Civilian Conservation Corps (CCC) and may be considered historically significant. Buildings determined as historical may have to be kept intact at their existing locations. There also are 11 mobilehome staff residences that may be affected by relocation alternatives. If campground facilities are added to San Clemente SB, relocation of the mobilehome residences will need to be provided.

POTENTIAL RELOCATION SITES

The following are descriptions of potential relocation sites that CDPR has considered so far. As previously noted, CDPR does not want to diminish the quality of recreation experience or facilities. While the following sites have been considered, no doubt others exist. CDPR considers it the obligation of TCA, if the CP Alignment alternative is selected, to take the responsibility for identifying and securing suitable locations acceptable to CDPR.

1. **Campgrounds**
San Clemente SB
This 110 acre coastal state park unit contains 85 family campsites, 72 RV campsites, and group use area. There is an existing trail that provides access to the beach from the campground. In addition to recreation facilities, this park unit also contains the Orange Coast District administration and maintenance facilities as well as 19 residences for park staff. Some or most of the District facilities and residences may have to be relocated in order to implement a campground relocation alternative. San Clemente SB is located approximately 2.8 miles from the San Mateo campground.
One potential relocation alternative would add San Mateo facilities to existing San Clemente SB campground facilities. The initial review for this report indicates that there may be up to 18.7 acres available for relocated campground facilities. An estimated 30 mitigation campsites with associated development could be added to the existing campground development. Site planning studies are needed to determine more definitive numbers and optimum layout. The estimated relocation acreage requires the relocation of District administration and maintenance facilities and 11 mobilehome staff residences out of San Clemente SB. The district headquarters building is an historic adobe building built by the CCC's in the 1930's and shall be left in place. This building could be adapted as a camp store concession or visitor center. There are 8 structures near the district headquarters building that were also built by the CCC's. Currently, three of these are use for district functions and five are used as staff residences. These buildings will also remain on site.
Another potential relocation alternative would involve the complete reconfiguration/redesign of San Clemente SB. This approach could result in improving the quality of overall park facility layout while allowing for the addition of an appropriate quantity of relocation facilities. This alternative, however, would

require the loss of available campsites and recreation use during redevelopment construction.

San Onofre SB, Subunit #3 "the "Boneyard" and existing Bluffs Campground
Subunit #3 is located on the coast just south of the San Onofre Nuclear Generating Station (SONGS). This coastal terrace area is currently used as a park storage area. Assuming a 200-foot setback from the bluff edge and a 100-foot setback from the SONGS boundary, there is approximately 9.6 acres of coastal terrace in the "Boneyard" area that may be available as a campground location. Site investigation is needed to determine how much coastal sage scrub habitat is affected. More importantly, current geologic stability evaluations of the coastal bluffs will be an important factor in determining the feasibility of relocating campground facilities here.
In addition to the relocation of facilities to the "Boneyard", another mitigation alternative that CDPR has considered for this area would be improving the quality of existing recreation facilities and experience in the "Bluffs Area" campground, especially between beach access trails number 1 and number 6. Some of these improvements include (but are not limited to) full utility service including municipal sewer connections, redesign of the campground layout to provide individual sites with more space/privacy, new campsite/day-use furniture, a coastal pedestrian and bicycle trail for reducing existing circulation conflicts. This could also include a soundwall between the campground and Interstate Highway 5 and the railroad line.

Crystal Cove SP, El Morro Area
This 2,791 acre coastal state park unit is located in Orange County between the communities of Laguna Beach and Newport Beach. CDPR intends to convert the existing El Morro mobilehome area to park use and facilities as called for in the General Plan. The General Plan proposes a 60-unit campground on a coastal bluff in the El Morro area overlooking Pacific Coast Highway and Moro Beach. CDPR anticipates that there will be a reevaluation of the General Plan recommendations, as a part of preparing the El Morro area for public use conversion, to assure the highest and best public use for the El Morro area. Development of more than 60 campsites in the area would require a general plan amendment.
The entire El Morro area is on a septic sewer system that is at maximum capacity. Any conversion of the El Morro area to park use would have to provide for new municipal sewer connections. An existing arch culvert under Pacific Coast Highway provides access to Moro Beach from the potential inland campground area.
A 294-unit mobilehome park whose master lease will expire on December 31, 1999 currently occupies the site. The mobilehome park residents are attempting to obtain a lease extension and continue occupying the area. Any conversion of the El Morro area to park development and use depends on resolution of the lease issues. CDPR cannot predict with certainty, when El Morro will be available for conversion to public use.

Marblehead
This coastal bluff site (250+ acres) is located between Dana Point and San Clemente SB. It is on the inland side of Pacific Coast Highway and adjacent railroad tracks. The beach in front of the property is in private ownership and is occupied by a trailer park but there is a local public beach nearby within walking distance. Currently, it is privately owned and is zoned and permitted for residential and commercial development.
Dana Point Headlands
This coastal bluff site (160-170 acres) is located immediately west of Dana Point Harbor. It is a significant headlands promontory feature along the coast. Within the Dana Point area, it is one of the few natural open space areas with coastal views along Pacific Coast Highway.

2. **District Office**
Locations to be determined in future investigations and relocation planning.

3. **Maintenance Yard**
San Onofre SB, subunit #4
This is the existing maintenance and storage area for the coastal portions of San Onofre SB. The coastal terrace area immediately south of the storage area could be developed as a new maintenance area extension.

San Clemente SB
San Clemente SB's existing maintenance facilities serve both the Orange Coast District and the park unit. The main district maintenance facilities may be relocated off site if it is necessary. There are certain maintenance facilities, however, that should remain at San Clemente SB or be relocated to San Onofre SB. These facilities are identified in "Relocation Criteria, 4D. Facilities and spatial requirements, Relocation of Orange Coast District operations facilities".

4. **Other Facilities**
San Clemente staff housing should be located within three (3) miles of San Clemente SB so that relocated staff can remain within the SONGS Emergency Protection Zone be available to provide backup assistance on Emergency Plan responsibilities.

PREPLANNING COST ESTIMATES FOR RELOCATION TO CANDIDATE SITES

Includes costs for: Relocation of existing facilities, demolition of existing facilities, preparation of new site, new site and facilities development, architectural and engineering (A & E) services, project/construction management services.

1. **Campgrounds**
Preplanning cost estimates were based in part on the cost of the San Mateo campground construction in 1989. That cost (obtained from the Division of the State Architect) for construction, contingencies, architectural and engineering design services, as well as construction management was $4,711,564. Dividing that figure by 161 campsites results in a cost of $29,264 per campsite. A 20% inflation

and escalation factor (2% per year for the 1989 to 1999 period) was added. This increases the replacement amount per campsite to $35,000 per campsite in today's dollars. The cost per campsite includes all development costs to establish the San Mateo Campground from an undeveloped parcel of land. This includes site clearing and grading; site drainage; internal site utilities; campsite development with facilities; restrooms with showers; roads and trails; entrance station and entry development; landscaping and irrigation; interpretive facilities; fencing and gates; refuse collection facilities; and signage. Itemized cost figures are not available from the Division of State Architect.

In initial project planning, preliminary cost estimate information is sometimes used. This information is based on an average of park projects compiled statewide. This guideline, which was updated in 1989, identifies an estimated cost of $27,000 for a family campsite. This includes the construction cost of each site as well as architectural and engineering design services, a proportional share of operations facilities, internal roads and trails, full utilities service (water, sewer, electrical, etc.), and contingencies. If this figure is adjusted for inflation and escalation factors, this estimate figure will increase to $32,400 per campsite in today's dollars. Attempts were made to obtain other coastal campground project costs for comparison but there has been very little new coastal campground development within the last twenty years. The only other recent new coastal campground construction was at Wilder Ranch State Park in Santa Cruz County. That development was a hike-in campground and is not comparable to the San Mateo campground. Most of the Department's campground projects in the last 20 years have been facility rehabilitation projects.

2. **Orange Coast District Office And Maintenance Facilities**

A real estate survey (using the information from the "Facilities And Spatial Requirements" section) of the southern Orange County coast area is needed to determine the availability and current cost of suitable commercial office space and real estate for relocated District facilities. In addition to this, the costs for moving personnel, furniture, equipment, vehicles, supplies, and other District materials needs to be included in any mitigation solution.

3. **Other Facilities**

A real estate survey of the southern Orange County coast area is needed to determine the availability and current cost of replacement residences for relocated San Clemente staff residences. If residence relocation is necessary, the costs for moving residents, their possessions, and (if applicable) their mobilehomes must also be included as a part of the mitigation solution.

If soundwalls are considered for any relocation alternatives, $100.00 per lineal foot for a ten-foot high reinforced concrete block wall can be used for estimating purposes. This is based on a unit cost of $10.00 / sq. ft. for construction, engineering design services, and construction management.

4. **Relocation Site Mitigation Costs**

A mitigation cost of $50,000/acre shall be used for impacted Coastal Sage Scrub vegetation/habitat (CSS). The source of this amount is the Coastal/Central NCCP in lieu fee mitigation amount.

Historical structure or archeological/paleological mitigation requires specific site evaluation. Cultural mitigation costs are difficult to estimate until the resource is identified and mitigation is determined.

5. **General Plan Amendments**
For each park unit: $250,000 for each amendment. Estimated time to complete each general plan amendment is 9 to 12 months. Potential relocation alternative scenarios could include more than one general plan amendment depending how many state park units are involved. Any general plan amendments needed for proposed mitigation would be added to the Department's general plan workload schedule.

6. **NEPA/CEQA, Agreements, Permits, And Approvals**
NEPA/CEQA compliance, sewer service agreements, coastal development permits, NCCP agreements or approvals, and other federal, state, and local regulations will need to obtained or complied with. CDPR staff time (Orange Coast District with technical assistance from the Southern Service Center, Resource Management Division, or Planning, Acquisition, and Environmental Design Division) would be needed to secure these agreements and permits to implement the campground relocation. If any relocation alternative affects a historic structure(s), review by the State Historic Preservation Officer (SHPO) will be required. CDPR is not requesting funds for actions we undertake as a part of our responsibilities under CEQA or NEPA. For other regulatory compliance, studies, investigations, or agreement processes, it may be necessary to fund a CDPR full time limited term position to be able to perform the necessary workload and represent CDPR interests on these issues. Estimated time to complete regulatory reviews and compliance as well as agreement processes is 6 to 12 months (some of these processes may be able to occur concurrently during a General Plan Amendment process.

ANALYSIS OF POTENTIAL RELOCATION SITES

This is an evaluation of specific constraints of each individual relocation site. This includes: development requirements (utilities, road/access improvements, potential site mitigation), accessibility (public, operations, disabled), suitability for proposed park facilities, physical/legal site constraints, ability to accommodate future needs or expansion. If not state property, what is site availability and what entitlements, permits, and approvals are needed? Are there any public constituency, local special interest groups, or political considerations?

1. **Campground**
<u>San Clemente SB</u>
San Clemente SB can accommodate some additional recreation development. Relocation of campground facilities to this existing developed park unit will likely require the off-site relocation of district administration and maintenance facilities as well as staff mobilehome residences. Site study schematic plans should be prepared to determine potential layouts, actual quantities of relocated facilities that could fit into the existing site, and reconfigurations of existing development. Careful consideration should be given so that relocation alternatives do not increase the

intensity of recreation development to a point that the quality of recreation experience for the San Clemente SB visitor is significantly degraded. Relocation of the San Mateo campfire center amphitheater to San Clemente will provide more adequate group facilities than what currently exists at San Clemente.

If campground facilities are relocated to San Clemente SB, the existing entrance road should be redesigned to accommodate entry access by more vehicles. The increase in campsites will create more vehicle stackup in front of the entrance. During the high visitation days this will cause long lines of vehicles waiting to enter the park to back out into the local street system. This creates a safety and traffic hazard.

Relocation of campground facilities to San Clemente SB will involve issues concerning historic structures because of the need to relocate District offices and maintenance facilities. Careful site planning is required to avoid any adverse impacts on historic structures.

There are rare plant and weed problems on certain portions of the property which may need to be addressed (depending on the nature and scope of the campground relocation proposal). There are also site drainage and bluff erosion problems on the seaward portions of the property.

Currently there is a buffer space between existing campsites and the traffic noise from Avenida del Presidente and the Interstate 5 highway. If relocated campsites are added, this buffer space will no longer exist because it is needed for campsite relocation. A sound wall running the length of the park boundary should be provided in order to mitigate noise impacts on San Clemente campsites.

It is not known if there would be any opposition (from the adjacent residential neighborhood) to increasing the intensity of recreation development at San Clemente SB.

San Onofre SB, subunit #3:

The "Bone yard" site is a coastal terrace area, which could accommodate some new campground development. One negative aesthetic aspect is that there is a very prominent view of the San Onofre Nuclear Generating Station. Current beach access is about a one and half mile walk away. Since there is coastal sage scrub vegetation on the site, NCCP mitigation will be required. A cultural survey is needed to determine if there is any evidence of archeological or paleological resources.

Recent events at the nearby Echo Arch area have raised concerns about the geologic stability of the bluffs area along the San Onofre SB coastline. This is due in part to drainage from off site sources and natural coastal processes. Geologic evaluations of the coast are currently in progress to determine the near and long term effects and what it may mean for recreation use in this area. This is a very popular recreation destination in Southern California and there will be many constituents who will strongly support continued coastal recreation use and access to this area.

Crystal Cove SP, El Morro area

There is good site potential for campground development at the El Morro area. The campground area identified for El Morro is currently a terraced mobilehome park. Conversion to an RV campground would be very feasible since all of the utility infrastructure already exists. Improving the existing sewer system with a municipal

sewer connection, however, will be essential since the existing system is old. Each of the campsites would have a blue water view of the ocean. If more than 60 campsites are relocated here, the additional campsites could be located below the terrace in the valley section next to Moro Creek. Campground and day use visitors would have pedestrian access to Moro Beach as well as the park's inland Moro Canyon watershed and Newport Coast open space lands.

CDPR is currently dealing with planning and political issues that will affect the future of the El Morro area. One of these issues is the potential expansion of the El Morro Elementary School that is adjacent to the proposed campground area. This issue has not yet been resolved.

Although the existing master lease is due to expire on December 31, 1999, CDPR expects that the current tenants will attempt to obtain a lease extension or a new long-term lease. This may affect the timing on the availability of El Morro for conversion to public use.

There are also some local groups who do not want any change to occur at this park.

Marblehead

There is good potential for campground development on this coastal open space parcel. There is no public beach access except to "North Beach". The property has at least one steep undevelopable canyon. This could provide some valuable habitat. Resource evaluations are needed to determine extent of known resource sensitivities.

The off ramp from the Interstate 5 highway is partially constructed according to informed Caltrans sources and local interests want the Marblehead developers to pay for completion of the off ramp. The charge against the Marblehead project for completion of off ramp development will be about $1.5 million. A new railway station provides rail service for this area.

The parcel however is zoned and has already secured permits for residential and commercial development.

This property was not certified in the Local Coastal Plan (LCP). The LCP must be amended to designate this site for park purposes. A Coastal Development Permit (CDP) must subsequently be secured for actual park development. Both of these items must be obtained from the Coastal Commission.

Dana Point Headlands

Although this is a coastal open space parcel, there may be limited developable areas because of topography. This site has problems with geologic instability. This season there was a major slide on a seaward bluff face. Resource evaluations are needed to determine extent of known resource sensitivities. A local special interest group opposes any development on this parcel.

Further investigation is needed to determine if an LCP Amendment and/or CDP is required for establishing and developing this parcel as a state park unit.

2. **District Office**

The current location of District headquarters facilities at San Clemente SB facilitates efficient District operations due to its close access to existing park units (San Clemente SB, San Onofre SB, and Doheny SB). Any off site relocation of the District headquarters office needs to be in similar close proximity so that there is no

loss in operations efficiency and access. Identification of specific relocation alternatives is needed for further evaluation.

3. **Maintenance Yard**
As with the District office, relocation of the District maintenance facilities to a central site is essential to continuing efficient District operations. Identification of specific relocation alternatives is needed for further evaluation.

San Clemente SB
The maintenance facilities identified in the facilities and spatial requirements section to remain at San Clemente SB, are those that are needed specifically for San Clemente SB operations.

San Onofre SB, Subunit #4
Relocation of maintenance and storage facilities from San Mateo and/or San Clemente to the San Onofre SB, Subunit #4 storage area is possible. This will involve expanding southward from the existing storage area. A potential expansion area of approximately 4.5 acres from the existing storage area will impact existing coastal sage scrub vegetation. If this is the case, NCCP mitigation will be required.

4. **Other Facilities: Staff residences**
Alternatives for staff residences need to be identified before any evaluations can be made.

EXH 10

DIVIDER

WEEKLY

October 1 - 7, 1999

The Death Ray

Welcome to South Orange County, home of uranium 238, illegal immigrants, rare trout, and the most powerful military laser in the world

by Ned Madden

THE VALLEY OF THE WEIRD

The best view of Orange County's Valley of the Weird is at the topmost point of Rancho San Clemente Ridgeline Trail, a dirt-path spine along a gully-cut plateau at San Clemente's summit, 888 feet above sea level. From here, you can see most of the Valley of the Weird, and what you can't see—like the artillery range at Camp Pendleton emitting the thumpa-wumpa, thoonka-whoonka of an 8-ton howitzer—you can hear.

The valley is just a few square miles at the southeast edge of San Clemente on the Orange County/San Diego County border. It's a small area, a crack in space, a geopolitical black hole where the 89.3 FM radio signal fades and leaks into 89.5 FM amid the hiss and buzz of distant lightning strikes and exploding galaxies.

It's small but includes the kind of distilled weirdness you'd swear needs a continent-wide canvas.

In addition to your howitzer thunder, you've got every radioactive U-235 pellet ever used at the 32-year-old San Onofre Nuclear Generating Station (known rarely by its felicitous acronym, SONGS) cooling in concrete storage pools and steel casks while awaiting removal to some distant and as-yet-unbuilt U.S. government waste site. The plant itself is famous for its eternally perky D-cup concrete-and-steel containment domes, breast-like in so Hollywood a way that they've appeared as visual gags in Leslie Nielsen movies. Nearby, you've got border cops who subject American citizens to random inspections of their persons and property at a station 70 miles from the U.S.-Mexico border, yellow signs of a *madre* and her *niños* running in silhouetted panic along the roadside, and the palatial former estate of Richard M. Nixon.

You've also got paradisiacal beauty, of course—acres of lush, vine-ripe tomatoes, a beach for nude sunbathers, and the world's most perfect breakers near Trestles Beach ("the Yosemite of Surfing," according to the Surfrider Foundation). There's even the San Mateo River, a waterway of rare steelhead trout—though the Marines plan to build base housing around the trout's river home, the county is eager to blast a new toll road (the 241) through the adjacent state park, and builders have bonneted the wild country with burned-earth terra-cotta-tiled homes.

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US: Orange County: **Trestles**

Interview with a Local
Trestles
Longtime Trestles surfer Dino Andino laments the loss of a point guard
More

Trestles Spots
Church
Cotton's
Lowers
Uppers

BACK TO MAP

Orange County Spots

GO

Lowers

Pictures do Lowers justice -- not words. Just look at almost any photo of a surf contest held at Lowers in the past 10 years and you'll know exactly what the break is about -- flawless lines, corduroy to the horizon. It's a jewel of a wave. Mother Nature's gift to Orange County's swelling population of quality surf-starved waveriders. It's hard not to start babbling when talking about the best days at Lowers. Don't be surprised if you catch yourself saying "all-time" and "epic" in the same sentence. The bottom line is that Lowers lives up to its reputation. There's just one small problem -- you and the rest of the surfers within a 60-mile radius have to compete for waves with the world's best.

Lowers bends out of the San Mateo Valley with its pebbly coastline pointing south and sucks in just about any swell coming from down under. The swells peak in a tight takeoff zone, and it's there that middle-aged longboarders, anxious grommets, confident ex-pros and the entire ASP Top 44 paddle in a frenzy for just about every wave that rolls in. On the best days, it's not uncommon to see 100-plus surfers converging on a five-wave set. That leaves 90 or so people empty-handed. Tension builds and usually words are exchanged between the longboarders catching most of the waves and the shortboarders who are getting skunked. It's rare to see any wave -- much less any good wave -- go unridden. Big swells help break up the pack and give your average surfer a chance to poke his 6'3" into a shot at glory. Oh, and one more thing: no matter how large it gets, Lowers rarely closes out.

If you do find yourself in perfect position for one of Trestles' classic widow's peaks, which way do you go? Left or right? Typically, the lefts tend to be shorter, hollower and punchier, with the rights being longer and better suited for multiple figure eights. In 1989, Christian Fletcher won big money at the Body Glove Surf Bout II by launching aerial after aerial on the rampy lefts. One year later, Kelly Slater showed the surfing world that the rights are not too shabby, either, by blasting a few tailslide off-the-lips and carving 360s to rake in an easy 30 grand. Whichever way you decide to go, you probably won't be disappointed with your choice.

Best tide: medium
Best swell direction: S, SW
Best size: anything above knee-high
Best wind: E

Perfecto-meter: 9 (1=Lake Erie; 10=Jeffreys Bay)
Bottom: sand, rock
Ability level: You may not need to know how to turn, but you do need to know how to catch a wave in a crowd.

SUR

EXH 11

DIVIRA

Conservancy COMMENTS

The Donna O'Neill Land Conservancy

at Rancho Mission Viejo

Volume 12 Number 1
Winter/Spring 2004

Winter Tracks

"What is a track?" asked Dean Schroeder, as he walked the trail with participants during his February tracking workshop.

Tracks on the trail can reveal much information. Basic track shapes, sizes, and arrangements can tell you who has been on the trail. Dean found the best bobcat scrape I have ever seen. The mud at the leading edge of the scrape clearly showed the distinctive features of a bobcat track.

"What is this track?" Dean urged us to apply our newly gained knowledge. Tiny toenail marks were visible as a dark etching in a lighter soil. Stooping to look

brought into view the ever-so-light impression. "What is that track?" we all asked ourselves with

continued on page 6

Young Explorers discover gypsum crystals during their hike at Forster Ranch in San Clemente! TDOLC provides many community programs. *(Photograph by Rachel Whitt.)*

Be Prepared Not Scared

On January 31, 2004 TDOLC participated in an important event--one organized to inform the public about mountain lions and raise funds for the victims of the recent attacks. This event, was called, "Be Prepared, NOT Scared". The Conservancy set up a display with photos and articles about mountain lions, and human mortality statistics.

What important information did we present? Mountain lions are essential to the integrity of our ecosystem. Mountain lions cannot be removed from Orange County without harming many other species. A mountain lion eats about 3 deer a month. In many areas in the United States where the top predators have been killed, the deer populations have exploded. In order to survive, these large populations often consume all plants within reach. The many small mammals and birds who

continued on page 6

Tour Richard and Donna O'Neill's Garden

Support The Conservancy and take advantage of this rare opportunity to tour the beautiful garden of Richard and Donna O'Neill. On a hillside overlooking the spectacular San Juan Creek Valley, magnificent large cacti and other succulents provide an unexpected palette of shape and pattern against the expansive Santa Ana Mountain backdrop.

Mike Evans, Owner of Tree of Life Nursery, and a close friend of Richard and Donna O'Neill, will lead walks through the garden. "It is a world-class garden that few people have had a chance to see," explains Mike Evans. The garden was designed with the help of Gary Lyons, curator of the desert gardens at *The Huntington Library, Art Collections, and Botanical Gardens* in San Marino. The

continued on page 3

Conservancy Calendar

Winter and Spring Programs at TDOLC

Conservancy programs are available for the general public, members, and special groups. Please call (949) 489-9778 to register for an event, arrange your own outing, or receive directions. Your registration makes it easier for us to plan for events. Please be prompt for your arrival, as we are surrounded by private land and must lock the gate behind us.

In case of rain (or overcast skies for astronomy), please call the office for information about possible postponement or cancellation of the event.

Guided Nature Walks and Hikes

The late winter and spring are full of mystery and surprises. When will the many different wildflowers bloom? When will the hills turn green? What tracks will be left after the rain? Enjoy the peace of rustling trees and bird songs. Family Nature Walks proceed at a child's pace. The 3- to 4-mile hikes are moderate, up a hill and down...and then through a canyon. Call 949-489-9778 for reservations.

Nature Walks

March 28th	*Family Nature Walk - Nature Bingo*	*2:00 -4:00 pm*
April 10th	*Family Nature Walk - Spring Surprises*	*2:30 - 4:30 pm*
April 30th	*Sunset Nature Walk*	*6:00 - 7:30 pm*

3- to 4- Mile Hikes

March 27th	*South Ridge Hike*	*2:30 - 5:30 pm*

Donation: *$5.00/adult $2.00/child*
$5.00/adult $3.00/child for Spring Surprises Walk

Astronomy Nights

Learn the constellations and marvel at the creativity of those who saw lions, bears, and hunters in the sky. Take a look through a telescope and discover star clusters, nebulae, the craters of the moon, and other treats. Learn how to find the north star and what "light year" really means. Call 949-489-9778 for reservations.

March 27th	*See the craters of the moon. 6:30 pm to 8:30 pm*
April 24th	*See the craters of the moon. 8:00 pm to 10:00 pm*

Donation: *Nonmembers: $8.00/adult $6.00/child age 8 & up*
Members: $6.00/adult $4.00/child age 8 & up
Not recommended for children 7 & under

Summary of March Events

14th	*Weed Warriors (9 am)*	*27th*	*South Ridge Hike (2:30 pm)*
20th	*Trail Clearing (8 am)*	*27th*	*Astronomy Night (6:30 pm)*
20th	*First Day of Spring Wildflower Wander (1 pm)*	*28th*	*Family Nature Walk - Nature Bingo (2:00 pm)*

Family Nature Walks

Enjoy a family adventure at TDOLC! In March, learn about our Orange County plants and animals with Wildlife Bingo. As you walk, create your nature reserve necklace, key ring, or bracelet.

In April, seek the unexpected during our Spring Surprises Walk. Discover unusual items hanging in the trees and bushes. Do they belong in the wilds?

March 28th	*Nature Bingo 2:00 -4:00 pm*
Donation:	*$5/adult; $2/child*
April 10th	*Spring Surprises 2:30 - 4:30 pm*
Donation:	*$5/adult;$3/child*

Help Clear the Trail

How often do you get a chance to do important work in beautiful surroundings? You can help us clear TDOLC trail. We need your assistance...and your good company. Spend a few hours in beautiful country with great people! We'll bring lunch! Call 949-489-9778 for directions.

March 20	*8:00 -11:30 am*	
April 17	*8:00 - 11:30 pm*	*FREE*

Weed Warriors

Help rid The Conservancy of invisive weeds. Help out the native wildlife...Maintain the food supply for our animals by protecting their food plants!

March 14	*9:00 - 11:30 am*	
April 17	*1:30 - 4:30 pm*	*FREE*

Summary of April Events

10th	*Family Nature Walk Spring Surprises (2:30 pm)*
17th	*Trail Clearing (8 am)*
17th	*Weed Warriors (1:30 pm)*
24th	*Wildflower & Butterfly Walk (9:30 am and/or 1 pm)*
24th	*Astronomy Night (8 pm)*
30th	*Sunset Walk (6pm)*

Wildlife Workshops

The Richard and Donna O'Neill Garden Tour

(continued from page 1)

garden is a wonderful combination of drought tolerant plants from all over the world. Bring your camera! Scenes from Richard and Donna O'Neill's garden appears in Mr. Lyon's photographic pictorial book, "Desert Gardens." This beautiful book features many elegant southern California gardens.

This is our spring benefit. We will provide three opportunities for tours: 9 a.m., 11:30 a.m., and 2 p.m. For more information, and to register for a tour, see the registration form on page eight of this newsletter.

Tree of Life Nursery Benefit Plant Sale

Support The Conservancy on May 15 (9 am to 4 pm) by attending our benefit plant sale at Tree of Life Nursery (near San Juan Capistrano).

The Tree of Life Nursery is amazing--the largest native plant nursery in the state of California, with the widest selection of native species.

Bring the true color fragrance, and seasons of California to your yard and patio. Support wild California with your planting--and your dollars. Proceeds benefit The Donna O'Neill Land Conservancy. Call 949-489-9778 for directions.

Programs of the Orange County Natural History Association

The Orange County Natural History Association has great programs. Call to find out about the upcoming speakers (at Irvine Ranch Water District). Visit the museum in Aliso Wood Canyons. Call 949-831-3287.

Sierra Sage

Sierra Sage offers monthly lectures, many local hikes, and some field trips for adults. For information, call Paul Carlton at 949-661-9505. Call if you are interested in supporting national conservation efforts.

WILDFLOWER WANDER...and Butterfly Walk

Wander with a naturalist guide through the hills and canyons of the TDOLC reserve in search of wildflowers and/or butterflies. To assist you with your identification skills, we will provide you with a wildflower and/or butterfly list.

Bring lunch and plenty of water and wear comfortable walking shoes or hiking boots, a hat, and sunscreen. Cameras and binoculars are welcome. Please call for reservations (949-489-9778).

March 20th ***First Day of Spring Wildflower Walk***
Explore from ridge to canyon, looking for March wildflowers: California buttercup, blue-eyed grass, popcorn flower, and more! Also search for butterflies. Receive a wildflower list and magnifying lens.
1:00 pm - 3:30pm *Donation:* *$6.00/person*

April 24th ***Wildflower and Butterfly Walk***
Explore from ridge to canyon, looking for April wildflowers. Bring a picnic lunch. Receive a wildflower list, butterfly list, and a magnifying lens.
9:30 am - 12:00 noon *Donation:* *$6.00/person*
and/or 1:00 pm - 5:00 pm

Thank you to The Donna O'Neill Endowment Fund Founders for their $5,000 donations:

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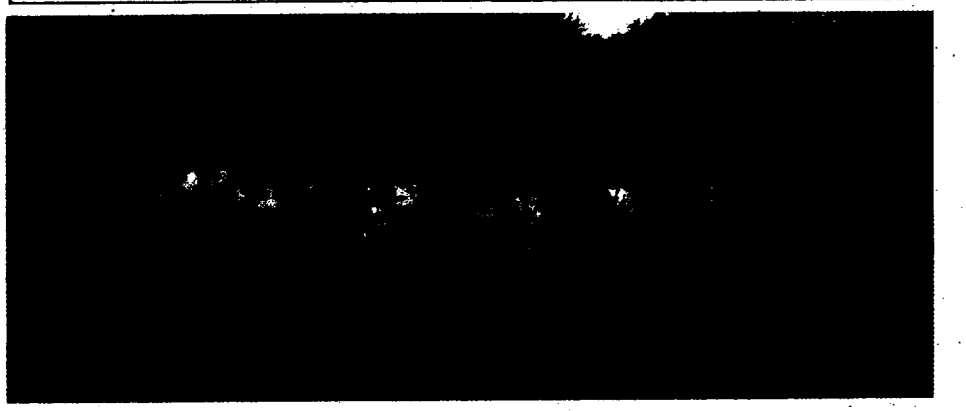
The Donna O'Neill Land Conservancy

at Rancho Mission Viejo

2003 Annual Report

The Donna O'Neill Land Conservancy is the steward for a wildlife reserve located in the coastal foothills of Southern California. Our mission is to create awareness about the rich natural and ecological resources of the San Mateo Watershed by providing opportunities for environmental education, biological research, and sensitive recreational access to the 1200-acre Donna O'Neill Land Conservancy in Orange County, California.



TDOLC Ecological Reserve

Nestled in the coastal foothills of southern Orange County lies a wildlife refuge representative of coastal Southern California as it appeared before the arrival of the Spanish settlers more than two centuries ago.

Oak Woodlands, Coastal Sage Scrub, and Valley Grasslands cloak the hills and canyons, providing a rich mosaic of habitats. Sagebrush, buckwheat, white sage, lemonadeberry, and monkeyflower are among the natives found within the scrub. Dense oak canopies traverse the entire reserve. Several coast live oaks within the woodlands are estimated to be over 500 years old. The high quality grasslands, dominated by purple needlegrass, delicately follow geologic contours of the landscape. The spring wildflower display is spectacular.

Secretive mammals such as the mule deer, bobcat, gray fox and mountain lion frequently leave their tracks in the sand. Hawks soar above, and song birds dart in and out of the trees.

Only 10 miles from a major urban center, the 1200-acre reserve offers a local wilderness experience to the community

TDOLC Management and Programs

The Donna O'Neill Land Conservancy is a non-profit 501(c)(3) corporation managed by a nine-member Board of Directors and a paid, full-time executive director.

The Conservancy steadfastly seeks to provide opportunities for the community to experience the beauty and solitude of wildlands. We provide a range of programs from nature walks to natural history lectures, which we advertise in Orange County newspapers and in our own quarterly newsletter. Conservancy programs draw visitors from as far away as Los Angeles, Riverside, and San Diego Counties. This year, more than 9,700 individuals participated in Conservancy programs, and 229 individuals and families supported the Conservancy as members.

Nature Walks

Throughout the year, guided nature walks are offered by biologists and trained docents. This year, more than 1,000 individuals participated. It is our goal to teach the community about the wondrous richness of California's biodiversity. Our Orange County natural legacy is often taken for granted. Orange County alone has 440 species of birds, five times more than are found in Yosemite National Park.

Children's Programs

Nature walks are regularly provided for groups of children, from scouts to science clubs to school groups. In 2003, more than 1,100 students visited TDOLC for our field studies program. Scout and Club programs were also provided.

Sixty children and their parents volunteered to eliminate invasive species and maintain trails.

The Orange County Wildlife Slide Presentations-for-Projects program brought photographer Richard Jackson's intimate portraits of our diverse species for free to 5,600 children all over the county. In exchange, each child completed a project on behalf of Orange County wildlife, from fund-raising to purchasing land to letter-writing to planting.

Astronomy Nights

Astronomers offer the popular monthly astronomy nights at the reserve, pointing their telescopes at the heavens. Dark evening skies are another benefit of protected wildlands.

Stewardship Projects

Control of non-native, invasive species is one of our most difficult problems. This year, with the help of seventy volunteers, we have removed hundreds of artichoke, milk, Italian, star, and Russian thistles . We have also seeded disturbed areas. Our latest Eagle Scout project involves creating a video about The Conservancy and its programs to attract more volunteers and support.

Research at the Reserve

South Coast Audubon conducts a Christmas Bird Count on the reserve annually. Members of the North American Butterfly Assn. conduct a Fourth of July butterfly count. Mountain lion use of the reserve is being informally monitored. A volunteer research group has been organized to begin monitoring other species.

Wildlife Workshops, Lectures & More...

Owls, bats, birds, insects, butterflies, native grasses, and wildflowers attracted much community attention. This year, these expert-led workshops were attended and enjoyed by several hundred individuals.

Community Outreach

Our TDOLC wildlife slide presentation has been shown to 150 individuals in libraries and local community groups. We continue to participate in Orange County Wild, an organization designed to link parks for resource sharing--and increasing public participation with private, county, state, and federal wilderness parks and reserves.

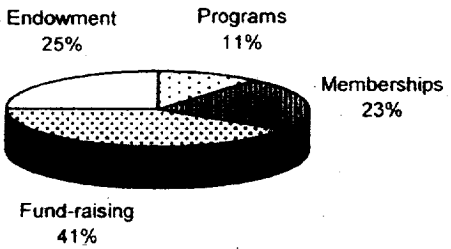
We provided activities at eleven large community events, from the Children's Drinking Water Festival to Earth Day at Upper Newport Bay. Our newsletter, detailing our events, is mailed quarterly to more than 1,100 individuals and distributed at libraries and businesses.

Our School Sponsorship program provides nature walks for underpriviledged children. We have also provided nature walks for many organizations, including college and high school classes, scouts, environmental groups, and church groups.

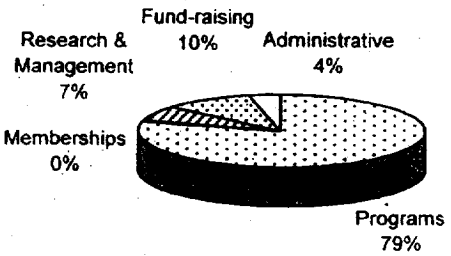
Volunteers

We have had much important assistance from volunteers. They are essential to our operations, from office work to trail maintenance to running our successful annual fund-raiser "A Date with Nature." In 2003, 212 volunteers contributed 1,850 hours of work.

Fiscal Year 2003



Total 2003 Revenues: $124,434



Total 2003 Expenses: $119,440

Winter Tracks

(continued from page 1)

increasing humility. (The workshop was causing us to take stock of our limitations and unrealized potential.")

Gato Road is overgrown with emerging plants, making it difficult to find footprints. That didn't stop Dean, "What about that hole in the slope? Is that a track? What do you think lives there? Let's look around for evidence. Start at the hole and observe the area around it. Can you find any clues?" Seven feet from the burrow, we found a large scattering of acorn shell remnants. (This is the first ground squirrel burrow I've seen on the reserve. Ground squirrels started to appear on Gato Road about two years ago. These squirrels are themselves the tracks change. What is the story behind their appearance?)

A flock of birds flew overhead, disappearing into an old sycamore. "Are those birds 'tracks'?" queried Dean. "Visualize water rippling as a stone strikes its surface. The concentric circles are tracks created by the pebble. If you could trace the birds' path back to its beginning, you would find a story that ripples in all directions."

We are, in every waking moment, engulfed by the ripples of numerous stories. On and around the trails of our lives we find the tracks of these stories, and we can choose to read--or we can simply pass them by. This spring, join us and read the tracks! --Laura Cohen, Director

Keeping Cougars Wild

"Mountain Lion Foundation would like to find a residence at the urban edge where they can build a model cougar-proof enclosure. These enclosures keep domestic animals safe during the hours when mountain lions are most active. A cougar is killed every 3 days in California, often for eating unprotected pets or livestock. Would you like a cougar-proof enclosure for your animals? Call 916-442-2666 X100 for an enclosure application.

Mountain Lion

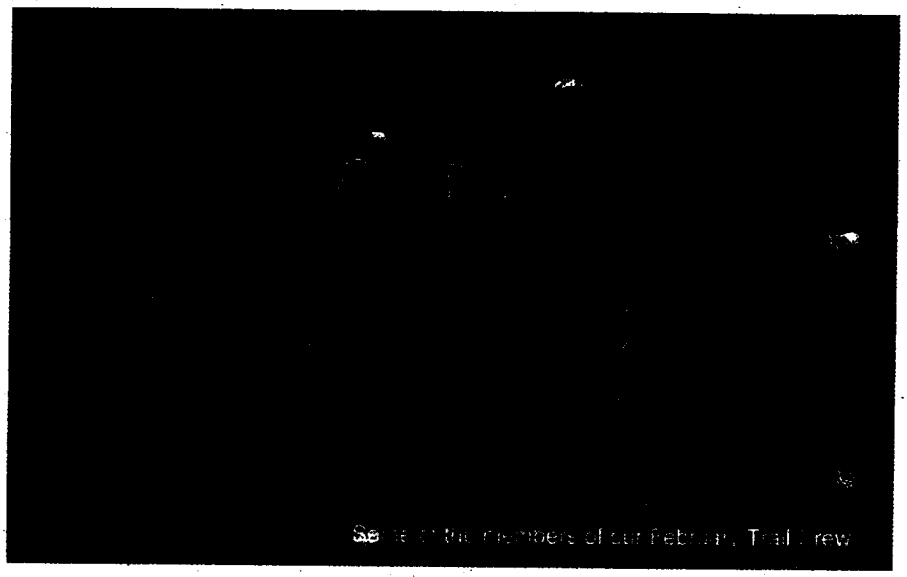
(continued from page 1)

depend on the plants die out. The hawks, owls, and other predators suffer because their prey is gone. Deer also have ticks that can carry Lyme disease. On the East Coast, Lyme disease is a big problem. In Orange County, where the deer population is kept at a healthy number by the lions, few people contract Lyme disease.

The mountain lion attacks are tragic, but they must be viewed in context. The fact is that in the U.S., only about 1 human dies from a mountain lion attack every five years. Compare that to 100 human deaths per year in deer-related accidents, 40 deaths per year from bee stings, or 18 human deaths per year from domestic dog attacks.

For every person killed by a lion, 1,200 are struck by lightening and 1,100 are killed in hunting accidents. Goats and jellyfish even account for more human fatalities than mountain lions. In the year 2000, in Orange County alone, more than 200 people committed suicide and 198 died in vehicular accidents.

The Conservancy thanks the Trail Angels, Trails for All, and all the others who organized the Outdoor Awareness Day. We appreciated the opportunity to share our information with the many wilderness enthusiasts. --Geordie Shaw, Educator



Some of the members of our February Trail Crew

Volunteer Thanks

Volunteers donated almost 2,000 hours of work in 2003 and they are off to an admirable start in 2004. Thanks to Judy & Jeff Bartholomew, La Verne Clark, Claudia Goodwin, Shirley Olson, Carla Polak, Steve and Lynne Robertson, and Rachel Whitt for their help around the office.

Thanks to our hard-working trail crews. In December: Pat Bearden, Don Kunze, Claire Prenovost, Steve & Lynne Robertson, and Ed Schlegel. In January: Don Kunze, Michael Johnson, Paul Miszkowicz, Steve & Lynne Robertson; Helen Scholfield, Rhonda Seamonds, Richard & Lorraine Seidmeyer, Rachel Whitt, and Tim Williams. In February: Ed Schlegel, Jeff Bartholomew, Paul Carlton, Pauline Faye, Ruth Gardner, John Kaiser, Don Kunze, Michelle Thames, and Tim Williams. Thanks to students of the El Toro High School Honor Society: Michelle Deeter, Melanie Gardner, Lauren Herzog, Elisa Kowal, Nhi Trung Nguyen, Ryan Stancil, and Rebecca Ziegler. Many thanks, also, to Amanda McConnell and the kids of the Central Youth and Family Resource Center for clearing our newest trail. Thanks to Dean Schroeder for his great tracking workshop!

The Donna O'Neill Land Conservancy
at Rancho Mission Viejo
P.O. Box 802
San Juan Capistrano, California 92693
949-489-9778 www.theconservancy.org

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To receive a monthly event list, please send us your e-mail address at: tdolc@lanset.com

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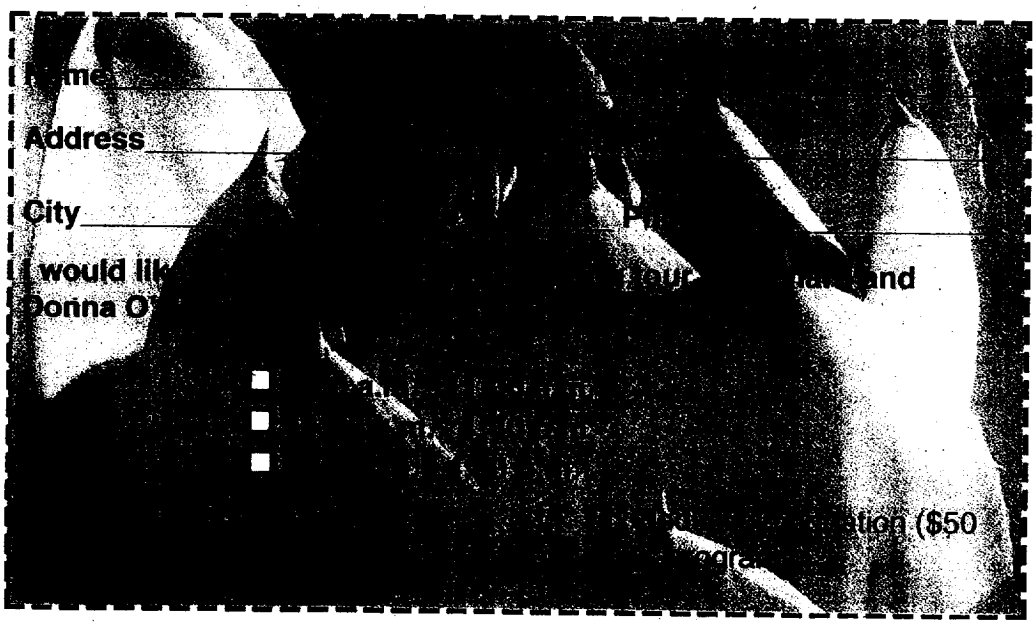
Tour the Magnificent Richard and Donna O'Neill Garden

Visit the private, world-class garden designed by Donna O'Neill with assistance from Gary Lyons, curator of the desert gardens at "The Huntington Library, Art Collections, and Botanical Gardens in San Marino." Enjoy a spectacular view of the San Juan Creek Valley and the Santa Ana Mountains.

Learn about the art of designing with cacti, succulents, and drought tolerant plants from our local area--and around the world. Bring your camera!

This is our spring benefit. On **May 8**, we will provide three opportunities for tours: **9 a.m., 11:30 a.m.**, and **2 p.m.** To participate, please send this form with your check in the enclosed envelope. Call 949-489-9778 for directions and further information. Register now! Participation is limited.



EXH 12

DIVIDER

550/9-74-004

INFORMATION ON LEVELS OF ENVIRONMENTAL NOISE REQUISITE TO PROTECT PUBLIC HEALTH AND WELFARE WITH AN ADEQUATE MARGIN OF SAFETY

MARCH 1974

PREPARED BY
THE U.S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF NOISE ABATEMENT AND CONTROL

This document has been approved for general availability. It does not constitute a standard, specification, or regulation.

For sale by the Superintendent of Documents, U.S. Government Printing Office Washington, D.C. 20402 - Price $2.10

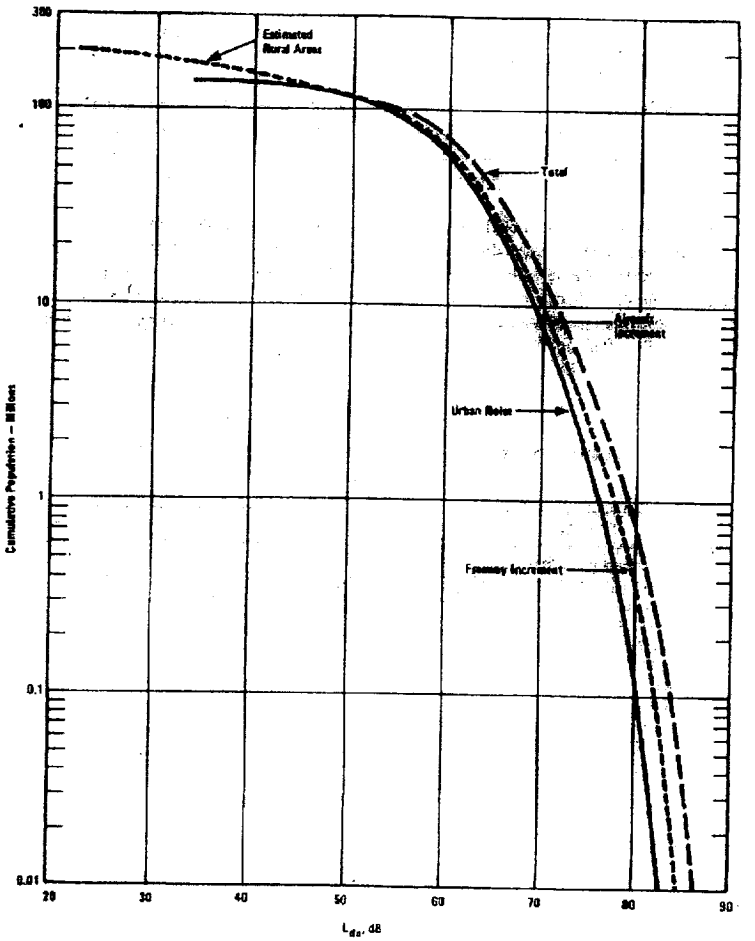
Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

FOREWORD

The Congress included among the requirements of the Noise Control Act of 1972 a directive that the Administrator of the Environmental Protection Agency "...develop and publish criteria with respect to noise..." and then "publish information on the levels of environmental noise the attainment and maintenance of which in defined areas under various conditions are requisite to protect the public health and welfare with an adequate margin of safety."

Not all of the scientific work that is required for basing such levels of environmental noise on precise objective factors has been completed. Some investigations are currently underway, and the need for others has been identified. These involve both special studies on various aspects of effects of noise on humans and the accumulation of additional epidemiological data. In some cases, a considerable period of time must elapse before the results will be meaningful, due to the long-term nature of the investigations involved. Nonetheless, there is information available from which extrapolations are possible and about which reasoned judgments can be made.

Given the foregoing, EPA has sought to provide information on the levels of noise requisite to protect public health and welfare with an adequate margin of safety. The information presented is based on analyses, extrapolations and evaluations of the present state of scientific knowledge. This approach is not unusual or different from that used for other environmental stressors and pollutants. As pointed out in "Air Quality Criteria"-Staff Report, Subcommittee on Air and Water Pollution, Committee on Public Works, U-S. Senate, July, 1968,



16

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Section 3

RATIONALE FOR IDENTIFICATION OF LEVELS OF ENVIRONMENTAL NOISE REQUISITE TO PROTECT PUBLIC HEALTH AND WELFARE

BASIS FOR IDENTIFYING LEVELS

For the identification of levels to protect against the direct, disease-producing effects of noise, protection against hearing loss is the guiding consideration. At this time, there is insufficient scientific evidence that non-auditory diseases are caused by noise levels lower than those that cause noise-induced hearing loss. In the event that future research renders this conclusion invalid, this document will be revised

accordingly (see Appendix E). in addition to direct disease-producing health effects, interference by noise with various human activities, such as speech-perception, sleep, and thought can lead to annoyance and indirect effects on well-being. All of these direct and indirect effects are considered here as effects on public health and welfare. It is important to note, however, the distinction between voluntary and involuntary exposures. Exposures to high levels of environmental noise are often produced or sought by the individual. For example, voluntary exposures to loud music are common. Consequently, the concept of total individual noise dose with regard to annoyance, must be applied only to involuntary exposure, although, of course, this argument does not apply to the effects of noise on hearing.

A further consideration is the physical setting in which the exposure takes place. Although there are no data to justify the assumption, it is judged here that, whereas a small amount of speech interference in most outdoor places is not detrimental to public health and welfare, the same is not true for most indoor environments. Based on this reasoning, adequate protection of the public against involuntary exposure to environmental noise requires special consideration of physical setting and the communication needs associated with each.

In the next subsection, the above rationale is applied to identify the maximum noise level consistent with an adequate margin of safety for the general classes of sound found most often in the environment. Certain special classes of sound, such as infrasound, ultrasound, and impulsive sounds are discussed in the final subsection.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

IDENTIFICATION OF MAXIMUM EXPOSURE LEVELS TO AVOID SIGNIFICANT ADVERSE EFFECTS

Hearing

Basic Considerations

The following considerations have been applied in identifying the environmental noise levels requisite to protect the hearing of the general population. For detailed derivation, justification and references, (see Appendix C).

1. The human ear, when damaged by noise, is typically affected at the 4000 Hz frequency first, and, therefore, this frequency can be considered the most noise-sensitive frequency. The averaged frequencies of 500 Hz, 1000 Hz and 2000 Hz have traditionally been employed in hearing conservation criteria because of their importance to the hearing of speech sounds. Since there is considerable evidence that frequencies above 2000 Hz are critical to the understanding of speech in lifelike situations, and since 4000 Hz is considered the most sensitive frequency, 4000 Hz has been selected as the most important frequency to be protected in this document.
2. Changes in hearing level of less than 5 dB are generally not considered noticeable or significant.
3. As individuals approach the high end of the distribution and their hearing levels are decreased,

they become less affected by noise exposure. In other words, there comes a point where one cannot be damaged by sounds, which one cannot hear.

4. The noise level chosen protects against hearing loss up to and including the 96th percentile of the population, ranked according to decreasing ability to hear at 4000 Hz. Since the percentiles beyond that point are also protected (see consideration number 3), virtually the entire population is protected against incurring more than a 5 dB noise-induced permanent threshold shift (NIPTS).

Explanation of Identified Level for Hearing Loss

Taking into account the assumptions and considerations mentioned above, the 8-hour exposure level, which protects virtually the entire population from greater than 5 dB NIPTS is 73 dB, (see Figure 3). Before this value of 73 dB for 8-hour exposures can be applied to the environmental situation, however, certain correction or conversion factors must be considered. These correction factors are:

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

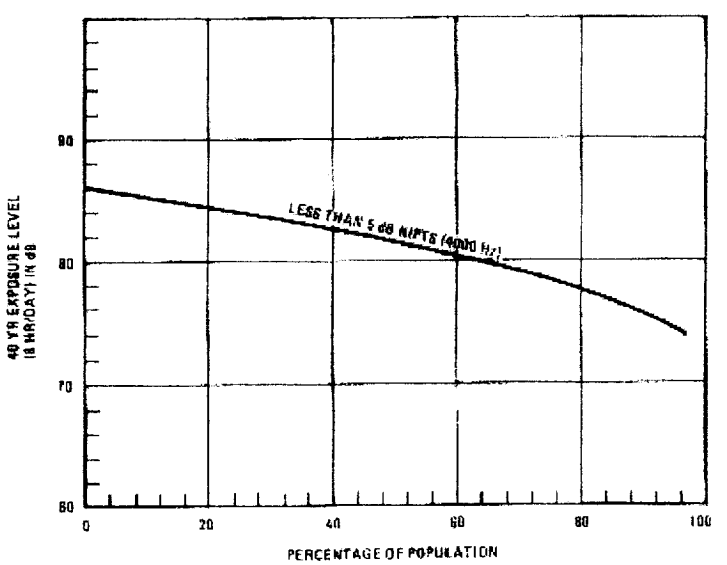


Figure 3. Percentage of Exposed Population That Will Incur No More Than 5 dB NIPTS Shown as a Function of Exposure Level. Population Ranked by Decreasing Ability to Hear at 4000 Hz. (See Appendix C for Rationale).

1. Intermittency: allows the exposure level to be 5 dB higher. This correction factor is required because most environmental noise is intermittent (not at a steady level, but below 65 dBA more than 10% of any one-hour period) and intermittent noise has been shown less damaging than continuous noise of the same L_{eq}. This correction should normally be applied except in situations that do not meet this criterion for intermittency.

2. Correction to yearly dose (250 to 365 days): requires reduction of the exposure level by 1.6 dB. All data used as the basis of Figure 3 come from occupational exposures which are only 250 days per year, whereas, this document must consider all 365 days in a year.

3. Correction to twenty-four hour day: the identified level of 73 dB is based on 8-hour daily exposures. Conversion to a 24-hour period using the equal-energy rule requires reduction of this level by 5 dB. This means that continuous sounds of a 24-hour duration must be 5 dB less intense than higher level sounds of only 8 hours duration, with the remaining 16 hours considered quiet.

Using the above corrections and conversions implies that the average 8-hour daily dose (based on a yearly average and assuming intermittent noise) should be no greater

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

---

than $L_{eq(8)} = 73+5-1.6 = 76.4$ dB. Extending the duration to 24 hours would yield a value of 71.4 dB. For continuous noise, this value would be 66.4 dB. However, since environmental noise is intermittent, this level is below that which is considered necessary to protect public health and welfare. In view of possible statistical errors in the basic data, it is considered reasonable, especially with respect to a margin of safety, to round down from 71.4 dB to 70 dB. Therefore, the level of intermittent noise identified here for purposes of protection against hearing loss is:

$$L_{eq(24)} = 70 \text{ dB}$$

(For explanation of the relationship between exposures of $L_{eq(8)} = 75$ dB and $L_{eq(24)} = 70$ dB, please see page 4.)

Adequate Margin of Safety

Section 5(a)(2), as stated previously, requires an adequate margin of safety. The level identified to protect against hearing loss, is based on three margins of safety considerations

1. The level protects at the frequency where the ear is most sensitive (4,000 Hz).

2. It protects virtually the whole population from exceeding 5 dB NIPTS.

3. It rounds off in the direction of hearing conservation (downward) to provide in part for uncertainties in analyzing the data.

Activity Interference/Annoyance

Basic Considerations

The levels of environmental noise which interfere with human activity (see Appendix D for detailed dicussion) depend upon the activity and its contextual frame of reference; I.e., they depend upon "defined areas under various conditions". The effect of activity interference is often described in terms of annoyance. However, various non-level related factors, such as attitude towards the noise source and local conditions, may influence an individual's reaction to activity interferences.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

The levels which interfere with listening to a desired sound, such as speech or music, can be defined in terms of the level of interfering sound required to mask the desired sound. Such levels have been quantified for speech communication by directly measuring the interference with speech intelligibility as a function of the level of the intruding sound, relative to the level of the speech sounds.

The levels interfering with human activities which do not involve active listening have not been as well quantified relative to the level of a desired sound. These relationships are more complicated because interference caused by an intruding sound depends upon the background level and the state of the human auditor; e.g., the degree of concentration when endeavoring to accomplish a mental task, or the depth of sleep, etc. Fortunately, there is a wealth of survey data on community reaction to environmental noise which, although subject to some shortcomings when taken alone, can be used to supplement activity interference data to identify noise levels requisite to protect public health and welfare. Thus, the levels identified here primarily reflect results of research on community reaction and speech masking.

Identified Levels for Interference

The level identified for the protection of speech communication is an L_{eq} of 45 dB within the home in order to provide for 100% intelligibility of speech sounds. Allowing for the 15 dB reduction in sound level between outdoors and indoors (which is an average amount of sound attenuation that assumes partly-open windows), this level becomes an outdoor L_{eq} of 60 dB for residential areas. For outdoor voice communication, the outdoor L_{eq} of 60 dB allows normal conversation at distances up to 2 meters with 95% sentence intelligibility.

Although speech-interference has been identified as the primary interference of noise with human activities and is one of the primary reasons for adverse community reactions to noise and long-term annoyance, the 10 dB nighttime weighting (and, hence, the term L_{dn}) is applied to give adequate weight to all of the other adverse effects on activity interference. For the same reason, a 5 dB margin of safety/ is applied to the identified outdoor level. Therefore, the outdoor L_{dn} identified for residential areas is 5 5 dB. (See Appendix E for relationship of L_{eq} to L_{dn}.)

The associated interior day-night sound level within a typical home which results from outdoors is 15 dB less, or 40 dB due to the attenuation of the structure. The expected indoor daytime level for a typical neighborhood which has an outdoor L_{dn} of 55 dB is approximately 40 dB, whereas the nighttime level is approximately 32 dB (see Figure A-7). This latter value is consistent with the limited available sleep

criteria [D-5]. Additionally,

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

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these indoor levels of 40 dB during the day and approximately 32 dB at night are consistent with the background levels inside the home which have been recommended by acoustical consultants as acceptable for many years, (see Table D-10).

The effects associated with an outdoor day-night sound level of 55 dB are summarized in Table 3. The summary shows that satisfactory outdoor average sentence intelligibility may be expected for normal voice conversations over distances of up to 3.5 meters; that depending on attitude and other non-level related factors, the average expected community reaction is none, although 1% may complain and 17% indicate "highly annoyed" when responding to social survey questions; and that noise is the least important factor governing attitude towards the area.

Identification of a level which is 5 dB higher than the 55 dB identified above would significantly increase the severity of the average community reaction, as well as the expected percentage of complaints and annoyance. Conversely, identification of a level 5 dB lower than the 55 dB identified above would reduce the indoor levels resulting from outdoor noise well below the typical background indoors (see Table 3) and probably make little change in annoyance since at levels below the identified level, individual attitude and life style, as well as local conditions, seem to be more important factors in controlling the resulting magnitude of annoyance or community reaction than is the absolute magnitude of the level of the intruding noise.

Accordingly, L_{dn} of 45 dB indoors and of 55 dB outdoors in residential areas are identified as the maximum levels below which no effects on public health and welfare occur due to interference with speech or other activity. These levels would also protect the vast majority of the population under most conditions against annoyance, in the absence of intrusive noises with particularly aversive content.

Adequate Margin of Safety

The outdoor environmental noise level identified in Table 3 provides a 5 dB margin of safety with respect to protecting speech communication. This is considered desirable for the indoor situation to provide for homes with less than average noise reduction or for persons speaking with less than average voice level. A higher margin of safety would be ineffective most of the time due to normal indoor activity background levels.

The 5 dB margin of safety is particularly desirable to protect the population against long-term annoyance with a higher probability than would be provided by the levels protecting indoor and outdoor speech communication capability alone. The 5 dB margin clearly shifts community response as well as subjective annoyance rating into the next lower

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Table 3

SUMMARY OF HUMAN EFFECTS IN TERMS OF SPEECH COMMUNICATION, COMMUNITY REACTIONS, ANNOYANCE AND ATTITUDE TOWARD AREA ASSOCIATED WITH AN OUTDOOR DAY/NIGHT SOUND LEVEL OF 55 dB re 20 MICROPASCALS

TYPE OF EFFECT	MAGNITUDE OF EFFECT
Speech - Indoors	100% sentence intelligibility (average) with a 5 dB margin of safety
Speech - Outdoors	100% sentence intelligibility (average) at 0.35 meters
	99% sentence intelligibility (average) at 1.0 meters
	95% sentence intelligibility (average) at 3.5 meters
Average Community Reaction	None evident; 7 dB below level of significant "complaints and threats of legal action" and at least 16 dB below "vigorous action" (attitudes and other non-level related factors may affect this result)
Complaints	1% dependent on attitude and other non-level related factors
Annoyance	1% dependent on attitude and other non-level related factors
Attitudes Towards Area	Noise essentially the least important of various factors

(Derived from Appendix D)

23

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

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response category than would be observed for the maximum level identified with respect to speech communication alone. According to present data, this margin of safety protects the vast majority of the population against long-term annoyance by noise. It would reduce environmental noise to a level where it is least important among environmental factors that influence the population's attitude toward the environment. To define an environment that eliminates any potential annoyance by noise occasionally to some part of the population appears not possible at the present state of knowledge.

EXH 13

DIVIDER

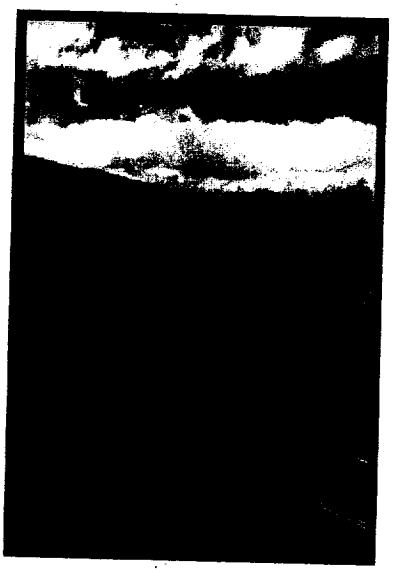
United States
Environmental Protection
Agency

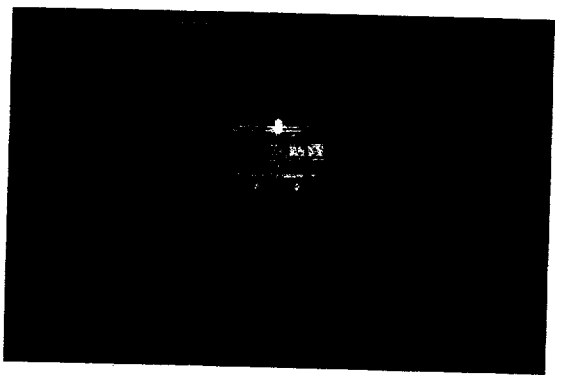
Policy
(2126)
Washington, DC 20460

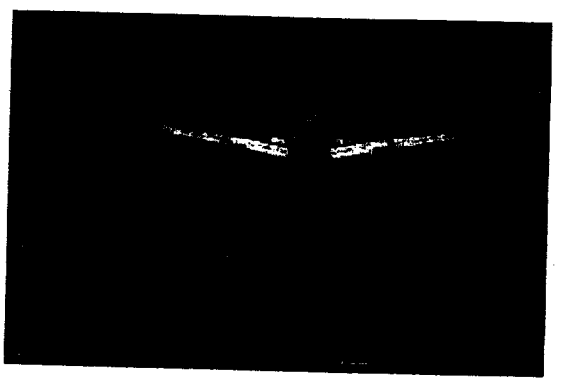
EPA 230-R-99-001
October 1999

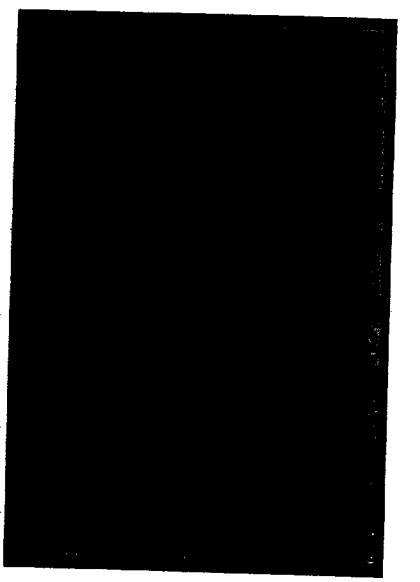
EPA

Indicators of the Environmental Impacts of Transportation









Updated Second Edition

Foreword

This is the second edition of a report issued by the U.S. Environmental Protection Agency on the environmental impacts of transportation in the United States. This report compiles national-level data on the effects of transportation on all environmental media — air, water, and land — and highlights environmental statistics that can be used to assess the magnitude of transportation impacts and track trends over time. It addresses a broad range of transportation-related activities, including infrastructure construction, vehicle and equipment manufacture, travel, operations and maintenance, and disposal. The document is designed as a reference for policy-makers, researchers, and others interested in the multi-media impacts of our nation's transportation system.

This report was prepared under contract #68-W4-0041 for the U.S. Environmental Protection Agency, Office of Policy, Energy and Transportation Sectors Division, by Hagler Bailly Services, Inc. EPA is pleased to acknowledge the input received during the initial report preparation process from representatives of the U.S. Department of Transportation (Office of the Secretary, Bureau of Transportation Statistics, Federal Aviation Administration, Federal Highway Administration), the U.S. Department of Energy, and the Center for Transportation and the Environment at North Carolina State University.

TABLE OF CONTENTS

1. Introduction **1**

1.1 Background 1

1.2 Definition of Indicators 5

1.3 Presentation of Environmental Indicators 9

2. Indicators Summary **11**

2.1 Criteria Air Pollutants 11

2.2 Toxics 19

2.3 Greenhouse Gases 20

2.4 Chloroflourocarbons and Stratospheric Ozone Depletion 23

2.5 Habitat and Land Use 24

2.6 Water Quality 28

2.7 Hazardous Materials Incidents 31

2.8 Noise 32

2.9 Solid Waste 33

3. Highway Environmental Indicators **35**

3.1 Highway Infrastructure Construction 35

3.2 Motor Vehicle and Parts Manufacture 42

3.3 On-Road Vehicle Travel 49

3.4 Maintenance, Support, and Operation 71

3.5 Disposal of Vehicles and Parts 78

4. Rail Environmental Indicators **85**

4.1 Railway Construction and Abandonment 85

4.2 Rail Car and Parts Manufacture 90

4.3 Rail Travel 94

4.4 Rail Operations, Maintenance and Support 104

4.5 Disposal of Rail Cars and Parts 109

5. Aviation Environmental Indicators **111**

5.1 Airport Construction and Infrastructure Improvement 111

5.2 Aircraft Parts and Manufacture 115

5.3 Air Travel 123

5.4 Aviation Operations and Support 137

5.5 Disposal of Aircraft and Parts 146

6. Maritime Environmental Indicators 147

6.1 Construction of Ports and Navigation Improvements 147

6.2 Manufacture of Vessels and Parts 153

6.3 Water-Borne Travel 160

6.4 Maritime Terminal Operation 175

6.5 Disposal of Vessels and Parts 180

7. Data Availability and Next Steps 181

7.1 Data Sources Focused on the Environment 181

7.2 Data Sources Focused on Transportation 186

7.3 Data Gaps 187

7.4 Next Steps 188

LIST OF TABLES

Table 2-1: Core Toxic Chemicals Released from Transportation Manufacturing Facilities (Subset of TRI Inventory) In Thousands of Pounds, 1988-1996 20

Table 2-2: Full Fuel Cycle CO_2-equivalent Emissions for Light-duty Motor Vehicles (grams per mile) 22

Table 2-3: Corrective Action Measures Reports for the Entire U.S., 1996-1998 30

Table 2-4: Percent of U.S. Population Exposed to Different Levels of Transportation Noise, 1980 32

Table 3-1: Wetland Losses and Creation Associated with the Federal Aid Highway Program 37

Table 3-2: Land Area Occupied by Roadways, 1990-1997 (Square Miles) 38

Table 3-3: Lane Miles, 1990-1997 38

Table 3-4: Public Road Mileage, 1945-1997 39

Table 3-5: Unpaved and Paved Public Road Mileage, 1945-1997 41

Table 3-6: Toxic Chemicals released from Motor Vehicle-Related Manufacturing Facilities, 1996 (pounds per year) 44

Table 3-7: Toxic Chemicals (Core) Released from Motor Vehicle-Related Manufacturing Facilities (SIC 3711, 3713, 3714, 3715, 3716, 3717, and 3792), 1988-1996 (thousands of pounds per year) 45

Table 3-8: Criteria Pollutant Emissions from Vehicle Manufacturing Facilities, 1990-1996 (short tons) 46

Table 3-9: Criteria Pollutant Emissions from Vehicle Manufacturing Facilities by SIC Code, 1996 46

Table 3-10: VOC Emissions from Solvent Utilization in Surface Coating for Autos & Light Trucks (Point and Area Sources), 1970-1997 47

Table 3-11: VOC Emissions from Motor Vehicle and Parts Manufacturing Facilities reported to AIRS 47

Table 3-12: CO Emissions from Motor Vehicle and Parts Manufacturing Facilities reported to AIRS 48

Table 3-13: NO_2 Emissions from Motor Vehicle and Parts Manufacturing Facilities reported to AIRS 48

Table 3-14: SO_2 Emissions from Motor Vehicle and Parts Manufacturing Facilities reported to AIRS 48

Table 3-15: PM_{10} Emissions from Motor Vehicle and Parts Manufacturing Facilities reported to AIRS 48

Table 3-16: Criteria Pollutant Emissions from Motor Vehicle Travel, 1997 50

Table 3-17: VOC Emissions from On-Road Vehicles, 1940-1997 51

Table 3-18: VOC Emissions by On-Road Vehicle Category (thousand short tons), 1970-1990 51

Table 3-19: NOx Emissions from On-Road Vehicles, 1940-1997 52

Table 3-20: NOx Emissions by On-Road Vehicle Category (thousand short tons), 1970-1997 52

Table 3-21: CO Emissions from On-Road Vehicles, 1940-1997 53

Table 3-22: CO Emissions by On-Road Vehicle Category (thousand short tons), 1970-1997 53

Table 3-23: PM_{10} Emissions from On-Road Vehicles, 1940-1997 54

Table 3-24: PM_{10} Emissions by On-Road Vehicle Category (thousand short tons), 1970-1997 54

Table 3-25: $PM_{2.5}$ Emissions from On-Road Vehicles, 1990-1997 55

Table 3-26: $PM_{2.5}$ Emissions by On-Road Vehicle Category (thousand short tons), 1970-1997 55

Table 3-27: SO_2 Emissions from On-Road Vehicles 56

Table 3-28: SO_2 Emissions from On-Road Vehicle Category (thousand short tons), 1970-1997 56

Table 3-29: Lead Emissions from On-Road Vehicles, 1940-1997 57

Table 3-30: Lead Emissions by On-Road Vehicle Category (short tons), 1970-1997 57

Table 3-31: Motor Vehicle Emissions of Toxic Pollutants, 1990 58

Table 3-32: PM_{10} Fugitive Dust, Emissions by Road Type, 1985-1997 59

Table 3-33: Carbon Dioxide Emissions by On-Road Vehicle Category (million metric tons of carbon) 60

Table 3-34: Nitrous Oxide Emissions from Motor Vehicles (thousand metric tons) 61

Table 3-35: Methane Emissions from Motor Vehicles (thousand metric tons) 62

Table 3-36: Estimated U.S. Emissions of CFC-12 and HFC-134a (all sources), 1990-1997 (thousand metric tons of gas) 64

Table 3-37: Percent of U.S. Population Exposed to Road Transportation Noise, 1980 65

Table 3-38: Length of Noise Barriers Constructed (miles) and Cost 65

Table 3-39: Highway Hazardous Materials Incident Totals, 1990-1997 67

Table 3-40: Highway Hazardous Materials Incidents, 1997 68

Table 3-41: Highway Salt Sales, 1970-1997 73

Table 3-42: Typical Motor Freight Terminal Operations: Materials Used and Types of Waste Possibly Generated 74

Table 3-43: VOC Emissions from Service Stations, 1940-1997 76

Table 3-44: Corrective Action Measures Reports for the U.S., 1996-1998 77

Table 3-45: Motor Vehicle Scrapped Annually (thousands) 79

Table 3-46: Rubber Tires in Municipal Solid Waste Stream, 1960-1996 82

Table 3-47: Lead Acid Batteries in Municipal Solid Waste Stream, 1960-1996 83

Table 4-1: Rail System Mileage in the U.S., 1960-1996 87

Table 4-2: New Rail and Crossties Laid by Class I Railroads, 1955-1996 89

Table 4-3: Criteria Pollutant Emissions from Vehicle Manufacturing Facilities, 1990-1996 (short tons) 90

Table 4-4: VOC Emissions from Solvent Utilization in Surface Coating for Rail Equipment (Point and Area Sources), 1940-1997 91

Table 4-5: Pollutant Emissions from Rail Equipment Manufacturing Facilities Reported to AIRS 91

Table 4-6: Toxic Chemicals (Core) Released from Railroad Equipment Manufacturing Facilities (SIC 3743), 1988-1996 (thousands of pounds per year) 93

Table 4-7: Criteria Pollutant Emissions from Railroad Operations, 1997 95

Table 4-8: CO Emissions from Railroad Operations, 1940-1997 96

Table 4-9: NOx Emissions from Railroad Operations, 1940-1997 96

Table 4-10: VOC Emissions from Railroad Operations, 1940-1997 97

Table 4-11: SO_2 Emissions from Railroad Operations, 1940-1997 97

Table 4-12: PM_{10} Emissions from Railroad Operations, 1940-1997 98

Table 4-13: $PM_{2.5}$ Emissions from Railroad Operations, 1940-1997 98

Table 4-14: Carbon Dioxide Emissions from Fossil Fuel Combustion in Rail Travel (million metric tons of carbon) 99

Table 4-15: Nitrous Oxide and Methane Emissions from Rail Travel, 1996 100

Table 4-16: Percent of U.S. Population Exposed to Rail Transportation Noise, 1980 100

Table 4-17: Railroad Hazardous Materials Incident Totals, 1990-1997 102

Table 4-18: Railroad Hazardous Materials Incidents, 1997 103

Table 4-19: Typical Railroad Terminal Operations: Materials Used and Types of Waste Possibly Generated 104

Table 4:20: Criteria Pollutant Emissions from Railway Maintenance, 1997 106

Table 4-21: CO Emissions from Railway Maintenance, 1986-1997 106

Table 4-22: VOC Emissions from Railway Maintenance, 1987-1997 107

Table 4-23: PM_{10} Emissions from Railway Maintenance, 1986-1997 107

Table 4-24: Pollutant Emissions from Line-Haul Operating Railroads (SIC 4011) Reported to AIRS 108

Table 5-1: Number of Airports in the U.S., 1980-1997 112

Table 5-2: Percent of Airports with Paved Runways, 1980-1997 114

Table 5-3: Criteria Pollutant Emissions from Aircraft Manufacturing Facilities, 1990-1996 (short tons) 116

Table 5-4: Criteria Pollutant Emissions from Aircraft Manufacturing Facilities by SIC Code, 1996 116

Table 5-5: VOC Emissions from Solvent Utilization in Surface Coating for Aircraft (Point and Area Sources), 1970-1997 117

Table 5-6: VOC Emissions from Aircraft and Parts Manufacturing Facilities Reported to AIRS 117

Table 5-7: CO Emissions from Aircraft and Parts Manufacturing Facilities Reported to AIRS 118

Table 5-8: NO_2 Emissions from Aircraft and Parts Manufacturing Facilities Reported to AIRS 118

Table 5-9: SO_2 Emissions from Aircraft and Parts Manufacturing Facilities Reported to AIRS 118

Table 5-10: PM_{10} Emissions from Aircraft and Parts Manufacturing Facilities Reported to AIRS 118

Table 5-11: Wastes Associated with Airplane Manufacturing Processes 120

Table 5-12: Toxic Chemicals Released from Aircraft-Related Manufacturing Facilities, 1996 (pounds per year 121

Table 5-13: Top 5 TRI Releasing Facilities Reporting Only 372 SIC Codes to TRI, 1996 122

Table 5-14: Toxic Chemicals (Core) Released from Aircraft-Related Manufacturing Facilities (SIC 3721, 3724, 3728), 1988-1996 (thousands of pounds per year) 122

Table 5-15: Criteria Pollutant Emissions from Aircraft Travel, 1997 124

Table 5-16: CO Emissions from Aircraft, 1940-1997 125

Table 5-17: NOx Emissions from Aircraft, 1940-1997 125

Table 5-18: VOC Emissions from Aircraft, 1940-1997 126

Table 5-19: SO_2 Emissions from Aircraft, 1940-1997 126

Table 5-20: PM_{10} Emissions from Aircraft, 1940-1997 127

Table 5-21: $PM_{2.5}$ Emissions from Aircraft, 1990-1997 127

Table 5-22: Lead Emissions from Aircraft, 1970-1997 128

Table 5-23: Carbon Dioxide Emissions from Fossil Fuel Combustion in Air Travel (million metric tons of carbon) 129

Table 5-24: Nitrous Oxide and Methane Emissions from Aircraft Travel, 1996 130

Table 5-25: Population Exposed to DNL 65 dB from Aircraft 131

Table 5-26: Population Exposed to 65 DNL at 30 Busiest Airports 132

Table 5-27: Aviation Hazardous Materials Incident Totals, 1990-1997 133

Table 5-28: Aviation Hazardous Materials Incidents, 1997 134

Table 5-29: Collisions between Wildlife and Civil Aircraft in the U.S., 1991-1997 136

Table 5-30: Criteria Pollutant Emissions from Airport, Flying Fields, and Terminals, 1990-1996 (short tons) 139

Table 5-31: VOC Emissions from Airports and Aviation Support Facilities reported to AIRS 139

Table 5-32: CO Emissions from Airports and Aviation Support Facilities Reported to AIRS 139

Table 5-33: NO_2 Emissions from Airports and Aviation Support Facilities Reported to AIRS 140

Table 5-34: SO_2 Emissions from Airports and Aviation Support Facilities Reported to AIRS 140

Table 5-35: PM_{10} Emissions from Airports and Aviation Support Facilities Reported to AIRS 140

Table 5-36: Criteria Pollutant Emissions from Airport Service Vehicles, 1997 140

Table 5-37: CO Emissions from Airport Service Vehicles, 1940-1997 141

Table 5-38: NO_X Emissions from Airport Service Vehicles, 1940-1997 141

Table 5-39: VOC Emissions from Airport Service Vehicles, 1940-1997 142

Table 5-40: PM_{10} Emissions from Airport Service Vehicles, 1940-1997 142

Table 6-1: Quantities Dredged by the U.S. Army Corps of Engineers, 1990-1998 150

Table 6-2: Disposal of Dredged by the U.S. Army Corps of Engineers, 1990-1998 150

Table 6-3: Criteria Pollutant Emissions from Ship and Boat Building and Repairing Facilities, 1990-1996 (short tons) 154

Table 6-4: Criteria Pollutant Emissions from Ship and Boat Building and Repairing Facilities by SIC Code, 1996 (short tons) 154

Table 6-5: VOC Emissions from Solvent Utilization in Manufacture of Large Ships (Point and Area Sources), 1940-1997 155

Table 6-6: VOC Emissions from Vessel Manufacturing Facilities Reported to AIRS 155

Table 6-7: CO Emissions from Vessel Manufacturing Facilities Reported to AIRS 156

Table 6-8: NO_2 Emissions from Vessel Manufacturing Facilities Reported to AIRS 156

Table 6-9: SO_2 Emissions from Vessel Manufacturing Facilities Reported to AIRS 156

Table 6-10: PM_{10} Emissions from Vessel Manufacturing Facilities Reported to AIRS 156

Table 6-11: Wastes Associated with Ship and Boat Manufacturing Processes 157

Table 6-12: Toxic Chemicals Released from Ship- and Boat-Building & Repairing Facilities, 1996 (pounds per year) 158

Table 6-13: Toxic Chemicals (Core) Released from Ship- and Boat-Building & Repairing Facilities, SIC 3731, 3732), 1988-1996 (thousands of pounds per year) 159

Table 6-14: Criteria Pollutant Emissions from Marine Vessel Travel, 1997 161

Table 6-15: CO Emissions from Ships and Boats, 1940-1997 162

Table 6-16: NOx Emissions from Ships and Boats, 1940-1997 162

Table 6-17: VOC Emissions from Ships and Boats, 1940-1997 163

Table 6-18: SO_2 Emissions from Ships and Boats, 1940-1997 163

Table 6-19: PM_{10} Emissions from Ships and Boats, 1940-1997 164

Table 6-20: $PM_{2.5}$ Emissions from Ships and Boats, 1940-1997 164

Table 6-21: Carbon Dioxide Emissions from Fossil Fuel Combustion in Water-borne Travel (million metric tons of carbon) 165

Table 6-22: Nitrous Oxide and Methane Emissions from Water-borne Travel, 1996 166

Table 6-23: Oil Spills in U.S. Navigable Waters from Vessel Incidents (Number of Incidents and Volume, in thousands of gallons), 1982-1996 169

Table 6-24: Maritime Hazardous Materials Incident Totals, 1990-1997 169

Table 6-25: Maritime Hazardous Materials Incident Totals, 1997 170

Table 6-26: Estimated Annual Garbage Generation by U.S. Maritime Sectors 174

Table 6-27: VOC Emissions from Marine Facilities Reported to AIRS 176

Table 6-28: CO Emissions from Marine Facilities Reported to AIRS 176

Table 6-29: NO_2 Emissions from Marine Facilities Reported to AIRS 176

Table 6-30: SO_2 Emissions from Marine Facilities Reported to AIRS 176

Table 6-31: PM_{10} Emissions from Marine Facilities Reported to AIRS 177

Table 6-32: Wastes Associated with Marine Vessel Terminal Operations 177

Table 7-1: Summary of Major Environment-Focused Databases and Publications 182

LIST OF FIGURES

Figure 1-1: Effects of Transportation and Related Activities on the Environment 8

Figure 2-1: Share of CO Emissions from Transportation, 1997 12

Figure 2-2: CO Emissions from Travel, 1970-1997 13

Figure 2-3: Share of VOC Emissions from Transportation, 1997 13

Figure 2-4: Share of NOx Emissions from Transportation, 1997 13

Figure 2-5: VOC and NOx Emissions from Travel, 1970-1997 14

Figure 2-6: Lead Emissions from Travel, 1970-1997 14

Figure 2-7: Share of PM_{10} Emissions from Transportation, 1997 15

Figure 2-8: Share of $PM_{2.5}$ Emissions from Transportation, 1997 15

Figure 2-9: Share of SO_2 Emissions from Transportation, 1997 16

Figure 2-10: Transportation Emissions, 1970-1997 16

Figure 2-11: Travel and Criteria Pollutant Emissions by Mode of Travel 17

Figure 2-12: Percent of Point Source Emissions from Transportation Vehicle and Equipment Manufacturing, 1997 18

Figure 2-13: Criteria Pollutant Emissions from Transportation Vehicle and Equipment Manufacturing, 1996 18

Figure 2-14: Mobile Source Contribution to HAP Inventories 19

Figure 2-15: Share of CO_2 Emissions from Transportation, 1997 21

Figure 2-16: Share of CH_4 Emissions from Transportation, 1997 23

Figure 2-17: Share of NO_2 Emissions from Transportation, 1997 23

Figure 2-18: Estimated U.S. Emissions of CFC-12 and HFC-134a, 1990-1997 24

Figure 2-19: Disposal/Use of Material Dredged by U.S. Army Corps of Engineers, 1998 25

Figure 2-20: Sources of Recent Wetland Loss 26

Figure 2-21: Number of Reported Strikes between Wildlife and Civil Aircraft 27

Figure 2-22: Number of Animal Collisions with Motor Vehicles Reported to HSIS 27

Figure 2-23: Number of Fuel Spills and Total Volume of Fuel Discharged Annually, 1982-1997 30

Figure 2-24: Number of Hazardous Materials Incidents, 1990-1997 31

Figure 2-25: U.S. Population Exposed to DNL of 65 dB or Greater from Aircraft 32

Figure 2-26: Number of Motor Vehicles Scrapped Annually (thousands), 1970-1995 33

Figure 3-1: VOC Emissions from Solvent Utilization in Surface Coating for Autos & Light Trucks (Point and Area Sources), 1970-1997 47

Figure 3-2: VOC Emissions from On-Road Vehicles 51

Figure 3-3: NO_X Emissions from On-Road Vehicles 52

Figure 3-4: CO Emissions from On-Road Vehicles 53

Figure 3-5: PM_{10} Emissions from On-Road Vehicles 54

Figure 3-6: $PM_{2.5}$ Emissions from On-Road Vehicles 55

Figure 3-7: SO_2 Emissions from On-Road Vehicles 56

Figure 3-8: Pb Emissions from On-Road Vehicles 57

Figure 3-9: Change in Criteria Pollutant Emissions Compared to Vehicle Travel, 1940-1997 58

Figure 3-10: PM_{10} Fugitive Dust Emissions 59

Figure 3-11: CO_2 Emissions from Motor Vehicles 61

Figure 3-12: N_2O Emissions from Motor Vehicles 62

Figure 3-13: CH_4 Emissions from Motor Vehicles 62

Figure 3-14: Highway Hazardous Materials Incidents, 1990-1997 67

Figure 3-15: Animal Collisions with Motor Vehicles 70

Figure 3-16: Highway Salt Sales 73

Figure 3-17: Uses of Salt in the U.S., 1996 73

Figure 3-18: VOC Emissions from Service Stations 76

Figure 3-19: Disposal of Used Oil, 1991 80

Figure 3-20: Disposition of Scrap Tires, 1995 81

Figure 4-1: VOC Emissions from Solvent Utilization in Surface Coating for Rail Equipment 91

Figure 4-2: CO Emissions from Railroad Operations 96

Figure 4-3: NO_X Emissions from Railroad Operations 96

Figure 4-4: VOC Emissions from Railroad Operations 97
Figure 4-5: SO_2 Emissions from Railroad Operations 97
Figure 4-6: PM_{10} Emissions from Railroad Operations 98
Figure 4-7: $PM_{2.5}$ Emissions from Railroad Operations 98
Figure 4-8: CO_2 Emissions from Railroads 99
Figure 4-9: Railroad Hazardous Materials Incidents, 1990-1997 102
Figure 4-10: CO Emissions from Railway Maintenance 106
Figure 4-11: VOC Emissions from Railway Maintenance 107
Figure 4-12: PM_{10} Emissions from Railway Maintenance 107
Figure 5-1: VOC Emissions from Solvent Utilization in Surface Coating for Aircraft 117
Figure 5-2: CO Emissions from Aircraft 125
Figure 5-3: NO_X Emissions from Aircraft 125
Figure 5-4: VOC Emissions from Aircraft 126
Figure 5-5: SO_2 Emissions from Aircraft 126
Figure 5-6: PM_{10} Emissions from Aircraft 127
Figure 5-7: $PM_{2.5}$ Emissions from Aircraft 127
Figure 5-8: Pb Emissions from Aircraft 128
Figure 5-9: Population Exposed to DNL 65 dB from Aircraft 131
Figure 5-10: Aviation Hazardous Materials Incidents, 1990-1997 134
Figure 5-11: Number of Reported Strikes between Wildlife and Civil Aircraft 136
Figure 5-12: CO Emissions from Airport Service Vehicles 141
Figure 5-13: NO_X Emissions from Airport Service Vehicles 141
Figure 5-14: VOC Emissions from Airport Service Vehicles 142
Figure 5-15: PM_{10} Emissions from Airport Service Vehicles 142
Figure 6-1: Disposal/Use of Material Dredged by Army Corps of Engineers, 1998 151
Figure 6-2: VOC Emissions from Solvent Utilization in Manufacture of Large Ships 155
Figure 6-3: CO Emissions from Ships and Boats 162

Figure 6-4: NO_X Emissions from Ships and Boats 162

Figure 6-5: VOC Emissions from Ships and Boats 163

Figure 6-6: SO_2 Emissions from Ships and Boats 163

Figure 6-7: PM_{10} Emissions from Ships and Boats 164

Figure 6-8: $PM_{2.5}$Emissions from Ships and Boats 164

Figure 6-9: Maritime Hazardous Materials Incidents, 1990-1997 170

1. INTRODUCTION

1.1 BACKGROUND

Although the nation's transportation system provides a wide range of benefits, it also generates unintended adverse impacts on environmental quality and human health. Since the late 1960s and early 1970s, increased recognition of environmental and health problems has led to significant policy actions aimed at reducing these impacts. Legislation on clean air and water, protection of environmentally sensitive habitats and species, noise control, and regulation of hazardous materials transportation, among others, have been successful in addressing some transportation impacts.

This report discusses transportation's impacts on the natural environment and provides quantitative estimates of those effects at a national level. It provides a comprehensive compilation of data on all of the environmental implications of the transportation sector. The document addresses all primary modes of transportation in environmental media and covers a wide range of transportation activities — infrastructure construction, vehicle maintenance, travel, operations and maintenance, and disposal. This document presents data that can be used as "indicators" of the magnitude of environmental problems associated with transportation.

PURPOSE

EPA intends this document to serve as a resource for transportation and environmental decisionmakers, researchers, and the public. The report compiles statistical information from many environmental data sources and identifies information that can be used to track environmental performance. EPA has three goals for this document:

1) To describe the full range of environmental impacts associated with transportation;

2) To identify quantified national-level data on these impacts; and

3) To assess gaps in data and limitations of various indicators.

This is the second edition of EPA's compilation of environmental indicators for the transportation sector. Since the first version of this report was completed in 1996, a large amount of new environmental information has become available. Environmental databases have been updated, methodologies have been revised, and new studies have been conducted. This document updates the environmental data and has been restructured to improve the presentation and discussion of environmental indicators.

SCOPE OF STUDY

When people think about the environmental impacts of transportation, they often think about habitat loss from road construction and air pollution from motor vehicle use. They often fail to consider other environmental consequences associated with transportation, such as the impacts of vehicle manufacture and supporting facilities. *This study is unique in its attempt to quantify the full range of environmental impacts caused by transportation.* It examines the full range of environmental consequences associated with four modes of transportation and for the transportation sector as a whole. The "life-cycle" of transportation activities and facilities is examined, although some upstream and downstream effects are

not emphasized. This study attempts to address the full range of environmental issues associated with transportation at a summary level.

MODES OF TRANSPORTATION

This report presents environmental information for four modes of transportation:

- ***Highway*** - The highway system includes road infrastructure, and on-road motor vehicles, including automobiles, light-duty trucks, buses, and freight trucks.
- ***Rail*** - The rail system includes intercity passenger rail (Amtrak), rail transit (light rail, heavy rail, and commuter rail), and freight rail.
- ***Aviation*** - The aviation system includes general and commercial aviation.
- ***Maritime*** - The maritime system includes water-borne freight, as well as passenger ferries and recreational boats.

In addition, this report compiles data on environmental impacts for the transportation sector as a whole, and identifies the contribution of travel and transportation-related industries in comparison to other sectors of the economy.

LIFE-CYCLE OF TRANSPORTATION ACTIVITIES

This report addresses the life-cycle of transportation activities and facilities:

- ***Infrastructure construction*** - Construction and development of transportation facilities, such as roadways, railways, airports, and navigation channels;
- ***Vehicle manufacture*** - Production of vehicles and parts (including motor vehicles, railcars and locomotives, aircraft, and ships and boats);
- ***Travel*** - Vehicle operations to transport people and goods;
- ***Operations, maintenance and support*** - Activities to support travel, such as application of deicing chemicals, as well as operation of facilities to support travel, such as gas stations, airport terminals, and marinas; and
- ***Disposal*** - Disposal or recycling of vehicles, parts, and facilities.

The upstream effects from ***fuel processing, storage, and distribution*** are also discussed briefly.

ENVIRONMENTAL CONSEQUENCES

This report examines the effects of transportation on all environmental media — air, water, and land. Because pollutant releases can have multi-media effects, this report generally presents environmental information by pollutant. It addresses:

- ***Criteria air pollutants*** —Pollutants that adversely affect human health and welfare: carbon monoxide (CO), ground level ozone (O_3) and its precursors, lead (Pb), nitrogen dioxide (NO_2), particulate matter (PM), and sulfur dioxide (SO_2);

- ***Toxics*** — Pollutants that cause or may cause cancer or other serious problems, such as reproductive effects or birth defects, or adverse ecological effects;
- ***Greenhouse gases*** — Compounds that contribute to global climate change by trapping heat within the Earth's atmosphere: carbon dioxide, methane, nitrous oxide, and several other compounds;
- ***Chlorofluorocarbons and stratospheric ozone depletion*** — Man-made chemicals that are known to deplete stratospheric ozone;
- ***Habitat and land use*** — Adverse effects on wildlife, ecosystems, and endangered species such as habitat destruction or fragmentation;
- ***Water quality and aquatic resources*** — Adverse effects to the water quality in lakes, streams, rivers, or groundwater and the ecosystems that depend on them;
- ***Hazardous materials incidents*** — Releases of hazardous materials during transportation;
- ***Noise*** — Unwanted sounds that interfere with communication or cause adverse health effects; and
- ***Solid waste*** — Disposal of materials and parts through recycling, reuse, or shipment to landfills.

IMPACTS DE-EMPHASIZED OR EXCLUDED

We have limited the scope of this study to the direct impacts of transportation infrastructure and activities. It does not address the full indirect, upstream, downstream, and historical impacts. Impacts de-emphasized or excluded include:

- ***Certain long-run and cumulative impacts*** — For example, no analysis of the historical destruction of wetlands and forests to build existing highways or the environmental benefits that would accrue if land use reverted to historical uses;
- ***Upstream impacts*** — Some examination of the manufacture of vehicles, but not raw inputs from the steel or chemical industries; limited evaluation of gasoline/oil refining;
- ***Downstream impacts*** — Some consideration of the disposal of tires, waste oil, and vehicles, but not a full analysis of all disposal impacts, such as wastes resulting from airport operations or industrial processes;
- ***Indirect impacts*** — No analysis of the effects associated with industrial or residential development that may occur near new transportation facilities;
- ***Local impacts*** — No analysis of impacts in specific watersheds, urban areas, or regions;
- ***Cultural, aesthetic, and social impacts*** — No analysis of these impacts; and
- ***Resource depletion impacts*** — Nonrenewable resource depletion (e.g., use of fossil fuels by motor vehicles) is not addressed as a separate issue because it does not damage the environment *per se*.

REPORT STRUCTURE

A number of changes have been made since the original edition to improve the report's utility. They reflect input from a panel of environmental experts from the U.S. Department of Transportation, U.S.

Department of Energy, and academic institutions who were asked to provide input on the organization of the report. They include:

- ***More focus on national statistics that can serve as indicators*** — This report focuses solely on environmental data that reflect national impacts; local examples are not presented in this report. In addition, the report presents trend data where available to provide a measure of progress and direction.
- ***More focus on context*** — Context is important in determining how problematic environmental impacts are and how much progress is being made. For example, the share of impacts from transportation sources affects how much importance should be placed on these effects (e.g., if a transportation source is a very small share of total releases, we may assign less importance to controlling this source). Exposure to pollution and resulting health and welfare impacts affect the importance of pollutant releases (e.g., if most areas of the nation attain air quality standards for lead, emissions of lead from aircraft may not be a significant health issue). Finally, when examining environmental impacts, it is important to be aware of the level of activity producing the effect (e.g., significant reductions in air pollutant emissions from motor vehicle travel are more striking given rapid increases in vehicle travel).
- ***More focus on data issues*** — The report includes a discussion of the major databases and data sources available. It highlights the limitations and weakness in these sources, as well as gaps in environmental information.
- ***Compilation of the impacts of the entire transportation sector*** — The report includes a chapter that summarizes the full transportation sector contribution to each environmental issue. In the initial edition of this report, impacts were addressed only in separate chapters for each mode of transportation, which did not allow for easy review of the total impact of transportation or comparisons of modal impacts. Although a number of reviewers suggested more modal comparisons, comparisons of effects per passenger mile or ton mile are not included in this report.[1]

This report is structured as follows:

Introduction

Chapter 1: Introduction — The report begins with a brief introduction to environmental indicators, discusses the strengths and weaknesses of various types of indicators, and presents information on data availability and limitations.

Transportation Environmental Indicators

Chapter 2: Transportation Indicators Summary — This chapter is organized by environmental topic and summarizes the contribution of transportation as a whole to each impact, as well as the contributions of specific transportation sources (e.g., modes and sub-modes).

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[1] Effects per passenger mile or ton mile may vary significantly in different places, by time of day, and by type of trip. Also, the modes are not exact substitutes for each other; the levels of service on the modes differ and the types of trips and types of freight carried by each mode differ. Given the level of effort required for this compilation and distinct nature of the research, the U.S. Environmental Protection Agency will undertake a separate research effort to develop such comparisons.

The report goes on to provide more detail on environmental impacts associated with each mode of transportation. Each chapter presents a discussion of environmental effects and quantified indicators, organized by type of transportation activity.

Chapter 3: Highway Indicators

Chapter 4: Rail Indicators

Chapter 5: Aviation Indicators

Chapter 6: Maritime Indicators

Data Issues

Chapter 7: Data Availability and Next Steps — This chapter identifies the major environmental databases used to track the environmental impacts of transportation and develop the indicators presented in this report. It also highlights data gaps and potential next steps.

1.2 DEFINITION OF INDICATORS

The term "indicator" is used throughout this report to refer to quantitative estimates of the magnitude or severity of a problem or issue. Indicators may be based on measurements or modeling. National estimates of environmental impacts are typically derived from modeling or other methods of extrapolation from local or site-specific data.

WHAT INDICATORS CAN DO

Indicators can be extremely useful in guiding transportation and environmental policy discussions. They can:

- ***Assess the magnitude of environmental problems*** — Indicators can highlight environmental problems by providing information on the largest sources of environmental problems. By identifying the full range of impacts, indicators can also provide a broad perspective on environmental issues.
- ***Help set priorities*** — By identifying problems and the share of problems caused by specific activities, indicators can help set priorities, particularly for research and among issues needing new or improved policies.
- ***Develop performance measures and track progress toward environmental goals*** — Ideal indicators can be tracked consistently and reliably tracked over time, and used to develop measures of environmental performance and track progress toward meeting targets.
- ***Educate policymakers, transportation and environmental stakeholders, and the public*** — By providing information on the contribution of transportation to environmental problems, indicators can help inform the public about environmental issues in transportation.

WHAT INDICATORS CANNOT DO

It is important to keep in mind that indicators can be misapplied so care should be taken to consider their limitations. Briefly, indicators cannot serve the following purposes:

- ***Isolate effects of individual regulations*** - Indicators may show improvement in a certain area (e.g. mobile source air emissions and air quality) but generally will not describe the root causes underlying that improvement. In other words, they may show the net results, but not why the situation improved. For example, indicators may show decreasing air emissions, but these could result either from policy-driven per-mile emissions reductions or from reduced travel due to recession or rising fuel prices.
- ***Provide an economic analysis*** - Indicators do not provide information about the benefits of travel and related activities. For example, deicing salt application has significant environmental impacts, but is beneficial in allowing travel and saving lives during storms. Indicators say nothing about the costs or benefits of policies that might alleviate such environmental impacts.
- ***Define acceptable levels of impact or rates of progress*** - Indicators may describe objectively the amount of impact or rate of progress, but subsequent policy decisions must be made about whether a given impact or rate of progress is acceptable. Indicators of environmental impact should not be used alone for setting priorities for regulatory action. Instead, cost-effectiveness of policy options should be considered.

TYPES OF INDICATORS

This report uses a three-stage framework for identifying environmental indicators:

- Outcomes
- Outputs
- Activities

These stages are shown in Figure 1-1. Transportation-related activities — infrastructure construction, vehicle manufacture, travel, maintenance and support, and disposal — result in releases of pollutants or damage to habitats. These outputs, in turn, have human health or welfare effects.

Indicators can be developed at each of these stages. Ultimately, people care about environmental outcomes; however, because of data gaps and the difficulty associated with isolating transportation's share of an impact from that of other sources, outcome indicators often are not available. Each type of indicator is described below with a short synopsis of strengths and weaknesses and examples of indicators.

OUTCOME INDICATORS

Indicators of outcomes are measures of end results. They provide quantitative information on health, environmental, and welfare effects resulting from transportation. Outcome indicators are desirable because they provide information about the effects that people care about. Unfortunately, quantified estimates of environmental outcomes are often unavailable or uncertain. Also, it is frequently difficult to separate the effects of transportation from other sources. In practice, many outcome indicators are subject to uncertainty or are qualitative in nature. For example, the number of states identifying highways as a source of habitat loss could be considered an outcome indicator because it provides a sense of magnitude about highway construction impacts on ecosystems. However, states may determine sources of habitat loss differently and the indicator does not say exactly how much habitat acreage has been lost. Other examples of outcome indicators include:

- Number of wildlife deaths

- Changes in the abundance of species
- Number of cases of illness or mortality

OUTPUT INDICATORS

Output indicators provide information on the amount of releases, emissions, or incidents that are associated with environmental damage, or the amount of land or resources consumed. They do not quantify the actual damage that takes place, but provide information about outputs that are known to be associated with human health, environmental, or welfare effects. Measurements, models, or other methodologies are often available to estimate outputs consistently over time. Examples of outcome indicators include:

- Quantity of pollution emitted or released
- Number of hazardous materials incidents
- Levels of noise

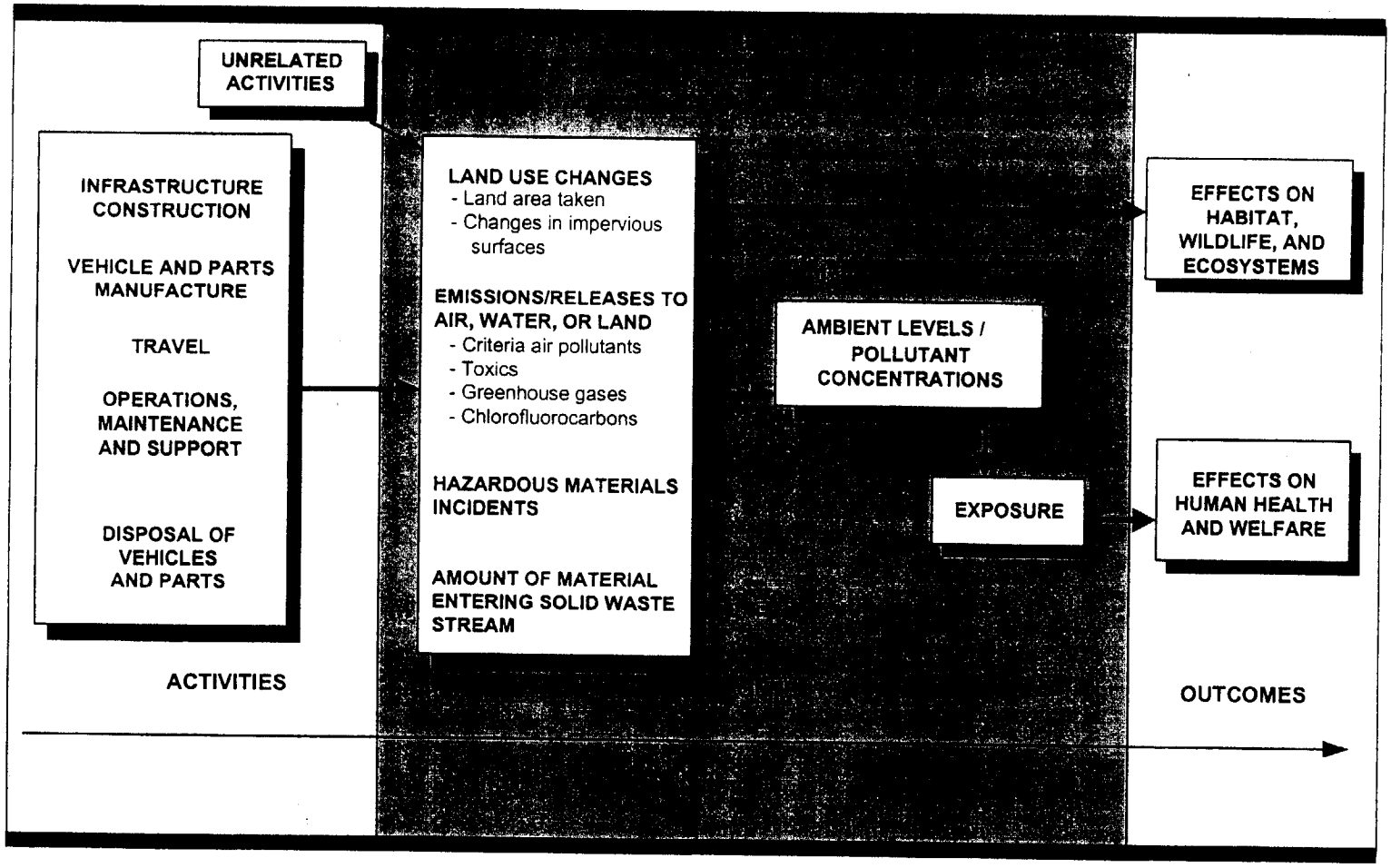
ACTIVITY INDICATORS

Activity indicators provide information about the extent of activities that are known to produce adverse environmental effects. Activity data tend to be the most readily available of all indicators. Examples include:

- Number of lane miles constructed
- Number of vehicles manufactured
- Number of vehicle miles traveled
- Quantity of deicing chemicals purchased (minus inventories)

While activity data are readily available, they are limited as environmental indicators because activities do not always correspond directly to environmental harm. For example, all else equal, increasing vehicle travel should produce greater quantities of pollutant emissions; however, motor vehicle emissions have been declining since the 1970s despite significant increases in vehicle travel because emission control technologies have improved. Likewise, a number of industries have significantly reduced pollutant outputs through improved technologies and pollution prevention.

Figure 1-1. Effects of Transportation and Related Activities on the Environment



IDEAL INDICATORS OF TRANSPORTATION IMPACTS

An ideal indicator:

- ***Focus on end results*** — Information should be provided on outcomes, such as number of illnesses caused, not outputs or activities that cause outcomes
- ***Isolate transportation's share of the impact*** — The indicator should identify the effect of transportation rather than providing an estimate of environmental quality that may depend on numerous sources
- ***Be reasonably certain*** — Although modeling may be necessary to estimate the national effect, the indicator should be generally agreed upon as reasonably accurate and reliable
- ***Be stated in meaningful units*** — The indicator should be presented in units that allow comparison to other sources of a problem or to a goal

In practice, there are tradeoffs between these traits. Although outcome indicators are the most desirable type of environmental information, data on environmental outcomes is typically not available or tracked consistently. When outcome measures are available, it is often impossible to identify the contribution of transportation separately from other sources. For example, one measure of outcomes for air quality is the number of people living in areas that do not meet one or more of the national ambient air quality standards (NAAQS). However, even if we know how many people are exposed to poor air quality, this figure does not tell us about the contribution of transportation to the problem. The estimation of health and welfare effects, such as the number of cases of respiratory problems associated with transportation-related pollution, can also be the subject of significant debate.

In general, the *best available* indicators of transportation's impact tend to be output indicators — measures of the quantity of pollution emitted or released, or the number of incidents known to cause environmental damage. Estimates of outputs tend to be estimated, reported, or tracked more consistently than outcome measures. As a result, this report focuses primarily on output indicators. It is important, however, to keep end results in mind when examining output indicators. Not all emissions or releases are equal; health and environmental results depend on exposure to pollution and other factors, such as the location and time of releases. In this report, activity indicators are presented when output data are unavailable.

1.3 PRESENTATION OF ENVIRONMENTAL INDICATORS

The following sections of this report present information on the environmental consequences associated with four modes of transportation: highways, rail, aviation, and maritime transport. A summary chapter highlights the effects of transportation on the environment and the relative magnitude of impacts from each mode. Individual chapters for each mode follow the summary chapter. In the modal chapters, subsections focus on the effects of each transportation activity — infrastructure construction; vehicle manufacture; travel; operations, maintenance, and support; and disposal.

Each environmental impact is presented with:

- ***Description of Impact*** — A brief discussion of environmental effects relating to transportation activities. The focus here is on processes that cause environmental outputs (generally, emissions, releases, or incidents), not on why the outputs are harmful (e.g., a brief discussion of sources of air pollutant emissions from aviation travel, not how different air pollutants affect health and welfare). An overview of each pollutant and the contribution of transportation is provided in the summary chapter at the end of this report.
- ***Impact Factors*** — A list of some of the primary factors that affect the magnitude of environmental impact.
- ***Indicators of Environmental Impact*** — The key indicators that have been quantified are presented. Because of data availability, output indicators predominate. Outcome indicators are presented when available; activity measures are presented when output information is not available.

2. TRANSPORTATION INDICATORS SUMMARY

This chapter summarizes national indicators of the environmental impacts of transportation. Transportation is defined broadly here to include transportation infrastructure construction and travel on the nation's transportation system, as well as related activities, such as transportation equipment manufacturing, infrastructure maintenance, and vehicle support. This chapter identifies the contribution of the transportation sector as a whole to specific environmental problems. Quantitative indicators and trends are presented, as available.

The availability of data for tracking the environmental impacts of transportation varies greatly for different aspects of the environment and types of transportation activities. Air pollution and greenhouse gases from travel are among the most well understood impacts of transportation, and estimates of emissions from travel have been quantified by mode. Many other environmental effects, such as the impacts of transportation systems on habitat fragmentation and water quality, have not been fully quantified nationally. In most cases, impacts associated with activities such as transportation equipment manufacturing and facility maintenance have not been tracked consistently or aggregated to the national level.

In this chapter, indicators are presented on nine environmental topics:

- Criteria air pollutants;
- Toxics;
- Greenhouse gases;
- Chlorofluorocarbons and stratospheric ozone depletion;
- Habitat and land use;
- Water quality;
- Hazardous materials incidents;
- Noise; and
- Solid waste.

This chapter compares the relative contribution of different transportation sources, modes, and activities to each of these environmental issues. The chapters following this one provide more detail on each mode of transportation: highway, rail, aviation, and maritime.

2.1 CRITERIA AIR POLLUTANTS

Criteria pollutants are those for which the U.S. Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) to protect public health and welfare. There are seven criteria pollutants with primary standards: ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), lead (Pb), particulate matter with

aerodynamic diameter less than or equal to 10 micrometers (PM_{10}), and particulate matter with aerodynamic diameter less than or equal to 2.5 micrometers ($PM_{2.5}$).[1] Health effects of these pollutants vary but include respiratory and cardiopulmonary problems, headaches, reduced learning ability, and premature mortality. These pollutants also contribute to acid rain, reduced agricultural yields, harm to vegetation, damage to building materials, and decreased visibility.

The effect of motor vehicles on air quality is one of the most recognized environmental implications of transportation. Recognizing the magnitude of the problem, regulations under the Clean Air Act and Amendments have dramatically reduced motor vehicle emissions of major criteria pollutants. The U.S. Environmental Protection Agency tracks air quality trends through an extensive monitoring network and maintains a program to estimate and track emission trends. Emission estimates provide an indication of how much pollution is being released by different types of sources, while monitored air quality data provide an indication of the severity of an air quality problem.

Monitoring data from across the U.S. show dramatic decreases in air pollutant concentrations since the early 1970s. Between 1978 and 1997, concentrations of ozone (one-hour) have fallen by 30 percent, carbon monoxide concentrations have fallen by 60 percent, and lead concentration have fallen by 97 percent. Between 1988 and 1997, the total number of days exceeding air quality standards has dropped 56 percent in Southern California and 66 percent in the rest of the United States.[2] These dramatic improvements in air quality have been due in part to significant reductions in transportation-related emissions, as presented below. Still, air pollution problems remain through large parts of the country, and transportation remains a significant contributor to this problem.

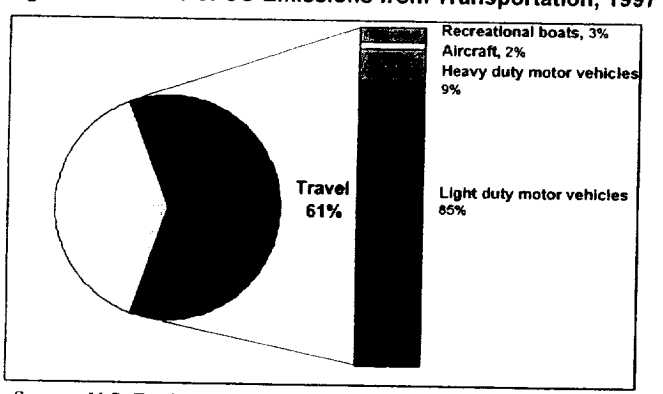
EMISSIONS FROM TRAVEL

Transportation contributes to air pollution primarily through the release of pollutants during the fuel combustion process. Pollutants are also emitted during the refining and processing of fuels and fuel evaporation. Transportation sources consumed about 66 percent of the petroleum used in the U.S. in 1997.[3]

Carbon Monoxide

Combustion of fuel during travel is a major source of carbon monoxide (CO) emissions, contributing about 61 percent of all CO emissions nationwide. Motor vehicles are the primary transportation source of CO emissions, contributing about 94 percent of travel emissions.

Figure 2-1: Share of CO Emissions from Transportation, 1997

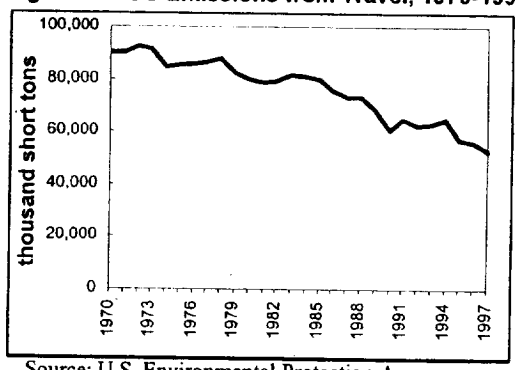


Source: U.S. Environmental Protection Agency. *National Air Pollutant Emission Trends, 1900-1997.*

[1] The new PM_{10} and ozone standards are on hold under court order as of the date of publication of this report.
[2] U.S. Environmental Protection Agency. *National Air Quality and Emission Trends Report, 1997.* pp. 9, 63.
[3] U.S. Department of Energy. *Transportation Energy Data Book: Edition 18.* Table 2.5.

Carbon monoxide has become less of a national air quality problem over the past twenty years as CO concentrations in the air have decreased by 60 percent nationwide. In 1997, only three counties (Los Angeles County, CA; Fairbanks, AK; and Imperial County, CA) had monitoring sites that failed to meet the NAAQS for CO. Declining transportation emissions have contributed significantly to the reduction in total CO emissions. Carbon monoxide emissions from transportation fell by 41 percent between 1970 and 1997, compared to an 11 percent reduction in emissions from non-transportation sources over this time period. Contributors to reduced CO emissions from motor vehicles include national standards for tailpipe emissions, new vehicle technologies, and use of oxygenated gasoline.

Figure 2-2: CO Emissions from Travel, 1970-1997



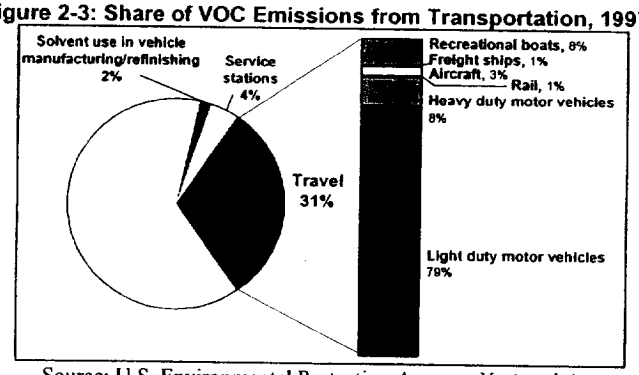
Source: U.S. Environmental Protection Agency. *National Air Pollutant Emission Trends, 1900-1997.*

Although exceedances of the CO standard have fallen significantly, high concentrations of CO often occur in areas with heavy traffic congestion. In cities, as much as 95 percent of all CO emissions may come from on-road vehicles.

Ozone and its Precursors

Ground level ozone (O_3) is the most pervasive air pollution problem in the U.S. Despite a 30 percent drop in one-hour ozone concentrations in the air between 1978 and 1997, about 47.9 million Americans lived in 77 counties with ozone concentrations above the pre-existing NAAQS in 1997. About 101.6 million Americans lived in counties with ozone concentrations above the level of the new eight-hour ozone NAAQS.

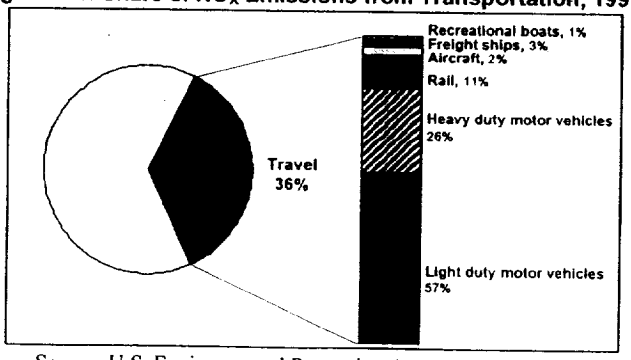
Figure 2-3: Share of VOC Emissions from Transportation, 1997



Source: U.S. Environmental Protection Agency. *National Air Pollutant Emission Trends, 1900-1997.*

Ozone is formed in the atmosphere through the reaction of volatile organic compounds (VOCs) and oxides of nitrogen (NO_X) in the presence of heat and sunlight. Ozone and these precursor pollutants can be transported by prevailing weather patterns to an area hundreds of miles away from pollution sources.

Figure 2-4: Share of NO_X Emissions from Transportation, 1997

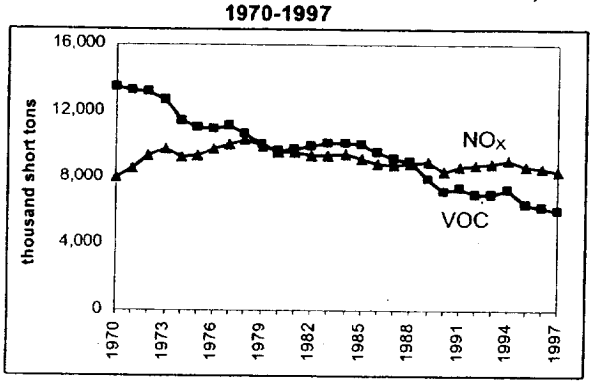


Source: U.S. Environmental Protection Agency. *National Air Pollutant Emission Trends, 1900-1997.*

Transportation is a major source of the volatile organic compounds and oxides of nitrogen that contribute to ozone formation. Transportation sources emitted 31 percent of VOCs and 36 percent of NO_X in 1997, as

shown in Figures 2-3 and 2-4. VOCs are emitted both from fuel combustion and fuel evaporation. Service stations and solvent use in vehicle manufacturing and refinishing also emitted significant amounts of VOCs. Diesel vehicles emit NO_X at much higher rates than gasoline vehicles; as a result, heavy-duty motor vehicles and rail are much larger contributors to NO_X emissions than to emissions of VOCs.

Figure 2-5: VOC and NO_X Emissions from Travel, 1970-1997



Source: U.S. Environmental Protection Agency. *National Air Pollutant Emission Trends, 1900-1997.*

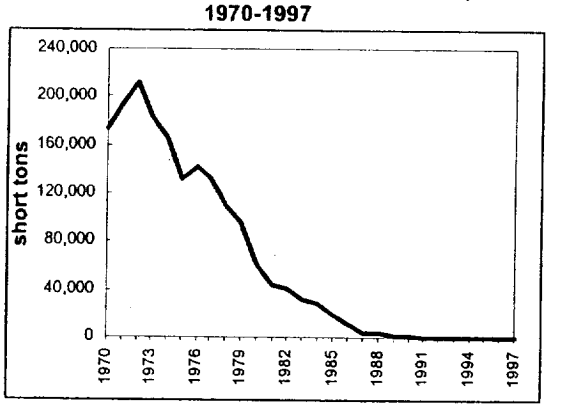
Significant progress has been made in reducing VOC emissions from transportation, and VOC emissions from transportation sources have dropped 56 percent between 1970 and 1997, in comparison to a 24 percent reduction from non-transportation sources. Most of the tonnage reduction has come from light-duty motor vehicles.

In contrast, NO_X emissions have proven more difficult to control. Nationally, NO_X emissions increased by about 11 percent between 1970 and 1997. NO_X emissions from transportation increased 5 percent over this time period. Most of the increase in NO_X from transportation came from non-road sources, like rail, aviation, and maritime transport. NO_X emissions from motor vehicles actually dropped 5 percent between 1970 and 1997, despite a 127 percent increase in vehicle miles traveled.

Lead

In the early 1970s, automobiles were the major contributors of lead (Pb) emissions to the atmosphere. As a result of EPA's regulatory efforts to remove lead from gasoline, transportation sector emissions of lead have declined dramatically, leading to the virtual elimination of lead as an ambient air quality problem. Concentrations of lead in the air decreased by 97 percent between 1978 and 1997, with total emissions of lead down 98 percent between 1970 and 1997.

Figure 2-6: Lead Emissions from Travel, 1970-1997



Source: U.S. Environmental Protection Agency. *National Air Pollutant Emission Trends, 1900-1997.*

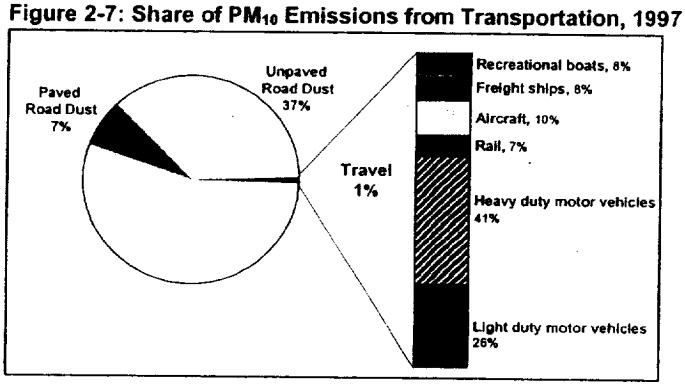
Today, metals processing is the major source of lead emissions and the highest ambient air concentrations of lead are found near ferrous and nonferrous smelters, battery manufacturers, and other stationary sources. Aviation is now the only major source of lead emissions from the transportation sector. Because industrial processes are now responsible for all violations of the lead standard, EPA's lead monitoring now focuses on these point sources.

Particulate Matter

Particulate matter is the term used to describe a mixture of solid particles and liquid droplets found in the air. These particles vary widely in size and can remain suspended in the air for extended periods. EPA has established a National Ambient Air Quality Standard (NAAQS) for both coarse particles under 10 microns in diameter (PM_{10}) and fine particles under 2.5 microns in diameter ($PM_{2.5}$). Fine particles are thought to be most harmful to human health because their small size allows them to penetrate the lungs, resulting in decreased lung function, increased respiratory symptoms and disease, and premature death. PM is also the major cause of reduced visibility in parts of the U.S., and can adversely affect plants, animals, and materials. PM can be emitted directly or formed in the atmosphere as a result of reactions of SO_X, NO_X, and other gases.

Most particulate matter emissions come from sources that are not traditionally inventoried, such as wind erosion, fugitive dust from paved and unpaved roads, and agriculture. Travel contributes more toward fine PM ($PM_{2.5}$) than to PM_{10}, but still makes up just about 4 percent of $PM_{2.5}$ emissions nationally, as shown in Figures 2-7 and 2-8.

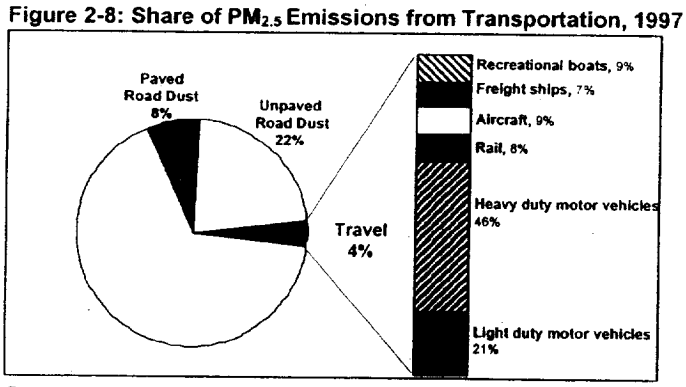
Figure 2-7: Share of PM_{10} Emissions from Transportation, 1997



Source: U.S. Environmental Protection Agency. *National Air Pollutant Emission Trends, 1900-1997.*

Particulate matter emissions tend to be associated most with diesel engines, so heavy-duty motor vehicles are the largest source of transportation-related PM emissions. In contrast to their share of most other pollutants, light-duty motor vehicles make up a relatively small portion of transportation emissions.

Figure 2-8: Share of $PM_{2.5}$ Emissions from Transportation, 1997



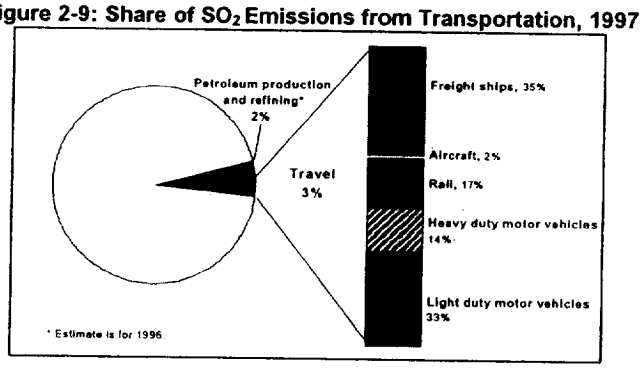
Source: U.S. Environmental Protection Agency. *National Air Pollutant Emission Trends, 1900-1997.*

Direct emissions of PM_{10} from the transportation sector declined by 26% between 1970 and 1997. Emissions from non-transportation sources have fallen due to controls on industrial sources and construction activities, as well as measures to reduce street dust emissions, including the use of clean anti-skid materials like washed sand, better control of the amount of material used, and removal of material from roads as soon as ice and snow melt.

Sulfur Dioxide

Sulfur dioxide (SO_2) is a less pervasive air quality problem nationwide compared to carbon monoxide, ozone, and particulate matter. Over the period 1978 to 1997, concentrations of SO_2 in the air declined by 55 percent. Fewer than 100,000 Americans lived in counties with air quality concentrations above the level of the SO_2 NAAQS in 1997. Despite the small number of exceedances of the SO_2 standard, sulfur dioxide emissions remains an environmental problem. SO_2 contributes to particulate matter in the atmosphere and acid rain.

Figure 2-9: Share of SO_2 Emissions from Transportation, 1997



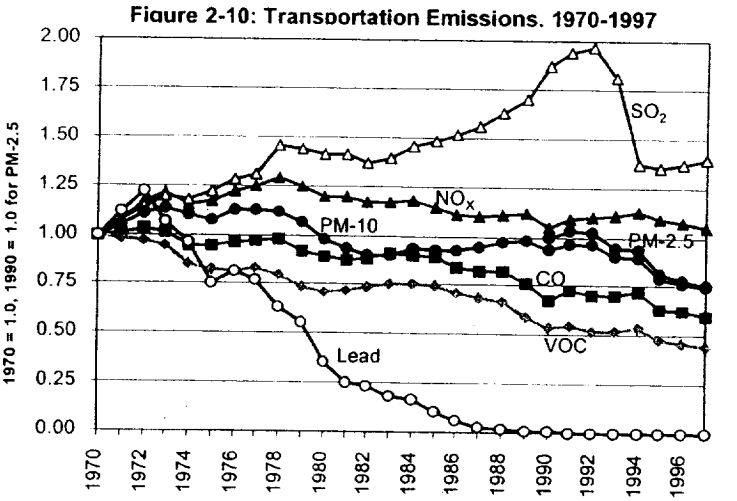
Source: U.S. Environmental Protection Agency. *National Air Pollutant Emission Trends, 1900-1997* and *NET Viewer*.

Transportation is a relatively minor source of SO_2 emissions, contributing about 3 percent of total SO_2 emissions nationwide. Production and refining of petroleum for transportation also contributes about 2 percent of national SO_2 emissions.[4] SO_2 is formed when fuel containing sulfur — mainly coal and oil — is burned and during metal smelting and other industrial processes. The highest monitored concentrations of SO_2 are recorded in the vicinity of large industrial facilities. In contrast to industrial sources, SO_2 emissions from transportation have trended upward through the 1970s and 1980s, largely due to increases in emissions by ships and boats. A substantial decline in heavy-duty vehicle emissions occurred, however, between 1992 to 1994. EPA recently promulgated a new rule that requires significantly lower sulfur content for gasoline, which in turn will help to reduce motor vehicles emissions of VOCs, CO, and NO_X since sulfur in gasoline inhibits the performance of the catalyst on advanced technology vehicles.

Comparative Trends

Trends in transportation emissions, 1970-1997, are shown in Figure 2-10. As described above, there has been significant progress in reducing transportation emissions of air pollutants since the early 1970s.

Figure 2-10: Transportation Emissions, 1970-1997



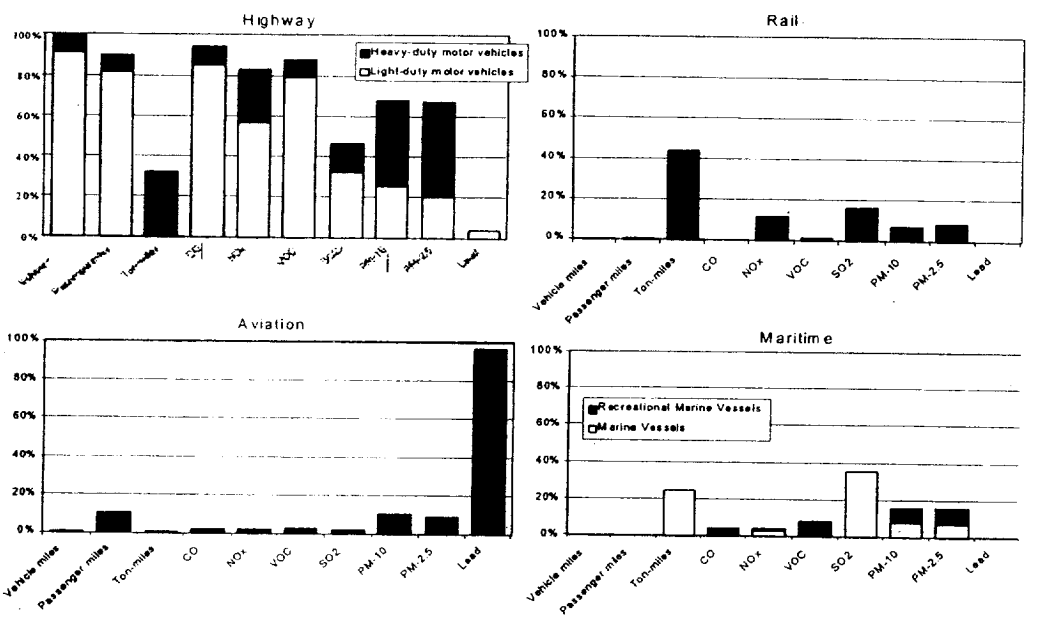
Source: U.S. Environmental Protection Agency. *National Air Pollutant Emission Trends, 1900-1997.*

[4] Petroleum production and refining emissions were estimated based on SIC codes 1311 (Crude Petroleum and Natural Gas), 1381 (Drilling Oil and Gas Wells), 1382 (Oil and Gas Field Exploration Services), 1389 (Oil and Gas Field Services, NEC), and 2911 (Petroleum Refining) (Source: U.S. Environmental Protection Agency. *NET Viewer*). This figure was then multiplied by 66.2%, the percent of petroleum used for transportation (Source: U.S. Department of Energy. *Transportation Energy Data Book: Edition 18*).

Transportation emissions have decreased substantially for three of the major pollutants emitted by transportation sources: CO, VOC, and lead. Transportation-related emissions of NO_X have risen slightly, but most of this increase has been from non-road sources. Motor vehicle emissions of NO_x have actually fallen 5 percent between 1970 and 1997, despite a 127 percent increase in vehicle miles traveled.

The contribution of emissions from different transportation sources varies significantly by pollutant, as shown in Figure 2-11. Light-duty on-road vehicles emit the most CO, NO_X, and VOC emissions of any mode of transportation. Light duty vehicles are used for the vast majority of all vehicle miles of travel and passenger miles of travel. Heavy-duty motor vehicles contribute a large portion of particulate matter emissions and NO_X emissions, primarily because diesel vehicles emit a much more of these pollutants than gasoline vehicles. Marine vessels are a major source of sulfur dioxide. Aircraft are the main source of lead emissions from transportation since the phase-out of leaded gasoline.

Figure 2-11: Travel and Criteria Pollutant Emissions by Mode of Travel, 1997



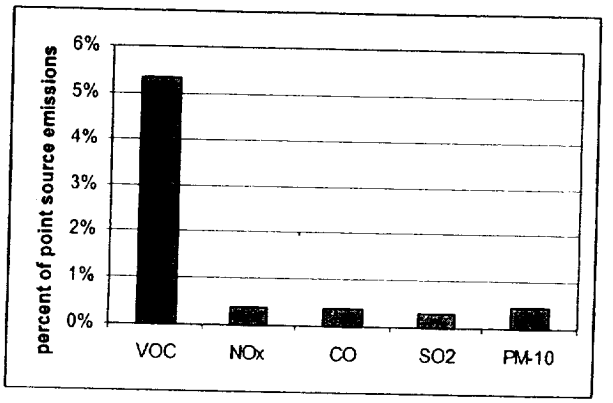
Source: Vehicle miles, passenger miles, ton-miles — U.S. Department of Transportation, Bureau of Transportation Statistics. *National Transportation Statistics 1998.* Emissions — U.S. Environmental Protection Agency. *National Air Pollutant Emission Trends, 1900-1997.* Travel Statistics are for 1996 and emissions estimates are for 1997. Vehicle miles and passenger miles do include recreational marine vessels. Ton miles figure is for domestic freight and assumes all on road transport is by heavy duty vehicles.

EMISSIONS FROM VEHICLE MANUFACTURE, MAINTENANCE, AND SUPPORT

In addition to emissions from travel, criteria pollutant emissions are released from transportation-related activities, including vehicle manufacture and maintenance and support operations. These activities release a very small portion of total criteria pollutant emissions with the exception of VOCs, as shown in Figure 2-12.

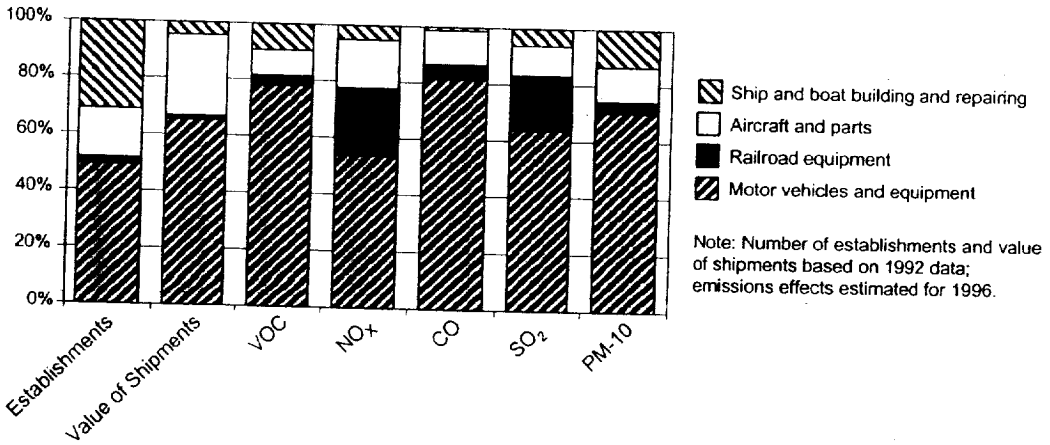
Figure 2-13 compares the contribution of different types of transportation manufacturing facilities to air pollutant emissions and to the number of establishments and value of shipments by industry. The motor vehicle and equipment manufacturing industry is by far the largest transportation-related manufacturing industry, and is responsible for about half of all transportation manufacturing establishments and two-thirds of the value of shipments. It is also responsible for the majority of emissions from transportation-related manufacturing industries. Criteria pollutants are also released from aviation ground support equipment and in the maintenance and support of the transportation system.

Figure 2-12: Percent of Point Source Emissions from Transportation Vehicle and Equipment Manufacturing, 1996



Source: U.S. Environmental Protection Agency. *NET Viewer.*

Figure 2-13: Criteria Pollutant Emissions from Transportation Vehicle and Equipment Manufacturing, 1996

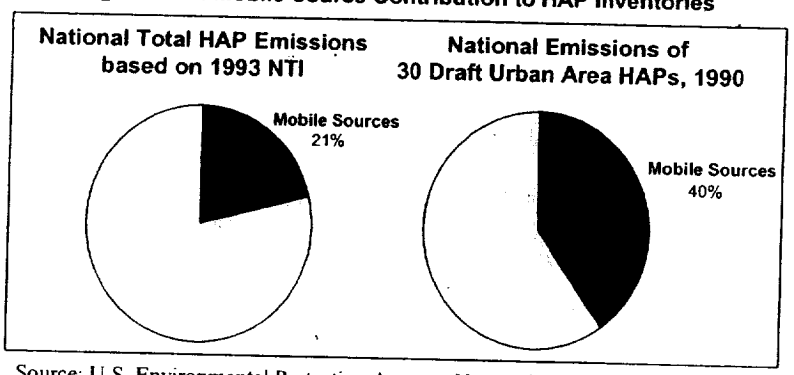


Sources: Establishments and Value of Shipments — U.S. Bureau of the Census. *1992 Census of Manufacturers.*
Emissions — U.S. Environmental Protection Agency. *NET Viewer.*

2.2 TOXICS

Hazardous air pollutants (HAPs), commonly referred to as air toxics or toxic air pollutants, are known or suspected to cause cancer or other serious human health effects or ecosystem damage. Section 112 of the Clean Air Act now lists 188 pollutants or chemical groups as hazardous air pollutants and targets sources emitting them for regulation. Compared to the criteria pollutants, less information is available concerning potential health and environmental effects of HAPs. Toxic air pollutants are known, however, to have a variety of environmental effects, including the potential for some HAPs to damage aquatic ecosystems.

Figure 2-14: Mobile Source Contribution to HAP Inventories



Source: U.S. Environmental Protection Agency. *National Air Quality and Emissions Trends Report, 1997.* pp. 69-79.

According to EPA's 1993 National Toxics Inventory (NTI), mobile sources released approximately 21 percent of hazardous air pollutants out of 8.1 million tons of air toxics released nationwide. Recognizing that not all toxics are national problems, EPA has also compiled an interim 1990 emission inventory for 30 proposed urban HAPs associated with area sources. Of these HAPs that pose the greatest threat to public health in urban areas, about 40 percent of emissions came from mobile sources. Urban areas tend to have a higher proportion of emissions coming from mobile sources than rural areas.

Toxics are also released from manufacturing facilities and are reported in the EPA's Toxic Release Inventory (TRI). The transportation equipment industry (SIC Code 37) represents a small share of TRI reported waste in comparison to its scope in the U.S. economy. In 1996, the transportation equipment industry was responsible for 1.6 percent of waste but encompassed 8.5 percent of employment and 12.5 percent of the value of shipments among the industries reporting to TRI.[5]

Over time, chemicals have been added to the TRI, deleted, or redefined. To enable comparison between years, the Table 2-1 reports releases of chemicals required to be reported in all years, called "core" chemicals.

[5] U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics. *1996 Toxics Release Inventory Public Data Release – 10 Years of Right-to-Know: Industry Sector Analyses.* December 1998 (Table 1-5).

Table 2-1: Core Toxic Chemicals Released from Transportation Manufacturing Facilities (Subset of TRI Inventory) in thousands of pounds, 1988-1996[6]

Year	On-road vehicle & equipment manufacturing (SIC 371, 375, 3792)	Rail equipment manufacturing (SIC 374)	Aircraft manufacturing (SIC 372)	Ship- and boat-building and repair (SIC 373)	Total Transportation
1988	116,724	2,210	40,270	17,966	174,960
1994	85,151	1,906	11,297	13,826	110,274
1995	75,855	1,561	9,577	14,869	100,301
1996	68,150	1,425	7,181	14,149	89,480

Source: U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics. *1996 Toxics Release Inventory Public Data Release – 10 Years of Right-to-Know: Industry Sector Analyses.* December 1998 (Table 14-3).

The majority of transportation industry toxic releases come from facilities involved in manufacturing motor vehicles and car bodies (SIC code 3711) and motor vehicle parts and accessories (SIC code 3714). Toxic chemicals may be released to the environment as air emissions, surface water discharges, underground injection, or on-site land releases. The vast majority of releases from transportation-related manufacture were releases to air, which include stack emissions, equipment leaks, evaporative losses, and releases from building ventilation systems.

Overall, the quantity of core toxic chemicals released from transportation-related manufacturing facilities declined by over 50 percent between 1988 and 1996. On- and off-site releases of core chemicals decreased from nearly 175 million pounds in 1988 to 89.5 million pounds in 1996. Reductions in releases were due in part to source reduction, on-site waste management, and tranfers off-site for waste management. One-fifth of firms submitting forms to TRI in the transportation equipment sector (SIC Code 37) reported undertaking one or more source reduction activities during 1996. Good operating practices and raw material and process modifications were the two source reduction activities cited most often by the motor vehicles and car bodies industry (SIC 3711) and the motor vehicle parts and accessories industry (3714) — the two largest sources of waste. Aviation and motor vehicle industries had the highest percentage of waste undergoing either on-site or off-site waste management. In 1996, within all transportation manufacturing industries about 54 percent of toxics were recycled (chemicals were recovered and made available for further use). Another 4 percent were used for energy recovery (combusted to generate heat or energy) and 13 percent were destroyed through treatment.[7]

2.3 GREENHOUSE GASES

Greenhouse gases trap heat within the earth's atmosphere. While most greenhouse gases occur naturally and serve to keep the planet hospitable to life, increasing concentrations of greenhouse gases in the atmosphere threaten to alter the earth's climate dramatically. The world's most respected scientists agree that the threat of global climate change is real and that potential impacts

[6] The transportation manufacturing industry, as defined in this report, excludes a portion of the industries that fall under SIC code 37 (Transportation Equipment). It excludes the following SIC codes: 3761 (Guided Missiles & Space Vehicles), 3764 (Space Propulsion Units & Parts), 3769 (Space Vehicle Equipment, nec), 3795 (Tanks & Tank Components), and 3799 (Transportation Equipment, nec).

[7] Calculated based on: U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics. *1996 Toxics Release Inventory Public Data Release – 10 Years of Right-to-Know: Industry Sector Analyses.* December 1998 (Table 14-9).

are significant, including extreme weather conditions, rising sea levels, and damage to agriculture and ecosystems.

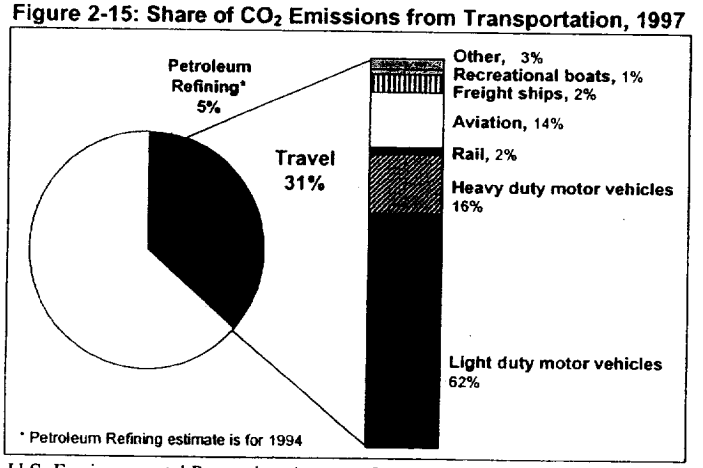
Transportation is a major contributor to emissions of carbon dioxide (CO_2), the most important greenhouse gas. Based on global warming potential, CO_2 accounts for about 84 percent of total greenhouse gas emissions in the U.S. The remainder is made up of methane (9 percent), nitrous oxide (5 percent), halocarbons, and other human-made gases, such as HFCs and PFCs (2 percent).[8] Greenhouse gas emissions from transportation have been rising, in contrast to emissions of other air pollutants, in large part because travel growth has outpaced improvements in transportation energy efficiency. In particular, for motor vehicles — the largest source of carbon dioxide emissions from transportation — vehicle fuel economy has been stagnant over the past few years as more travel has shifted from automobiles to less efficient light trucks, including pick-up trucks, sport utility vehicles, and minivans.

In the following discussion highlighting the percentage of total greenhouse gas emissions from transportation, note that transportation sources are a subset of "mobile sources." As a result, the share of emissions from travel is smaller than the share reported for mobile sources in national greenhouse gas emission inventories compiled by the U.S. Department of Energy and U.S. Environmental Protection Agency.[9]

CARBON DIOXIDE

Transportation sources emitted approximately 31 percent of all carbon dioxide emissions from fossil fuel combustion in the U.S. in 1997. In addition emissions from refining petroleum in the United States for transportation sector use compromised about 5 percent of total emissions. Not accounted for are the emissions associated with extracting crude oil (imports of crude oil made up 42 percent of U.S. petroleum consumption in 1997) and refining oil that is imported as refined petroleum (5 percent of U.S. petroleum consumption in 1997).[10]

Figure 2-15: Share of CO_2 Emissions from Transportation, 1997



U.S. Environmental Protection Agency. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-1997.* March 1999 (draft) and U.S. Department of Energy. *Manufacturing Energy Consumption Survey, 1994.*

[8] U.S. Department of Energy, Energy Information Administration. *Emissions of Greenhouse Gases in the United States 1997.* October 1998 (Table ES2).

[9] Transportation sources do not include farm equipment, construction equipment, and utility equipment, which are considered mobile sources. Note that recreational boating is included as a transportation source in this report, even though it is not purely for a transportation purpose.

[10] Percent of emissions from petroleum refining were calculated based on energy data for SIC code 2911 (Source: *Manufacturing Energy Consumption Survey, 1994.*); this figure was then multiplied by 66.2%, the percent of petroleum used for transportation (Source: U.S. Department of Energy. *Transportation Energy Data Book: Edition 18*). Other energy data reported come from U.S. Department of Energy. *Transportation Energy Data Book, 18th. Edition.* Table 1.8.

Transportation sources emitted 460.4 million metric tons of carbon in 1997, out of a total of 1.48 billion metric tons of carbon from fossil fuel combustion.[11] Most transportation emissions come from on-road motor vehicles. About 78 percent of transportation emissions come from on-road vehicles and approximately 14 percent come from aircraft, with the remainder from rail, ships, boats, and other sources. Carbon dioxide emissions from travel have been growing rapidly, in contrast with trends in other air emissions. Transportation emissions increased about 10 percent between 1990 and 1997, growing from 419.1 million metric tons to 460.4 million metric tons of carbon.[12]

In addition to direct release of CO_2 during fossil fuel combustion, CO_2 and other greenhouse gases are released from upstream fuels processing, distribution of fuels, vehicle assembly, and facility maintenance. It is estimated that for gasoline light-duty vehicles CO_2 emissions from feedstock/fuel distribution and production equal approximately 25 to 30 percent of the amount of CO_2 emitted from the vehicle, as shown in Table 2-2. Car assembly and materials emit another 16 percent of the amount emitted from the vehicle. In total, upstream processes emit another 41 to 46 percent of the CO_2 emitted from the vehicle for light-duty gasoline vehicles and about 28 percent of the CO_2 emitted from the vehicle for heavy-duty diesel vehicles.

Table 2-2: Full Fuel Cycle CO_2 -equivalent Emissions for Light-duty Motor Vehicles (grams per mile)

Study	Fuel	Vehicle Use	Feed/Fuel distribution & production	Car assembly & materials	Total Emissions
M.A. Delucchi, Argonne National Laboratory.1991.	Conventional gasoline	344.5	85.9	55.9	486.3
	Reformulated gasoline	333.7	101.6	55.9	491.2
	Diesel fuel	325.0	56.8	42.1	423.9
	Diesel fuel, heavy-duty	2,052.1	369.0	206.0	2,627.1
U.S. Department of Energy. August 1996.	Gasoline	272.4 *	74.9 *	-	347.3 *

*Only includes CO_2 emissions; other estimates are for CO_2 equivalent emissions and consider CO_2, CH_4, N_2O, NO_X, CO, and NMOCs.

Sources: M.A. Delucchi, Argonne National Laboratory. "Emissions of Greenhouse Gases from the Use of Transportation Fuels and Electricity." ANL/ESD/TM-22, Vol. 1, 1991 (Table 9).U.S. Department of Energy. "Alternatives to Traditional Transportation Fuels 1994. Vol. 2: Greenhouse Gas Emissions." DOE/EIA-0585(94)/2, August 1996 (Table 7).

Fossil fuels can also be used for producing products such as plastics, asphalt, or lubricants that store carbon for long periods of time. Asphalt used in road construction, for example, stores carbon. Fossil fuels used in the manufacture of materials like plastics for motor vehicles can also store carbon if the material is not burned.

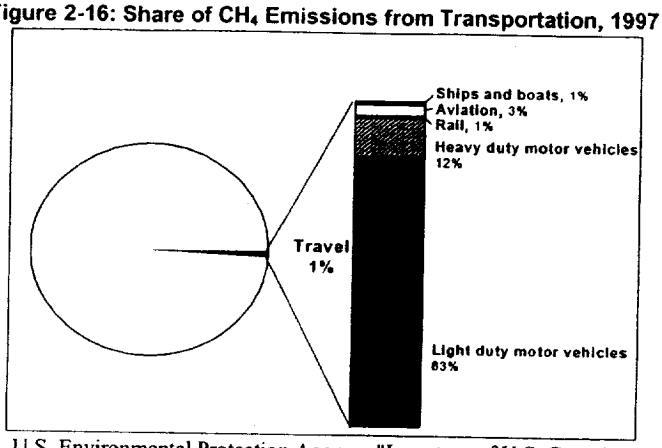
[11] U.S. Environmental Protection Agency. "Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-1997." March 1999 (draft).

[12] U.S. Department of Energy, Energy Information Administration. *Emissions of Greenhouse Gases in the United States 1997.* October 1998, Table 10.

METHANE

Travel contributes less than one percent of methane (CH_4) emissions nationally, with the majority of emissions coming from landfills and agriculture. Methane emissions from transportation in 1997 were estimated at 234,000 metric tons, down about 11,000 metric tons from 1990 levels. Nearly 95 percent of transportation emissions of methane come from on-road vehicles, with the vast majority of those from light-duty vehicles. Aircraft emit approximately 3 percent of transportation methane emissions, with smaller amounts from locomotives, ships, and boats.

Figure 2-16: Share of CH_4 Emissions from Transportation, 1997

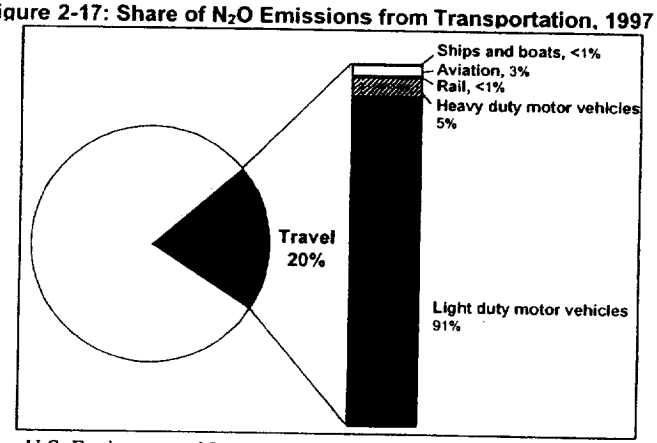


U.S. Environmental Protection Agency. "Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-1997." March 1999 (draft).

NITROUS OXIDE

In 1997, travel was the second largest source of nitrous oxide (N_2O) emissions, producing about 20 percent of N_2O emissions in the U.S. Other major sources of N_2O are agricultural soil management and adipic and nitric acid production. Travel was associated with 206,000 metric tons of nitrous oxide in 1997, up nearly 30 percent from the 159,000 metric tons emitted in 1990.

Figure 2-17: Share of N_2O Emissions from Transportation, 1997



U.S. Environmental Protection Agency. "Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-1997." March 1999 (draft).

Transportation-related N_2O is a product of the reaction that occurs between nitrogen and oxygen during fossil fuel combustion. Like NO_X emissions, N_2O emissions are closely related to fuel characteristics, air-fuel mixes, and combustion temperatures, as well as use of pollution control equipment. In particular, N_2O can be formed by the catalytic processes used to control NO_X and CO emissions.

2.4 CHLOROFLUOROCARBONS AND STRATOSPHERIC OZONE DEPLETION

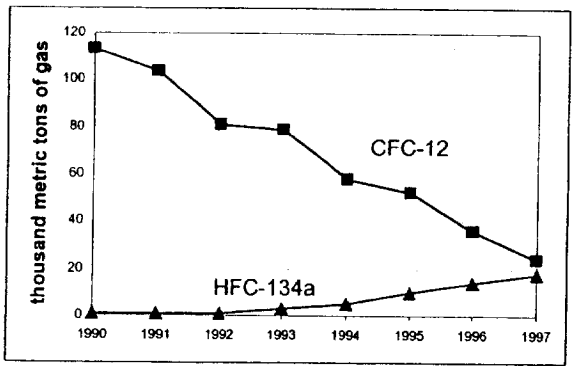
Chlorofluorocarbons (CFCs) are human-made derivatives of hydrocarbons. For decades CFC-12 (also known by the trade name Freon) was used as the refrigerant in motor vehicle air conditioning systems. In response to increased scientific understanding of damage to the ozone layer, a worldwide ban on the production of ozone-depleting substances, including CFC-12, has been implemented. Ozone loss in the upper atmosphere is likely to lead to an increase in cataracts

and skin cancer, could weaken the human immune system, and can have significant effects on agriculture and plant and animal life. By signing the *Montreal Protocol on Substances that Deplete the Ozone Layer* and *Copenhagen Amendments*, the United States committed to eliminating the production of all CFCs by the end of 1995. On December 31, 1995, CFC-12 production essentially ended in the U.S.

It is still legal to use existing stockpiles of CFC-12, but several companies have also developed new substitutes. In order to make sure existing CFC-12 is not released to the atmosphere, EPA issued regulations under the Clean Air Act to require mechanics to recycle CFC-12.

Hydrofluorocarbon HFC-134a became the standard automobile air conditioner refrigerant in 1994, and HFC emissions have been growing as CFCs gradually disappear from the automobile fleet, as shown in Figure 2-18. HFCs, which contain no chlorine, have no effect on stratospheric ozone, but are a greenhouse gas.

Figure 2-18: Estimated U.S. Emissions of CFC-12 and HFC-134a, 1990-1997



Source: U.S. Department of Energy, Energy Information Administration. *Emissions of Greenhouse Gases in the United States 1997*. October 1998 (Table 31).

2.5 HABITAT AND LAND USE

Development of transportation infrastructure has direct and indirect effects on land use and habitat. Land is used directly for public and private transportation infrastructure, including roads, parking lots, railway terminals, airports, and marine cargo facilities. In addition, the development of these facilities may stimulate changes in land uses, including the development of commercial, residential, and industrial areas, which in turn can reduce or fragment habitat.

LAND USE AND HABITAT FRAGMENTATION

Use of land for transportation infrastructure can adversely impact sensitive ecological resources such as endangered plant and animal species. It can also have more significant impacts through fragmentation of habitats and secondary development. While all forms of transportation infrastructure can adversely affect wildlife and habitat, highways and roads tend to be viewed as the most significant cause of concern because of their pervasiveness and their linear nature, which can form barriers to wildlife. The linear nature of highways — and railways to a lesser extent because they tend to be narrower — divides wildlife habitat into smaller, more isolated pieces of land that can create barriers between functional areas.

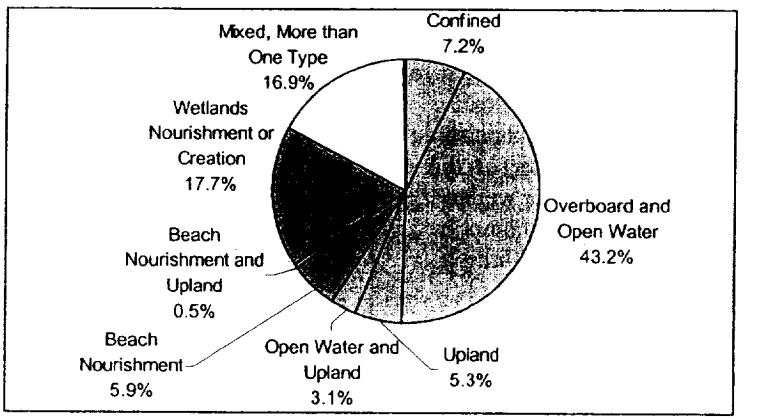
Transportation infrastructure is extensive in the United States and growing. Public roads occupied an estimated 17,345 square miles of land in the United States in 1997, a 2 percent increase over

the amount in 1990.[13] Between 1945 and 1997, public road mileage increased by about 19%, from 3.32 million miles to 3.96 million miles. Existing rail mileage is approximately 177,000 miles of track.[14] There were 18,345 airports in the U.S. in 1997, a 21 percent increase since 1980. Although infrastructure is pervasive, national-level information on the cumulative impacts of transportation infrastructure on wildlife and ecological systems is limited. Most transportation-related impacts on wildlife and habitat are studied at the local level.

DREDGING AND IMPACTS TO AQUATIC RESOURCES

Dredging is undertaken to improve navigation for water-borne transportation. Damage to habitat can occur because of disturbance and removal of bottom material and disposal of dredged material. The U.S. Army Corps of Engineers dredges and disposes of about 200 to 300 million cubic yards of material annually from Congressionally-authorized navigation improvement and maintenance projects. In addition, permit applicants (e.g., port authorities, terminal owners, industries, and private individuals) dredge an additional 100 million cubic yards annually from navigation projects (i.e., ports, berths, and marinas).[15]

Figure 2-19: Disposal/Use of Material Dredged by U.S. Army Corps of Engineers, 1998



Source: Army Corps of Engineers, Navigation Data Center. *Dredging Statistics Database.* Information compiled as of January 1999.

Dredged material can be disposed of in open water or on land. Open water disposal can alter bottom habitats, decrease water quality, and adversely affect marine organisms. If not contaminated, dredged material can also be used for beneficial purposes, such as construction, beach nourishment, land creation, wetland creation, and wetland restoration. Each year approximately 60 million cubic yards of dredged material is disposed of in the ocean at designated sites.[16] At least 24 percent of dredged material disposed by the U.S. Army Corps of Engineers in 1998 was used for beneficial purposes (beach nourishment, wetlands nourishment or creation), as shown in Figure 2-19.

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[13] Estimate based on data from U.S. Department of Transportation, Federal Highway Administration. *Highway Statistics 1990, 1995, 1996,* and *1997.* Table HM-60.

[14] Association of American Railroads. www.aar.org, as cited February 14, 1999.

[15] U.S. Environmental Protection Agency. "Ocean Dumping Program Update." EPA842-F-96-003. 1996. http://www.epa.gov/OWOW/OCPD/oceans/update3.html and Army Corps of Engineers, Navigation Data Center. *Dredging Statistics Database.*

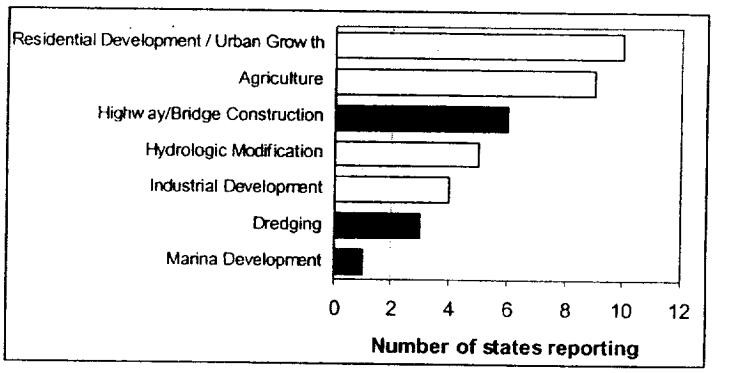
[16] U.S. Environmental Protection Agency. "Ocean Dumping Program Update." EPA842-F-96-003. 1996. http://www.epa.gov/OWOW/OCPD/oceans/update3.html

WETLANDS

Wetlands are a specific type of habitat that has received special attention because they perform important ecological functions, including providing habitat for a variety of species and improving water quality by removing nutrients and some contaminants. Highway development has historically been a source of wetland losses, as has dredging for waterway projects.[17]

Of the 12 states providing information about wetland losses in 1996 305(b) reports, 6 states reported wetland losses due to highway or bridge construction, 3 states reported losses due to dredging, and 1 state reported losses due to marina development, as shown in Figure 2-20. Of the 8 states that reported sources of degraded wetland integrity, 3 reported that road construction was a cause. Currently, most states are not equipped to report on the integrity of their wetlands and national trends cannot be drawn from this limited information.

Figure 2-20: Sources of Recent Wetland Loss



Source: U.S. Environmental Protection Agency, Office of Water. *National Water Quality Inventory: 1996 Report to Congress.* April 1998.

Although adverse impacts on wetlands may be unavoidable for some projects, compensatory mitigation efforts are now undertaken to mitigate for unavoidable wetland losses. Mitigation banking is a mitigation technique in which wetland losses are offset by efforts to restore or create other wetlands of comparable value. For the most recent fiscal years, the ratio of wetland creation to wetland loss from the Federal Aid Highway Program has been greater than 2.2:1. In the fiscal years 1996 to 1998, about 10,815 acres of wetlands were created in response to 4,537 acres lost due to the Federal Aid Highway Program, for a net increase of 6,278 acres.[18] There is some debate about the effectiveness of wetland mitigation options in terms of wetland function.

WILDLIFE COLLISIONS

Collisions between vehicles and wildlife can impact certain wildlife populations. Collisions, however, are more frequently regarded as a safety concern because they can lead to vehicle damage and loss of human life. Collisions between transportation vehicles and wildlife can occur with all modes of transportation: motor vehicles, trains, aircraft, and maritime vessels and recreational boats.

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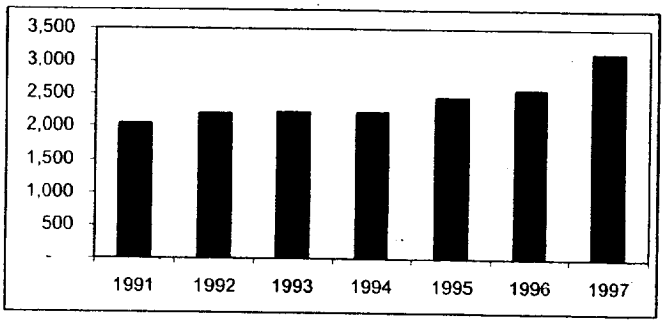
[17] U.S. Environmental Protection Agency. *Appendixes from the National Water Quality Inventory: 1996 Report to Congress.* http://www.epa.gov/OW/resources/9698/appendix.xls

[18] U.S. Department of Transportation, Federal Highway Administration. "Wetlands No-Net-Loss Summary Data." 1998.

There is incomplete data on the extent to which animals are killed by collisions with transportation vehicles and vessels nationwide. The most complete data are for bird and other wildlife strikes with aircraft, which have been monitored by the Federal Aviation Administration since 1965. Quantitative analyses from 1991 to 1997 show an increasing number of collisions over time, as shown in Figure 2-21. Birds were involved in 97 percent of all strikes. As development patterns have disrupted migratory patterns of birds, some airports have become major bird flocking areas due to the sufficient amount of open space.

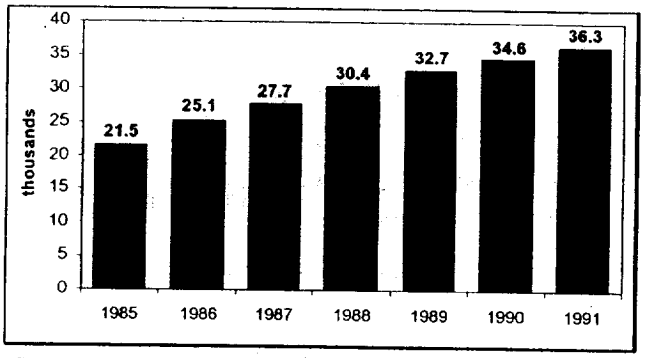
Figure 2-21: Number of Reported Strikes between Wildlife and Civil Aircraft



Source: U.S. Department of Transportation, Federal Aviation Administration. *Wildlife Strikes to Civil Aircraft in the United States 1991-1997.* September 1998.

Data on collisions between animals and motor vehicles is less complete, but also shows a trend of increasing animal-vehicle collisions. The Highway Safety Information System (HSIS) reports on motor vehicle crashes in five states — Illinois, Maine, Minnesota, Utah, and Michigan — for 1985 to 1990 revealed a total of approximately 208,300 animal crashes over this period. Although some crashes involved domestic animals, Michigan's crash report indicated whether the crash was deer related. For Michigan, almost all the hit-animal crashes (99.7 percent) were deer related, and recent data from Minnesota indicate that over 90 percent of animal crashes involved deer. Data from the five states shows a 69 percent increase in animal collisions with motor vehicles over the period 1985 to 1991.

Figure 2-22: Number of Animal Collisions with Motor Vehicles reported to HSIS



Source: U.S. Department of Transportation, Federal Highway Administration, Turner-Fairbank Highway Research Center. "HSIS Summary Reports: Investigation of Crashes with Animals." March 1995 (FHWA-RD-94-156). http://tfhrc.gov/hsis/94-156.htm

INTRODUCTION OF NON-NATIVE SPECIES

Introduction of non-native species, such as non-native grasses and vegetation, can be a significant problem with adverse consequences on habitat and ecosystems. Non-native species may compete with native species for food and force out existing creatures.

Ships are known to be a source of introduction of non-native species to bodies of water. Although national data are not available on damages to ecosystems or species loss due to introduction of

non-native species via ship, impacts in specific bodies of water have been identified. For example, over 130 non-native species have been introduced to the Great Lakes since 1800, and nearly a third are believed to have been carried in by ships.[19] Highway maintenance has also been a source of introduction of non-native species of grasses and vegetation. Highway right-of-way has in many instances been planted with non-native grasses, which have spread and forced out native vegetation from the area around highways.

2.6 WATER QUALITY AND AQUATIC RESOURCES

Transportation affects water quality in four ways: 1) the creation of impervious surfaces can adversely affect water quality due to faster rates of runoff, lower groundwater recharge rates, and increased erosion; 2) pollutants such as vehicle exhaust, oil, and dirt, and deicing chemicals, are deposited to roadways and other impervious surfaces; 3) leaking underground storage tanks release petroleum to groundwater; and 4) in the maritime sector, oil spills affect the water quality of inland waterways and coastal areas.

IMPERVIOUS SURFACES

The construction of surface transportation facilities creates impervious surfaces which can harm water quality in a number of ways including:

1. Runoff from roadways, runways, and parking lots can produce increased pollutant loadings to wetlands and streams unless the runoff is treated.

2. An increase in the amount of impervious surfaces results in lower recharge rates for groundwater.

3. Construction of surface transportation facilities contributes to increased erosion, which also occurs as a result of increased runoff from impervious surfaces.

Impervious surfaces are associated with all modes of transportation, but are most extensive for the highway system and airports. The growth in road mileage in the United States has been relatively slow, increasing by 19 percent from 1945 to 1997. Lane mileage in the United States has grown faster, from an estimated 2,693,604 miles in 1984 to 3,968,813 miles in 1997: a 47 percent increase.[20]

Traffic levels are much higher in urban areas than in rural locations; thus, pollutant levels from highway runoff are higher in urban areas than rural areas. Runoff pollution includes particulates and heavy metals from vehicle exhaust fumes, copper from brake pads, tire and asphalt wear deposits, and drips of oil, grease, antifreeze, hydraulic fluids, and cleaning agents.

In the aviation sector, national data on the amount of land area covered by airport runways and facilities is not readily available, although the amount is believed to be quite large. The number of airports with paved runways increased by more than 60 percent between 1980 and 1997, from just under 5,000 to over 8,000.

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[19] Council on Environmental Quality. *Environmental Quality 1993.*
[20] Includes all nonlocal lane mileage from Table HM-60 in *Highway Statistics* 1984 and 1997.

RELEASES OF DEICING CHEMICALS, CLEANING FLUIDS, AND WASTEWATER

Use of deicing chemicals facilitates travel during winter weather conditions, and is particularly important for highways and airports. Rock salt is the principal deicing agent used in winter road maintenance throughout the nation. Environmental impacts of road salt include adverse effects to roadside vegetation, harm to soil structure, and potential impacts on drinking water and aquatic life. The actual amount of salt applied to roads nationally is not known, but statistics on road salt sales are available. Approximately 16 million tons of highway salt were sold in 1997.[21]

Aircraft deicers and anti-icers used in North America are based on glycols such as ethylene glycol, diethylene glycol, and propylene glycol, while runway and taxiway deicers are typically formulated with a combination of urea, glycols, sodium formate, and/or potassium acetate. Glycols are biodegradable but can reduce the oxygen available to aquatic life in waters to which deicing and anti-icing fluids are released. Urea degrades to ammonia and nitrate, which are toxic and can contaminate drinking water. It is estimated that 11.5 million gallons of deicing products are used annually in aviation.[22]

Wastewater is another water quality issue associated with transportation. Facilities such as gas stations, maintenance shops, service stations, and freight terminals impact water quality through runoff of gas, oil, and dirt; spills during refueling; waste releases to sewer systems; and cleaning of freight tank interiors. Truck, railcar, and ship cargo interiors that carry fluids must be washed, resulting in the output of spent cleaning fluids, water treatment system sludge, and tank residues.

RELEASES FROM LEAKING UNDERGROUND STORAGE TANKS

Underground storage tanks (USTs) are used to store fuel at gas stations and other facilities, as well as other chemicals. Leaking petroleum USTs can be a source of groundwater contamination. Releases from tanks and piping occur from corrosion of older, unprotected steel tanks and piping, or from cracks in tanks made from other materials. The UST regulations that EPA issued in 1988 established a number of corrective action requirements for UST owners and operators, including the requirement to clean up soil and groundwater as needed to protect human health and the environment. EPA regulations required that by 1998 all existing USTs have spill protection through catchment basins, automatic shutoff devices, overfill alarms, and mandatory corrosion protection for steel tanks and piping. As a result of these stringent regulations, there has been a decrease in the number of active petroleum USTs in the U.S. as petroleum UST systems have been closed.

Data on number of active tanks and the cumulative number of closed tanks, releases reported, cleanups initiated and completed, and emergency responses are compiled in EPA's Corrective Action Measures reports (formerly called "STARS", Strategic Targeted Activities for Results System), summarized in Table 2-3.

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[21] Salt Institute, 1998. http://www.saltinstitute.org/33.html#highways

[22] D'Itri (ed.). *Chemical Deicers and the Environment.* Lewis Publishers. 1992.

Table 2-3: Corrective Action Measures Reports for the Entire U.S., 1996 - 1998

Time Period	# Active Tanks	Tanks Closed*	Confirmed Releases*	Cleanups Initiated*	Cleanups Completed*
1st Half FY 1996	1,093,018	1,043,437	314,720	241,787	141,185
2nd Half FY 1996	1,064,478	1,074,022	317,488	252,615	152,683
1st Half FY 1997	1,031,960	1,111,266	329,940	276,603	162,431
2nd Half FY 1997	969,652	1,150,824	341,773	292,446	178,297
1st Half FY 1998	919,540	1,186,341	358,269	301,842	192,065
2nd Half FY 1998	891,686	1,236,007	371,387	314,965	203,247

*Cumulative

Source: U.S. Environmental Protection Agency, Office of Underground Storage Tanks. "Corrective Actions Measures Archive." http://www.epa.gov/swerust1/cat/camarchv.htm

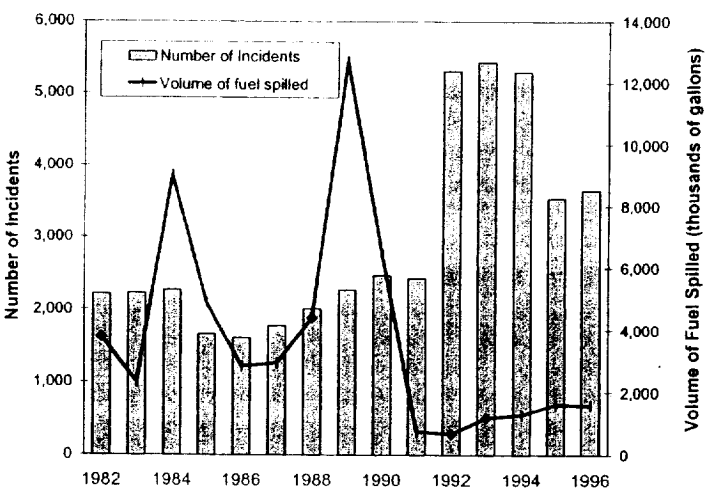
OIL SPILLS AND OTHER RELEASES TO WATER IN THE MARITIME SECTOR

Oil spills during marine transport are the most publicized adverse impact of the maritime industry because of the severe damage to the maritime environment they can cause. The discharge of solid wastes and sewage by maritime vessels can also affect water quality, especially in coastal areas where the volume of traffic is high.

Oil Spills

While the number of incidents in which oil was spilled has increased since 1982, the volume of fuel spilled has actually declined in recent years. Increased safety standards and enforcement resulting in part from the Exxon Valdez spill have led to a dramatic decline in the volume of fuel spilled in recent years.

Figure 2-23: Number of Fuel Spills and Total Volume of Fuel Discharged Annually, 1982-1997



Source: U.S. Department of Transportation, Bureau of Transportation Statistics. *National Transportation Statistics 1998* (Table 4-42).

Dumping of Solid Waste

No information is available on environmental damage caused nationally by dumping of solid waste from ships. It is estimated, however, that the U.S. maritime sector generates over 800,000 metric tons of garbage annually.[23] No information was available on the quantity of this waste that is disposed of at sea as opposed to at port. The most pronounced effects of solid waste dumping are entanglement, ingestion and ghost fishing (when discarded fishing gear continues to catch finfish and shellfish).

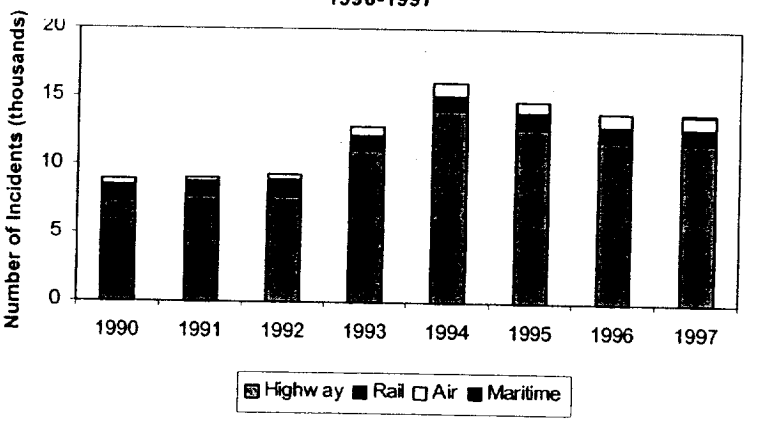
Sewage Dumping

Two major effects of sewage dumping are the introduction of microbial pathogens into the environment and a reduction in dissolved oxygen levels. No nationwide indicators of the environmental impacts of sewage dumping are available. The U.S. Coast Guard estimates that 90 to 95 percent of U.S. commercial vessels and 75 to 80 percent of recreational vessels are equipped with marine sanitation devices.[24] Marinas were reported to be a source of pollution on 3 percent of surveyed miles, with 25 percent of impaired river miles reporting marinas as a source of pollution. This pollution could be from a variety of factors, including sewage, oil spills, and other waste.[25]

2.7 HAZARDOUS MATERIALS INCIDENTS

Hazardous materials are shipped by all modes of transportation, and accidents in all modes that release hazardous materials damage the environment. The number of hazardous materials incidents reported to the Hazardous Materials Incidents System (HMIS) rose from about 8,880 in 1990 to 13,853 in 1997. Most reported incidents occurred in the highway sector, with rail and aviation reporting the next largest number of incidents. Although the number of reported incidents has grown, the incident rate is uncertain. The increase in reported incidents could be due in part to improved reporting or increased economic activity. Ton-miles and vehicle miles of freight increased over the 1990s, but data are not available on the level of shipment of hazardous materials nationally.

Figure 2-24: Number of Hazardous Materials Incidents, 1990-1997



[23] National Research Council, Marine Board, *Clean Ships, Clean Ports, Clean Oceans: Controlling Garbage and Plastic Wastes at Sea*, National Academy Press, 1995.
[24] U.S. Coast Guard.
[25] U.S. Environmental Protection Agency. *Appendices from the National Water Quality Inventory: 1996 Report to Congress.*

2.8 NOISE

The transportation system is a major source of noise in the United States. Intrusive noise can degrade the quality of life for people in affected areas. In extreme cases, intrusive noise can pose a threat to hearing. Sound is measured on a non-linear scale in units of decibels. An adjusted scale, using A-weighted decibels [dB(A)], emphasizes those sound frequencies that humans hear best. On this scale, a 10-dB(A) increase is perceived as a doubling of sound. Sound above 65 dB(A) is considered annoying and sound above 125 dB(A) is painful. Noise generated from the transportation system generally falls above the annoyance level but below that which is painful. Noise can cause stress and other health problems and can affect the habitat of species living near the roadway.

Recent national data on exposure to noise by different transportation sources are not available. An estimate of the percent of the population exposed to different levels of transportation noise is available for 1980, however, as shown in the following table.

Table 2-4: Percent of U.S. Population Exposed to Different Levels of Transportation Noise, 1980

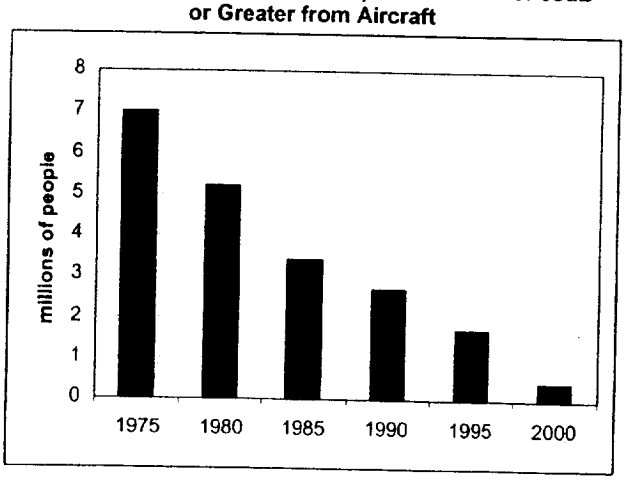
Mode	>55 dB(A) - Annoyance Level	>65 dB(A) - Communication Interference
Highway	37.0%	7.0%
Rail	2.4%	1.0%
Aviation	9.0%	2.0%

Source: Organization for Economic Cooperation and Development (OECD). *Indicators for the Integration of Environmental Concerns into Transport Policies*, OECD Publications, 1993.

Noise levels are site specific and dissipate as the distance from the source increases. Noise is primarily a problem produced by surface transportation and aviation, because of the loud sounds produced by motor vehicles, trains, and aircraft, and their proximity to residential areas.

As shown in Table 2-4, estimates from 1980 suggest that exposure to highway noise is the most significant transportation noise problem in terms of the number of people exposed to high levels of noise, with aviation also a significant problem. Noise from aircraft has been significantly reduced from 1980 levels, however. Noise associated with road transport comes primarily from engine operations, but also includes noise generated from pavement-wheel contact, aerodynamic effects, and the vibration of structures. Typical noise levels for highway vehicles range from about 70dB(A) for freeway traffic to 85 dB(A) for a heavy truck. Noise barrier construction has been used to mitigate this noise exposure, but recent estimates of noise exposure are not available and exposure levels are not known nationally. Noise associated with rail transport comes primarily from engine operations, but also includes rail-wheel contact, aerodynamic effects, and vibration of structures during operations. At the national level, railroad noise is not considered a significant problem, although at the

Figure 2-25: U.S. Population Exposed to DNL of 65dB or Greater from Aircraft



Source: U.S. Department of Transportation, Federal Aviation Administration, *Reprint of Preamble to the Amendments to PART91 Stage 2 Aircraft Phaseout*. 1995.

local level noise impacts from rail may be severe. Typical noise levels are 89dB for an electric locomotive, 93dB for a diesel locomotive, and 120 dB(A) for a locomotive whistle.

Noise is the most recognized environmental impact from aircraft. The U.S. Federal Aviation Administration (FAA) has focused its noise control efforts primarily on regulating aircraft and engines, which has resulted in significant reductions in exposure to aircraft noise. Regulations define three classes of aircraft in terms of their noise levels, with stage 1 being the loudest and stage 3 aircraft being the quietest. All stage 1 aircraft have already been phased out, and the last stage 2 aircraft over 75,000 pounds must be removed from service by December 31, 1999. Other types of controls to reduce aircraft noise exposure include modification of flight paths and timing of aircraft operations (usually to minimize nighttime operations) and soundproofing of buildings subject to the severest noise exposure.

The FAA measures noise through a measurement called the Day-Night Sound Level (DNL) which is also expressed in decibels (dB). Areas subject to a DNL of 65dB or above are considered incompatible with residential uses, but may be compatible with other uses. The population exposed to a DNL of 65dB or higher has been falling over time as Stage 2 aircraft are phased out. It is estimated that by the year 2000, less than 0.5 million people will be exposed to a DNL of over 65dB, down from about 7.0 million people exposed to that sound level in 1975.

2.9 SOLID WASTE

Disposal of parts and vehicles, aircraft, and vessels is the last phase of the life-cycle analysis of the environmental impacts of the transportation sector. National statistics on solid waste generation by the transportation sector are only available for the highway sector. In the maritime sector, most ship disposal (shipbreaking) is done overseas, and in the aviation sector, many older aircraft after are exported.

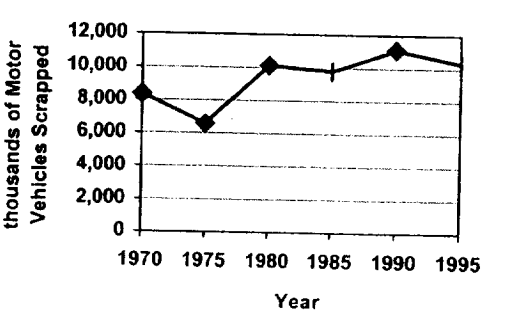
Motor vehicle dismantling operations generate both solid and fluid waste. Fluids, including motor oil, antifreeze, and air conditioning refrigerants, are recovered to the extent possible and reprocessed or sent to energy recovery facilities. Many vehicle parts, such as radiators and catalytic converters contain valuable metal materials and are usually removed before scrappage for recycling or reuse. In addition, the battery, fuel tank, and tires are also removed before disposal for safety or environmental reasons.

MOTOR VEHICLE SCRAPPAGE

Over 11 million motor vehicles were scrapped in 1996. The number of vehicles scrapped has not grown proportionately with the motor vehicle fleets as the average age of vehicles has grown over time. Figure 2-26 shows the number of vehicles scrapped from 1970-1995.

Approximately 75 percent of the material collected from scrapped vehicles (steel, aluminum, copper) is recycled and 25 percent is landfilled. Scrapped vehicle waste comprises about 1.5 percent of total municipal landfill

Figure 2-26 : Number of Motor Vehicles Scrapped Annually (thousands), 1970-1995



Source: U.S. Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics 1998*, Table 4-45.

waste.[26]

MOTOR OIL

Used motor oil is an environmental hazard as it contains concentrations of detergents, heavy metals, and other toxics. Improperly disposed motor oil is an extremely concentrated water contaminant . One quart of motor oil can contaminate a million gallons of fresh water. Over 70 percent of motor oil is burned or rerefined. 13.4 percent of used motor oil is illegally dumped and 10.1 percent is landfilled.[27]

TIRES

The characteristics that allow tires to last many thousands of miles on vehicles also make them difficult to dispose of. Many landfills do not allow tire disposal because tires decompose very slowly, collect gases from other garbage, and then gradually float up to the surface of the landfill. Since they retain stagnant water, tires are ideal breeding grounds for mosquitoes. In addition, they contain oil, making them a fire hazard. When ignited, tires emit toxic gases and the use of water to extinguish tire fires can result in soil and water contamination. Tire fires are very difficult to put out, sometimes burning for more than a year. In 1996, some 266 million tires were scrapped, of which 76 percent were recovered.[28] Recovery removes tires from the municipal waste stream through recycling, use as fuel, and exports to other countries. Despite efforts to remove tire dumps, about 800 million tires remain in stockpiles nationwide and represent an ongoing environmental hazard.[29]

BATTERIES

Lead-acid batteries are the largest source of lead entering the waste stream. Close to three-fourths (by weight) of the lead-acid batteries shipped domestically in 1989 were automotive batteries. Improper disposal of lead-acid batteries can cause environmental damage since the average vehicle battery contains 18 pounds of lead, 2 pounds of plastic, and a gallon of acid. The national recycling rate for lead-acid batteries is high, however: about 90 percent are recycled.[30]

RAIL EQUIPMENT, AIRCRAFT, SHIPS AND BOATS, AND PARTS

Solid waste from aircraft and ground support equipment includes batteries, tires, brake pads and other used vehicle components. The main impact of disposal of non-recycled vessel parts is that they contain toxic components (e.g. batteries and engine parts). Estimates of the health and environmental impacts of disposal of rail cars, aircraft, and ships and boats are not available.

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[26] U.S. Environmental Protection Agency, *Profile of the Motor Vehicle Assembly Industry*, EPA Office of Compliance Sector Notebook Project, September 1995.

[27] U.S. Environmental Protection Agency, *Municipal Solid Waste Fact Book – Internet Edition* http://www.epa.gov/epaoswer/non-hw/muncpl/factook/mswf/

[28] Scrap Tire Management Council: http://www.rma.org.

[29] Hilts, Michael. "Broadening the Market for Scrap Tire Rubber." *Solid Waste Technologies*, 10(1):14-19. January/February 1996.

[30] Battery Council International, www.ibstl.com. U.S. Environmental Protection Agency. *Characterization of Municipal Solid Waste in the United States: 1997 Update.* Prepared by Franklin Associates, Ltd. May 1998.

3. HIGHWAY ENVIRONMENTAL INDICATORS

This chapter describes the environmental impacts of highway transportation. Highway transportation is defined here to encompass all forms of on-road motor vehicle transportation including travel and related activities involving personal vehicles, motorcycles, freight trucks, and buses. Agricultural-related mobile sources, like tractors, and off-road recreational vehicles are not included in this discussion. Impacts are described for five categories of highway activities:

- Highway Infrastructure Construction
- Motor Vehicle and Parts Manufacture
- On-road Vehicle Travel
- Maintenance, Support, and Operations
- Disposal of Vehicles and Parts

3.1 HIGHWAY INFRASTRUCTURE CONSTRUCTION

Highway infrastructure projects include construction of new roads, additions to road capacity, and system preservation projects, such as resurfacing and reconstruction. Over the five years, 1993 to 1997, an average of 16,389 miles of Federal-aid roadway improvements were underway each year. On average, 492 miles of new routes (3 percent of project miles) and 2,130 miles of capacity additions (13 percent of project miles) were underway annually, while the remaining miles were system preservation-related projects such as reconstruction and resurfacing.[1] Considerable construction-related activity also occurs on non-Federal-aid highways, which make up over three-fourths of all highway miles.[2]

Highway infrastructure projects can impact natural resources in and around new or existing rights of way. Development of new roads involves taking of developed or undeveloped land for right of way and for "borrow pits" that are used as a source of fill material during construction. Environmental impacts that occur during road construction and widening include erosion, degradation of water quality as a result of excessive runoff during excavation activities, and air pollutant and greenhouse gas emissions from construction equipment.

Longer-term environmental impacts caused by highway infrastructure construction include fragmentation and loss of habitat, and degradation of water quality associated with increases in impermeable road surfaces. Indirectly, road construction contributes to changes in land use patterns, which can have more extensive effects on habitat. Motor vehicle-related infrastructure, such as paved parking lots and driveways, also destroy and fragment habitat. Upstream effects are also associated with the manufacture of asphalt, concrete, steel, and other materials used in highway projects.

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[1] U.S. Department of Transportation, Federal Highway Administration. *Highway Statistics 1997.* November 1, 1998. p. IV-43.

[2] U.S. Department of Transportation, Federal Highway Administration. *Highway Statistics 1997.* November 1, 1998. Table HM-18.

Environmental regulations and environmental management activities by transportation agencies limit the amount environmental damage caused by highway construction. A detailed environmental impact statement (EIS) is usually required prior to project development and impacts on environmental resources such as wetlands or endangered species and their habitats are usually mitigated through project modifications. During construction, erosion impacts are minimized through careful project management, and efforts are now being made to address polluted runoff from highways through stormwater management programs.

LAND USE AND HABITAT DISRUPTION

DESCRIPTION OF IMPACT

Taking of land for a new highway may adversely affect sensitive ecological resources such as endangered plant and animal species or their habitats. Since the annual increase in road mileage is relatively small compared to the existing system, the aggregate national impacts associated with direct loss of habitat to new construction are low. Roads, however, can have a significant impact locally and regionally. Roads can split natural habitats, decreasing habitat necessary to support certain species populations and reducing interaction with other communities. Habitat fragmentation (also affected by the volume of traffic) is known to produce declines in both the number of species (diversity) and their populations (abundance).

Wetlands are a specific type of habitat that has received special attention because they perform important ecological functions. Wetlands support a diverse range of species and provide critical habitat for more than half of all endangered fish and amphibian species in the United States. Wetlands also provide other desirable functions such as flood control, mitigation of damage from erosion, and improvement in water quality by removing excess nutrients and some chemical contaminants. Due to the linear nature of highway projects, many cross watercourses and some may have unavoidable adverse effects on wetlands.

Although significant wetland losses have occurred historically due to highway development and urban development, compensatory mitigation efforts are now undertaken to mitigate for unavoidable wetland loss. The national policy of "no net loss of wetlands" has recently been strengthened with new priorities to produce net increases in wetland acreage resulting from Federal-aid highway projects. Questions still remain, however, about the effectiveness of wetland mitigation approaches in terms of wetland function.

FACTORS THAT AFFECT IMPACT

- Type of construction activity (maintenance v. capacity expansion)
- Ecological conditions/type of land (i.e., wetlands, forest, etc.)
- Species/habitat in and near the right of way
- Type of road surface (paved/unpaved) and barriers to wildlife crossing
- Implementation of various efforts to avoid or mitigate impacts (e.g. wildlife crossings)

INDICATORS OF ENVIRONMENTAL IMPACT

Wetland acreage affected by highways is the only measure of habitat loss associated with road construction that is tracked nationally. Quantified data on other environmental outcomes from highway infrastructure, such as losses of endangered species and habitat fragmentation are not

available at a national level. The amount of highway construction and land area occupied by highways provide an indication of environmental impact. These measures, however, are limited because they do not provide information on environmental mitigation practices, the sensitivity of wildlife in a project area, or secondary effects.

WETLANDS LOSSES AND GAINS FROM MITIGATION

The Clean Water Act requires states and other jurisdictions to provide a variety of information on water quality to EPA as part of "305(b)" reports. However, flexibility in the 305(b) reporting requirements means that reporting of wetlands-related impacts due to road construction is not mandated. Only 12 states provided information about wetlands losses in 1996 305(b) reports. Of these states, 6 (50 percent) reported wetlands losses due to highway/bridge construction.[3] Of 8 states reporting sources of degraded wetland integrity, 3 (37 percent) reported that road construction was a cause, while 7 (87 percent) reported urban run-off as a cause. Trend data are unavailable because reporting methodologies vary from year to year.

Source: U.S. EPA, Appendices from the National Water Quality Inventory: 1996 Report to Congress. http://www.epa.gov/OW/resources/9698/appendix.xls

While historically transportation has been a source of net wetland losses, in recent years, the Federal-aid Highway System has been a net contributor to wetland acreage through mitigation projects.

Table 3-1: Wetland Losses and Creation Associated with the Federal Aid Highway Program

Year	Wetland Acres Impacted	Wetland Acres Mitigated	Ratio of Wetlands Created to Wetlands Lost
FY 1996	1,568	3,554	2.3 : 1
FY 1997	1,699	4,483	2.6 : 1
FY 1998	1,270	2,778	2.2 : 1

Source: U.S. Department of Transportation, Federal Highway Administration. "Wetlands No-Net-Loss Summary Data." 1998. Data based on figures reported by FHWA Regional Offices.

LAND OCCUPIED BY HIGHWAYS

In 1997, public roads occupied an estimated 17,345 square miles of land (11.1 million acres), not including road shoulders and medians. This area equals less than 0.5 percent of U.S. land area. It is an increase from 17,013 square miles (10.9 million acres) in 1990.

[3] Other sources included agriculture (9 states), and residential development and urban growth (10 states).

Table 3-2: Land Area Occupied by Roadways, 1990-1997 (Square Miles)

Year	Rural Roads	Urban Roads	Total Public Roads	% Increase from 1990
1990	13,402	3,610	**17,013**	-%
1995	13,278	3,926	**17,205**	1.1%
1996	13,284	3,963	**17,247**	1.4%
1997	13,363	4,012	**17,375**	2.1%

Source: Estimate based on data from U.S. Department of Transportation, Federal Highway Administration. *Highway Statistics 1990, 1995, 1996* and *1997*. Table HM-60.[4]

Rural roads made up approximately 77% of all land used for highways, occupying an area larger than the state of Maryland. Urban roads took up 23% of total land used for highways, occupying an area larger than the state of Delaware.

One study estimated that paved and unpaved public roads (including medians and shoulders) occupy about 25,000 square miles of land; if off-street parking, garages, carports, and driveways are included, the land area increases to 29,000 square miles.

Source: Delucchi, M.A. "Bundled Private Sector Costs of Motor Vehicle Use." Report No. 6 in the Series: *The Annualized Social Costs of Motor Vehicle Use in the U.S., Based on 1990-91 Data*. Davis, CA: University of California, Davis, Institute of Transportation Studies.

LANE MILEAGE

There were approximately 8.24 million lane miles on roadways in the U.S. in 1997. This is an increase of nearly 167,000 lane miles since 1990 — a 2.1 percent increase.

Table 3-3: Lane Miles, 1990-1997

Year	Lane Miles	% Increase from 1990
1990	8,071,708	-%
1995	8,158,181	1.1%
1996	8,177,823	1.3%
1997	8,238,494	2.1%

Source: U.S. Department of Transportation, Federal Highway Administration. *Highway Statistics 1990, 1995, 1996* and *1997*. Table HM-60.

ROAD MILEAGE

Between 1945 and 1997, 638,998 new miles of public roads were added in the United States, a 19 percent increase in road mileage. The most significant increases in road mileage occurred in the 1950s and 1960s. Between 1990 and 1997, road mileage in the United States increased by 91,357 miles, or 2.4 percent.

[4] Values calculated based on number of lane miles times estimated average width per road type: interstate highways - 12 ft., rural other arterials - 11.9 ft., urban other arterials - 11.8 ft., rural collectors - 11 ft., urban collectors - 11.3 ft., local roads - 11 ft.

Table 3-4: Public Road Mileage, 1945 - 1997

Year	Public Road Mileage	% Increase from 1945
1945	3,319,286	-%
1950	3,312,975	0%
1955	3,418,214	3%
1960	3,545,693	7%
1965	3,689,666	11%
1970	3,730,082	12%
1975	3,838,146	16%
1980	3,859,838	16%
1985	3,863,913	16%
1990	3,866,927	16%
1991	3,883,921	17%
1992	3,901,082	18%
1993	3,905,212	18%
1994	3,906,596	18%
1995	3,912,227	18%
1996	3,933,986	19%
1997	3,958,284	19%

Source: U.S. Department of Transportation, Federal Highway Administration. *Highway Statistics Summary to 1995* (Table HM-212), *Highway Statistics 1996* and *1997* (Table HM-12).

HIGHWAY RUNOFF AND WATER QUALITY IMPACTS

DESCRIPTION OF IMPACT

At highway construction sites, run-off, particularly where groundcover is removed, can cause erosion of soil, sedimentation in water bodies, and other changes that disrupt aquatic habitats such as fish-spawning areas and water vegetation. Longer term effects of roadway infrastructure include changes in watershed hydrology. Unpaved roads contribute to sedimentation as soil and gravel run off into stream channels. Impervious road surfaces increase both the volume and rate of surface water runoff and act as a conduit for a wide variety of toxic pollutants. Pavement covers soils and vegetation that would otherwise slow and absorb runoff before it reaches receiving bodies of water, and stormwater systems speed the flow of runoff to sewers. Higher volumes and faster rates of runoff in turn increase sedimentation, nutrients, and acidity of water. High volumes of runoff from hot paved surfaces can also boost surface water temperatures harming fish and other aquatic life.

Average daily traffic (ADT) also has a strong influence on the quality of runoff. Because ADT levels are higher in urban areas than rural locations, pollutant levels in highway runoff are higher in urban areas. Contaminants are deposited on roadway surfaces, median areas, and rights-of-way from atmospheric fallout, vehicle exhaust, lubrication system losses, tire and brake wear, transportation load losses, deicing agents, and paint from infrastructure. During storm events, rainwater washes out atmospheric pollutants and upon surface impact (or snowmelt) it picks up roadway deposits and runs off into receiving water bodies.

Runoff pollutants from vehicles include particulates and heavy metals from exhaust fumes, copper from brake pads, tire and asphalt wear deposits, and drips of oil, grease, antifreeze, hydraulic fluids, and cleaning agents. Indirectly, vehicles also contribute to polluted runoff by carrying solids from parking lots, urban roadways, construction sites, farms, and dirt roads.

FACTORS THAT AFFECT IMPACT

- Paved surface area
- Level of traffic activity
- Rate of deposition of contaminants on road surface per vehicle
- Precipitation activity: antecedent dry period, storm intensity and duration, total amount of rainfall/snowmelt
- Drainage characteristics
- Ecology and other aspects of receiving water bodies: type, size, diversity, potential for dispersion

INDICATORS OF ENVIRONMENTAL IMPACT

Information on water quality is compiled by states, but it is difficult to determine what portion of impaired river miles and lakes are directly affected by highway runoff. As a result, the actual contribution of highways to poor quality of water bodies is unknown. Paved surface area serves as an indicator of runoff impacts because impervious surfaces are associated with higher rates of runoff.

IMPAIRED WATERWAYS IMPACTED BY HIGHWAY RUNOFF AND URBAN RUNOFF

In 1996, of the 693,905 river miles surveyed, urban runoff was estimated to be a leading source of impairment for 13 percent of impaired river miles, up from 11 percent in the 1994 report.

Of the 16.8 million acres of lakes, reservoirs, and ponds surveyed, 417,138 acres were reported to be impaired due to highway maintenance and runoff — 6 percent of impaired lake acres (2 percent of total lake acres surveyed). The proportion of impaired lake acres reported affected by urban runoff decreased from 24 percent to 21 percent between 1994 and 1996, and the number of impaired estuaries affected by urban runoff decreased from 59 percent to 46 percent.

Source: U.S. Environmental Protection Agency. *Appendixes from the National Water Quality Inventory:1996 Report to Congress.* http://www.epa.gov/OW/resources

IMPERVIOUS SURFACES

The exact contribution of transportation to urban runoff is not known, but it is expected to be large, since road surfaces occupy a significant portion of land in urban areas, 19 percent according to Tolley, 1995. While road mileage is not growing quickly, paved mileage is growing more rapidly.[5] While total road mileage increase 19 percent between 1945 and 1997, paved road mileage increased almost threefold (278 percent). The percentage of roads in the U.S. that are paved has increased from about 19% in 1945 to 61% in 1997.

[5] This has implications for increased runoff impacts, but also has other implications, such as reduced particulate emissions from re-entrained dust and perhaps higher speeds of travel and greater emissions per VMT for certain pollutants.

Table 3-5: Unpaved and Paved Public Road Mileage, 1945-97

Year	Unpaved	Paved	% Paved
1945	2,681,316	637,970	19%
1950	2,532,978	779,997	24%
1955	2,422,428	995,786	29%
1960	2,315,224	1,230,469	35%
1965	2,235,066	1,454,600	39%
1970	2,071,661	1,658,421	44%
1975	1,982,786	1,855,360	48%
1980	1,787,145	2,072,692	54%
1985	1,749,855	2,114,057	55%
1990	1,612,104	2,254,822	58%
1991	1,604,317	2,279,603	59%
1992	1,598,345	2,302,736	59%
1993	1,627,525	2,277,686	58%
1994	1,564,416	2,342,179	60%
1995	1,533,958	2,378,268	61%
1996	1,553,913	2,380,072	61%
1997	1,548,349	2,409,935	61%

Sources: U.S. Department of Transportation, Federal Highway Administration. *Highway Statistics Summary to 1995* (Table HM-212), *Highway Statistics 1996* and *Highway Statistics 1997* (Table HM-12).

3.2 MOTOR VEHICLE AND PARTS MANUFACTURE

The motor vehicle and motor vehicle equipment industry is the largest manufacturing industry in North America, accounting for about 4 percent of gross domestic product (GDP).[6] Nearly 6.1 million passenger cars and 5.7 million commercial vehicles were manufactured in the U.S. in 1996.[7] There are approximately 4,467 motor vehicle and equipment facilities in the U.S., 39% of which are in the Great Lakes Region.[8] The massive size of the automotive industry and the diverse nature of parts required to produce a car requires the support of many other major U.S. industries such as the plastics and rubber industry and the electronic components industry.

Facilities involved with the manufacturing of automobiles are located across the U.S. and are organized based on the types of products produced. Businesses involved in the manufacturing of these products range from the large multi-national automakers to small independent automotive parts suppliers.

The many different production processes employed to manufacture a motor vehicle require a vast amount of material input and generate large amounts of waste. The outputs resulting from the various stages of production range from air emissions from foundry operations to wastewater containing spent solvents from surface painting and finishing. For the industry as a whole, solvents such as toluene and acetone comprise the largest number of releases. The large quantity of solvent releases can be attributed to the solvent-intensive finishing processes employed by the industry. In addition to being used to clean equipment and metal parts, solvents are components of many coatings and finishes applied to automobiles during the assembly and painting/finishing operations.

Federal regulatory programs, such as the Clean Air Act and the Resource Conservation and Recovery Act (RCRA) of 1976, which addresses solid and hazardous waste management activities, have helped to reduce the environmental impacts of vehicle equipment manufacture. Voluntary initiatives by the automotive industry to explore pollution prevention opportunities also have reduced environmental impacts.

TOXIC RELEASES

DESCRIPTION OF IMPACT

The manufacture of motor vehicles and equipment results in environmental impacts through the release of toxics to the air, soil, and water. The top five toxic pollutants (by volume) generated by the motor vehicle manufacturing industry include xylene, glycol ethers, toluene, methyl isobutyl ketone, and N-butyl alcohol. These are solvents used to clean equipment and metal parts, and are

[6] U.S. Department of Commerce, Bureau of Economic Analysis.

[7] U.S. Department of Transportation. *National Transportation Statistics 1998* (Table 1-28). www.bts.gov/btsprod/nts/

[8] U.S. Environmental Protection Agency. *Sector Notebook: Motor Vehicle Assembly Industry*. 1995.

used in many coatings and finishes.[9] The industry has reduced toxic releases considerably in recent years through a mix of voluntary and mandated actions.

The manufacturing process begins with foundries that cast metal products, which are used in the production of motor vehicles and motor vehicle equipment. Foundries create a number of wastes that may pose environmental concerns. Dust is created during sand preparation, molding, and shakeout and is of concern due to the carcinogenic potential of the crystalline silica in the sand. Gases containing lead, cadmium, particulate matter, and sulfur dioxide are created during iron melting. Wastewater generated primarily during slag quenching operations and by wet scrubbers employed as air pollution control devices may contain cadmium and lead.

The next major process in the manufacturing of automotive parts is metal fabrication. Metal fabrication involves the shaping of metal components. Many automotive parts, including fenders, hubcaps, and body parts are manufactured in metal fabricating shops. Each of the metal shaping processes can result in waste metalworking fluids. Metalworking fluids typically become contaminated with extended use and reuse and they may contain constituents of concern, including toxics such as cadmium, chromium, and lead. Many fluids may also contain chemical additives such as chlorine, sulfur and phosphorus compounds, phenols, cresols, and alkalines. In the past, such oils have commonly been mixed with used cleaning fluids and solvents (including chlorinated solvents). Air emissions may result through volatilization during storage, fugitive losses during use, and direct ventilation of fumes.

Following fabrication, metal parts must be finished. Numerous methods are used to finish metal products, and surface preparation operations generate wastes contaminated with solvents and or metals depending on the type of cleaning operation. Concentrated solvent-bearing wastes and air emissions may arise from degreasing operations. Chemical treatment operations can result in wastes that contain metals of concern. Electroplating operations can result in solid and liquid waste streams that contain constituents of concern. Related operations, including all non-painting processes, can contribute wastes including scrap metals, cleaning wastewater, and other solid materials.

Once the various automotive parts are produced, they are ready to be brought together for assembly. Due to advances in technology, well designed operating procedures, and the implementation of strategies to limit waste from assembly, little waste is generated during the actual assembly of an automobile. The final phase of motor vehicle manufacture is painting. Various solid and liquid wastes may be generated throughout painting operations and are usually the result of paint application and drying, cleanup operations, and disposal of leftover and unused paint as well as containers used to hold paints.

FACTORS THAT AFFECT IMPACT

- Number of vehicles built
- Efficiency of controls and efforts to reuse or recycle chemicals, including pollution prevention
- Amount of chemicals transferred to other locations for recycling, energy recovery, or treatment

[9] U.S. Environmental Protection Agency. *Sector Notebook Data Refresh - 1997.* May 1998 (p. T2).

- Types of chemicals released - toxicity
- Exposure to impacts (population in vicinity of manufacturing facility)

INDICATORS OF ENVIRONMENTAL IMPACT

No quantified data on human health impacts, such as increased incidence of cancer from toxics, or habitat and species impacts are available. Estimates of TRI releases are available, however.

TOXIC RELEASES

According to the 1996 Toxic Release Inventory, 728 motor vehicle-related manufacturing facilities (SIC codes 3711, 3713, 3714, 3715, 3716, 3751, and 3792) released nearly 73 million pounds of toxic pollutants to the environment in 1996, as shown in the table below. The largest quantity of toxic chemicals were reported released from industries producing motor vehicles and car bodies (SIC code 3711) and motor vehicle parts and accessories (SIC code 3714).

Table 3-6: Toxic Chemicals Released from Motor Vehicle-Related Manufacturing Facilities, 1996 (pounds per year)

SIC	Industry Type	Total On-Site Releases	Total Off-Site Releases (Transfer to Disposal)	Total Quantity Released to the Environment
3711	Motor Vehicles & Car Bodies	40,587,234	1,517,251	42,104,485
3713	Truck & Bus Bodies	4,770,261	133,698	4,903,959
3714	Motor Vehicle Parts & Accessories	16,080,845	4,348,414	20,429,259
3715	Truck Trailers	1,821,756	16,370	1,838,126
3716	Motor Homes	1,353,532	1,438	1,354,970
3751	Motorcycles, Bicycles, & Parts	721,200	9,050	730,250
3792	Travel Trailers & Campers	1,276,632	49,181	1,325,813
-	TOTAL	**66,611,460**	**6,075,402**	**72,686,862**

Note: On-site releases from Section 5 of Form R. Off-site releases from Section 6 of Form R.

Source: U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics. *1996 Toxics Release Inventory Public Data Release – 10 Years of Right-to-Know: Industry Sector Analyses.* December 1998 (Table 14-3).

Total production-related waste for motor vehicle-related manufacturing totaled 271.3 million pounds of toxic chemicals in 1996. Of the total production-related toxic waste, 12 percent underwent on-site waste-management (either recycling, use for energy recovery, or treatment on-site) and 61 percent was transferred off-site for waste-management. In total, 57 percent of total production-related toxic waste was recycled.

Source: U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics. *1996 Toxics Release Inventory Public Data Release – 10 Years of Right-to-Know: Industry Sector Analyses.* December 1998 (Table 14-9).

Most toxic releases from motor vehicle-related manufacturing facilities were emitted to the air. Because chemicals have been added to the Toxic Release Inventory (TRI), deleted, or redefined over time, the following table reports only releases of "core" chemicals required to be reported in

all years, 1988-1996.[10] Releases of core chemicals dropped by 48.56 million pounds — a 42 percent reduction — between 1988 and 1996.

Table 3-7: Toxic Chemicals (Core) Released from Motor Vehicle-Related Manufacturing Facilities (SIC 3711, 3713, 3714, 3715, 3716, 3751, and 3792), 1988-1996 (thousands of pounds per year)

Year	On-site Releases					Off-site Releases	Total Releases to the Environment
	Air	Water	Under-ground injection	Direct to land	Total On-site Releases		
1988	101,613.4	167.3	1.4	1,731.2	103,513.3	13,211.0	116,724.3
1994	79,145.9	15.1	-	152.8	79,313.7	5,837.5	85,151.3
1995	69,200.0	12.5	-	313.4	69,522.9	6,332.5	75,855.4
1996	62,797.2	20.7	-	541.9	63,359.8	4,790.1	68,149.9

U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics. *1996 Toxics Release Inventory Public Data Release – 10 Years of Right-to-Know: Industry Sector Analyses.* December 1998 (Table 14-14).

CRITERIA AIR POLLUTANTS

DESCRIPTION OF IMPACT

Criteria air pollutants are emitted during various stages of the manufacturing process. Of particular note, volatile organic compounds (VOC) result from the painting and finishing application processes (paint storage, mixing, applications, and drying) as well as cleaning operations. These emissions are composed mainly of organic solvents that are used as carriers for the paint. Solvents are also used during cleanup processes to clean spray equipment between color changes, and to clean portions of the spray booth.

FACTORS THAT AFFECT IMPACT

- Number of vehicles built
- Efficiency of controls and efforts to reduce emissions, including pollution prevention
- Exposure to impacts (population in vicinity of manufacturing facility)

[10] Tables for 1988 to 1996 include only chemicals that were reportable in all years for 1988 to 1996. These tables do not include, for example, chemicals added in 1990, 1991, 1994, or 1995. Because non-fibrous forms of aluminum were removed from the list in 1989, aluminum oxide is not included. Reporting definitions for ammonia, hydrochloric acid and sulfuric acid have also changed, and are not included in multi-year comparisons. The set of "core" chemicals differs depending on which years are being examined, so the figures in this table may not equal those in other tables that use different years.

INDICATORS OF ENVIRONMENTAL IMPACT

ESTIMATES FROM NATIONAL INVENTORIES

Quantified information on criteria pollutant emissions from vehicle and parts manufacturing facilities can be extracted from EPA's national emissions inventory. These estimates include only point sources.

Table 3-8: Criteria Pollutant Emissions from Vehicle Manufacturing Facilities, 1990-1996 (short tons)

Year	VOC	NO_x	CO	SO_2	PM-10
1990	108,050	20,848	22,046	41,670	4,616
1991	102,731	16,905	16,744	30,893	4,692
1992	107,456	21,445	17,093	35,489	5,192
1993	108,488	19,796	14,927	32,335	5,514
1994	113,542	19,583	18,008	31,468	5,641
1995	108,678	18,900	18,286	31,232	4,923
1996	102,782	18,913	18,384	31,233	4,922

Note: Based on following SIC codes — 3711, 3713, 3714, 3715, 3716, 3751, 4213.

Source: U.S. Environmental Protection Agency. *NET Viewer.*

Motor vehicle and car bodies (SIC 3711) report the largest quantity of emissions of all facilities within the vehicle manufacturing industry.

Table 3-9: Criteria Pollutant Emissions from Vehicle Manufacturing Facilities by SIC Code, 1996 (short tons)

SIC	Industry Type	VOC	NO_x	CO	SO_2	PM-10
3711	Motor Vehicles and Car Bodies	73,936	8,683	12,528	16,641	1,803
3713	Truck and Bus Bodies	7,299	164	59	59	74
3714	Motor Vehicle Parts & Accessories	16,174	9,924	5,704	14,311	2,794
3715	Truck Trailers	2,092	27	15	25	162
3716	Motor Homes	183	3	18	0	0
3537	Indust. Trucks, Tractors, Trailers, Stackers	520	39	27	2	24
3751	Motorcycles, Bicycles & Parts	2,475	53	27	152	60
4213	Trucking	103	21	7	42	4
-	TOTAL	102,782	18,913	18,384	31,233	4,922

Source: U.S. Environmental Protection Agency. *NET Viewer.*

Most of the VOC emissions from vehicle manufacturing facilities come from solvent utilization in surface coating for vehicles.

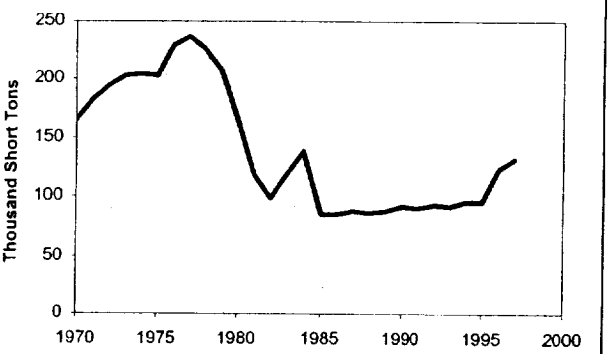
Estimates of total VOC emissions from solvent use in surface coating for autos and light trucks are available for 1970 to 1997. The estimates reported below include both point and area sources, so the figures do not correspond to the figures reported above by SIC category, which only include point sources.

Table 3-10: VOC Emissions from Solvent Utilization in Surface Coating for Autos & Light Trucks (Point and Area Sources), 1970-1997

Year	Thousand Short Tons
1970	165
1975	204
1980	165
1985	85
1990	92
1991	90
1992	93
1993	92
1994	96
1995	96
1996	123
1997	132

Source: U.S. Environmental Protection Agency. *National Air Pollutant Emissions Trends Report, 1900-1997* (Table A-3).

Figure 3-1: VOC Emissions from Solvent Utilization in Surface Coating for Autos & Light Trucks



REPORTS FROM LARGE MANUFACTURING FACILITIES

Reports of criteria pollutant emissions from individual large manufacturing facilities are compiled in EPA's AIRS database. These data are not complete. They do not include information from all manufacturing facilities or allow consistent tracking of trends. They do, however, provide a basis for comparing the contribution of motor vehicle manufacturing facilities to that of other industrial facilities.

Table 3-11: VOC Emissions from Motor Vehicle and Parts Manufacturing Facilities reported to AIRS

Industry Type (SIC)	Number of Facilities Reporting VOC	Percent of Total Facilities Reporting	Pollutant Emissions (tons/year)	Percent of Total Emissions
3465 - Automotive Stampings	2	0.05%	662	0.04%
3711 - Motor Vehicles And Car Bodies	56	1.46%	52,515	2.94%
3713 - Truck And Bus Bodies	21	0.55%	6,087	0.34%
3714 - Motor Vehicle Parts & Accessories	57	1.48%	14,363	0.8%
3715 - Truck Trailers	7	0.18%	1,744	0.1%
3716 - Motor Homes	1	0.03%	126	0.01%
3751 - Motorcycles Bicycles & Parts	6	0.16%	2,149	0.12%
3792 - Travel Trailers And Campers	5	0.13%	692	0.04%
5013 - Automotive Parts And Supplies	1	0.03%	136	0.01%
TOTAL - Motor Vehicle Manufacture	**156**	**4.1%**	**78,474**	**4.4%**

Source: U.S. EPA, Office of Air and Radiation. *AIRS Database*. January 1999.

Table 3-12: CO Emissions from Motor Vehicle and Parts Manufacturing Facilities reported to AIRS

Industry Type (SIC)	Number of Facilities Reporting VOC	Percent of Total Facilities Reporting	Pollutant Emissions (tons/year)	Percent of Total Emissions
3711 - Motor Vehicles And Car Bodies	3	0.59%	4,490	0.12%
3714 - Motor Vehicle Parts & Accessories	1	0.2%	1,390	0.04%
TOTAL - Motor Vehicle Manufacture	**4**	**0.79%**	**5,880**	**0.16%**

Source: U.S. EPA, Office of Air and Radiation. *AIRS Database.* January 1999.

Table 3-13: NO_2 Emissions from Motor Vehicle and Parts Manufacturing Facilities reported to AIRS

Industry Type (SIC)	Number of Facilities Reporting VOC	Percent of Total Facilities Reporting	Pollutant Emissions (tons/year)	Percent of Total Emissions
3711 - Motor Vehicles And Car Bodies	23	0.5%	6,602	0.08%
3714 - Motor Vehicle Parts & Accessories	20	0.43%	8,891	0.1%
TOTAL - Motor Vehicle Manufacture	**43**	**0.93%**	**15,493**	**0.18%**

Source: U.S. EPA, Office of Air and Radiation. *AIRS Database.* January 1999.

Table 3-14: SO_2 Emissions from Motor Vehicle and Parts Manufacturing Facilities reported to AIRS

Industry Type (SIC)	Number of Facilities Reporting VOC	Percent of Total Facilities Reporting	Pollutant Emissions (tons/year)	Percent of Total Emissions
3711 - Motor Vehicles And Car Bodies	14	0.58%	5,795	0.04%
3714 - Motor Vehicle Parts & Accessories	19	0.79%	6,966	0.04%
3751 - Motorcycles Bicycles & Parts	1	0.04%	118	0%
5013 - Automotive Parts And Supplies	1	0.04%	116	0%
TOTAL - Motor Vehicle Manufacture	**35**	**1.45%**	**12,995**	**0.08%**

Source: U.S. EPA, Office of Air and Radiation. *AIRS Database.* January 1999.

Table 3-15: PM_{10} Emissions from Motor Vehicle and Parts Manufacturing Facilities reported to AIRS

Industry Type (SIC)	Number of Facilities Reporting VOC	Percent of Total Facilities Reporting	Pollutant Emissions (tons/year)	Percent of Total Emissions
3711 - Motor Vehicles And Car Bodies	1	0.09	221	0.05
3715 - Truck Trailers	1	0.09	135	0.03
TOTAL - Motor Vehicle Manufacture	**2**	**0.18**	**356**	**0.08**

Source: U.S. EPA, Office of Air and Radiation, *AIRS Database.* January 1999.

3.3 ON-ROAD VEHICLE TRAVEL

Road vehicle travel is the dominant form of transportation in the United States. In 1997, about 2.56 trillion vehicle miles were traveled on U.S. roads by passenger cars, motorcycles, buses, light-duty trucks, and heavy-duty trucks.[11] Vehicle travel has increased rapidly — rising from 719 billion miles in 1960, to 1.11 trillion miles in 1970, to 1.53 trillion miles in 1980, and to 2.14 trillion miles in 1990.

Air pollution from motor vehicles is the most widely recognized and studied environmental impact of transportation. Air pollution from vehicle travel comes from by-products of the combustion process and evaporation of unburned fuel, as well as particulate matter that is entrained by passing automobiles. Vehicle travel also causes other adverse effects, such as greenhouse gas emissions, noise problems, collisions with wildlife, and water quality impacts from oil leaks. Hazardous materials incidents during highway transport may release harmful chemicals to the environment.

TAILPIPE AND EVAPORATIVE EMISSIONS

DESCRIPTION OF IMPACT

On-road vehicle travel results in emissions of pollutants that are harmful to human health and welfare. Carbon monoxide (CO), sulfur oxides (SO_x), oxides of nitrogen (NO_x), volatile organic compounds (VOC), and particulate matter (PM) are by-products of the internal combustion process and are emitted directly from vehicle exhaust. VOCs are also emitted during fuel evaporation. Evaporation occurs from vaporization of gasoline during travel (running losses), after parking while the engine is still warm (hot soak), vapors escaping while refueling the vehicle, and even as a vehicle sits parked while the engine is cool on hot summer days (diurnal emissions).

Toxic air pollutants are also emitted by motor vehicles. Many toxic air pollutants are emitted in the form of particulates or VOC. Major hazardous air pollutants emitted by motor vehicles include Acetaldehyde, Benzene, 1,3-Butadiene, Formaldehyde, Toluene, and Xylenes.

Modern emissions control equipment has significantly reduced the rate at which vehicles emit pollutants from the tailpipe. Lead emissions have been virtually eliminated due to the phase-out of leaded gasoline. Increasingly stringent vehicle emissions standards and reformulated and oxygenated fuels have led to significant progress at controlling vehicle emissions. In fact, on-road vehicle emissions have fallen since the 1970s despite rapid growth in vehicle travel. Still, challenges remain because rapid growth in travel has offset some of the potential emissions reductions from improved technologies and continued vehicle travel growth threatens air quality in many urban areas.

FACTORS THAT AFFECT IMPACT

Factors that affect the amount of emissions coming from motor vehicles include:

- Number of vehicle trips - number of cold-starts, hot-starts, hot-soaks

[11] U.S. Department of Transportation, Federal Highway Administration. *Highway Statistics 1997* (Table VM-1).

- Vehicle miles of travel (VMT)
- Vehicle type, age, weight, and emissions control technology
- Type of fuel consumed (gasoline, diesel fuel, etc.)
- Travel characteristics: speed, acceleration, etc. - affects emissions per mile

Factors that influence the amount of environmental damage that occurs from air pollutant emissions include:

- Topographical conditions (hills, valleys, etc.) - affects dispersion/dilution of pollutants
- Climatic conditions (temperature, wind, rain, etc.) - affects dispersion/dilution of pollutants and formation of secondary pollutants
- Population density - affects number of people exposed to pollution
- Sensitivity of local ecosystems

INDICATORS OF ENVIRONMENTAL IMPACT

AIR POLLUTANT EMISSIONS

A large portion of national emissions of carbon monoxide, volatile organic compounds, and oxides of nitrogen come from motor vehicle travel. Although there has been a steady trend of improvement in air quality since the 1970s, air pollutant emissions from motor vehicle travel still remain a major challenge for many urban areas that fail to meet national air quality standards.

Table 3-16: Criteria Pollutant Emissions from Motor Vehicle Travel, 1997

Pollutant	Quantity Emitted (thousand short tons)	Percent of total Emissions of Pollutant
Carbon Monoxide (CO)	50,257	57.5%
Nitrogen Oxides (NO_x)	7,035	29.8%
Volatile Organic Comp. (VOCs)	5,230	27.2%
Sulfur Dioxide (SO_2)	340	1.6%
Particulate Matter (PM_{10})	268	8.6%*
Particulate Matter ($PM_{2.5}$)	207	9.2%*
Lead (Pb)	0.019	0.5%

*Note: Percentage of emissions from traditionally inventoried sources (does not include agriculture and forestry, fugitive dust, or natural sources like windblown dust)

Source: U.S. Environmental Protection Agency. *National Air Pollutant Emission Trends, 1900-1997.*

Table 3-17: VOC Emissions from On-Road Vehicles, 1940-1997

1940	4,817
1950	7,251
1960	10,506
1970	12,972
1980	8,979
1985	9,376
1986	8,874
1987	8,477
1988	8,290
1989	7,192
1990	6,313
1991	6,499
1992	6,072
1993	6,103
1994	6,401
1995	5,701
1996	5,502
1997	5,230

Source: U.S. Environmental Protection Agency, *National Air Pollutant Emissions Trends, 1900-1997* (Table A-3).

Figure 3-2: VOC Emissions from On-Road Vehicles

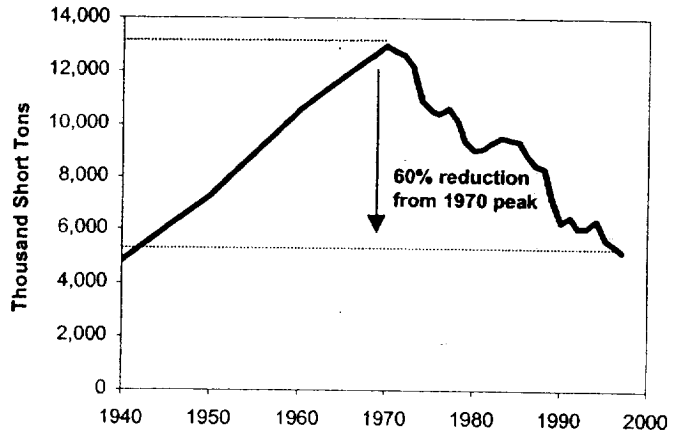


Table 3-18: VOC Emissions by On-Road Vehicle Category (thousand short tons), 1970-1990

Year	Gas			Diesel		
	Light-Duty Vehicles*	Light-Duty Trucks	Heavy-Duty Vehicles	Light-Duty Vehicles	Light-Duty Trucks	Heavy-Duty Vehicles
1970	9,193	2,770	743	NA	NA	266
1975	7,248	2,289	657	15	NA	335
1980	5,907	2,059	611	8	2	392
1985	5,864	2,425	716	8	2	360
1990	3,947	1,622	432	13	3	297
1991	4,069	1,688	423	12	3	304
1992	3,832	1,588	334	13	3	302
1993	3,812	1,647	326	13	3	301
1994	3,748	1,909	414	13	4	313
1995	3,426	1,629	327	14	4	302
1996	2,875	2,060	293	12	5	245
1997	2,755	1,968	268	12	5	221

*includes motorcycles

Source: U.S. Environmental Protection Agency, *National Air Pollutant Emissions Trends, 1900-1997* (Table A-3).

Table 3-19: NO_x Emissions from On-Road Vehicles, 1940-1997

1940	1,330
1950	2,143
1960	3,982
1970	7,390
1980	8,621
1985	8,089
1986	7,773
1987	7,651
1988	7,661
1989	7,682
1990	7,040
1991	7,373
1992	7,440
1993	7,510
1994	7,672
1995	7,323
1996	7,171
1997	7,035

Source: U.S. Environmental Protection Agency, *National Air Pollutant Emissions Trends, 1900-1997* (Table A-2).

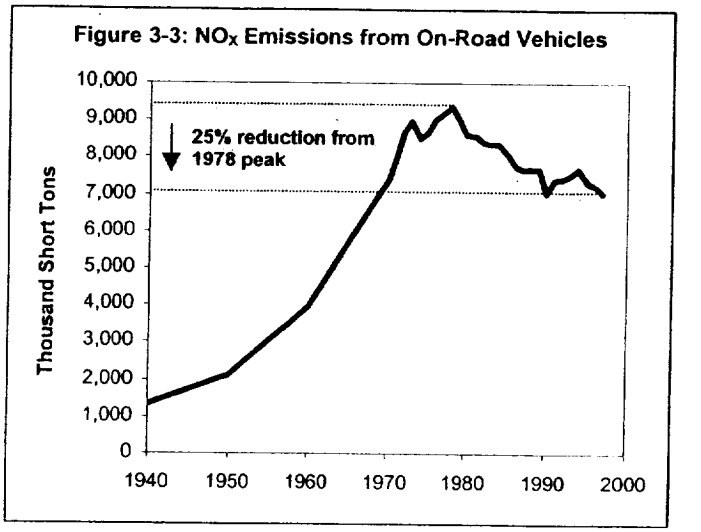


Table 3-20: NO_x Emissions by On-Road Vehicle Category (thousand short tons), 1970-1997

Year	Gas			Diesel		
	Light-Duty Vehicles*	Light-Duty Trucks	Heavy-Duty Vehicles	Light-Duty Vehicles	Light-Duty Trucks	Heavy-Duty Vehicles
1970	4,158	1,278	278	NA	NA	1,676
1975	4,725	1,461	319	23	NA	2,118
1980	4,421	1,408	300	25	5	2,463
1985	3,806	1,530	330	28	6	2,389
1990	3,220	1,256	326	39	7	2,192
1991	3,464	1,339	326	37	8	2,199
1992	3,614	1,356	308	39	8	2,116
1993	3,680	1,420	315	39	8	2,047
1994	3,573	1,657	351	38	10	2,043
1995	3,444	1,520	332	39	10	1,979
1996	2,979	1,950	329	35	13	1,941
1997	2,875	1,901	326	35	12	1,886

*includes motorcycles

Source: U.S. Environmental Protection Agency, *National Air Pollutant Emissions Trends, 1900-1997* (Table A-2).

Table 3-21: CO Emissions from On-Road Vehicles, 1940-1997

[illegible]	[illegible]
1940	30,121
1950	45,196
1960	64,266
1970	88,034
1980	78,049
1985	77,387
1986	73,347
1987	71,250
1988	71,081
1989	66,050
1990	57,848
1991	62,074
1992	59,859
1993	60,202
1994	61,833
1995	54,106
1996	53,262
1997	50,257

Source: U.S. Environmental Protection Agency, *National Air Pollutant Emissions Trends, 1900-1997* (Table A-1).

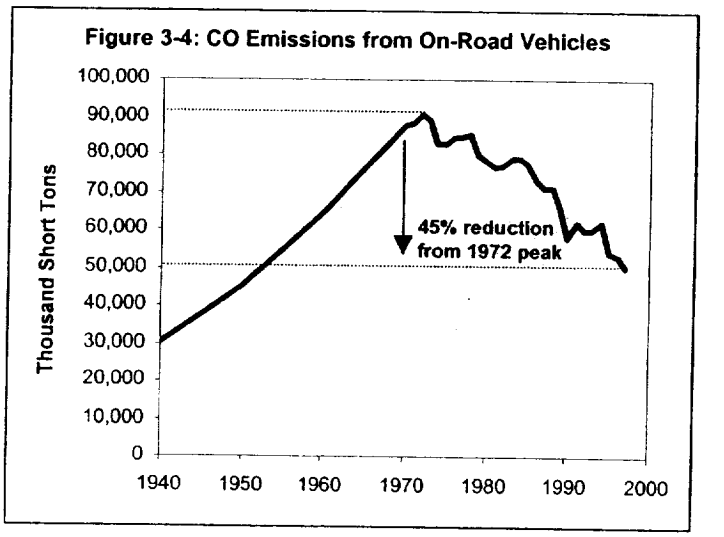


Table 3-22: CO Emissions by On-Road Vehicle Category (thousand short tons), 1970-1997

Year	Gas			Diesel		
	Light-Duty Vehicles*	Light-Duty Trucks	Heavy-Duty Vehicles	Light-Duty Vehicles	Light-Duty Trucks	Heavy-Duty Vehicles
1970	64,031	16,570	6,712	NA	NA	721
1975	59,281	15,767	7,140	30	NA	915
1980	53,561	16,137	7,189	19	4	1,139
1985	49,451	18,960	7,716	22	4	1,235
1990	37,407	13,816	5,360	31	5	1,229
1991	40,267	15,014	5,459	30	6	1,298
1992	39,370	14,567	4,569	31	6	1,315
1993	39,163	15,196	4,476	33	7	1,328
1994	37,507	17,350	5,525	32	8	1,411
1995	33,701	14,829	4,123	33	8	1,412
1996	28,732	19,271	3,766	29	11	1,453
1997	27,036	18,364	3,349	30	11	1,468

*includes motorcycles

Source: U.S. Environmental Protection Agency, *National Air Pollutant Emissions Trends, 1900-1997* (Table A-1).

Table 3-23: PM_{10} Emissions from On-Road Vehicles, 1940-1997

[illegible]	[illegible] Short Tons
1970	443
1975	471
1980	397
1985	363
1986	356
1987	360
1988	369
1989	367
1990	336
1991	349
1992	343
1993	321
1994	320
1995	293
1996	282
1997	268

Source: U.S. Environmental Protection Agency, *National Air Pollutant Emissions Trends, 1900-1997* (Table A-5).

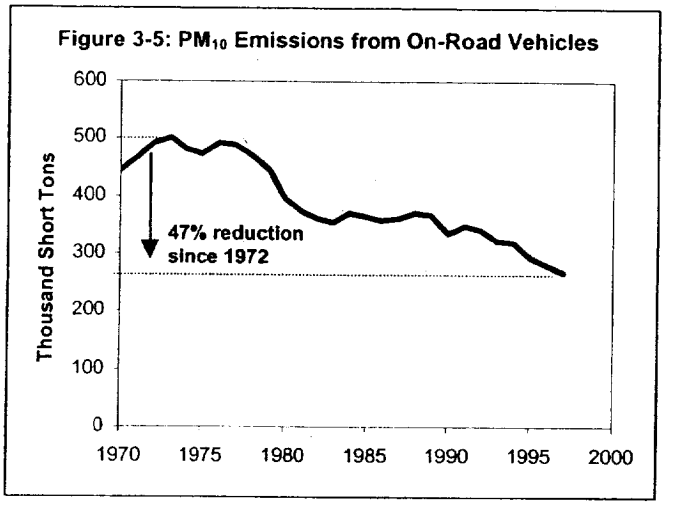


Table 3-24: PM_{10} Emissions by On-Road Vehicle Category (thousand short tons), 1970-1997

Year	Gas			Diesel		
	Light-Duty Vehicles*	Light-Duty Trucks	Heavy-Duty Vehicles	Light-Duty Vehicles	Light-Duty Trucks	Heavy-Duty Vehicles
1970	225	70	13	NA	NA	136
1975	207	72	15	10	NA	166
1980	120	55	15	12	2	194
1985	77	43	14	8	1	219
1990	61	30	10	9	1	224
1991	63	32	10	9	2	234
1992	64	31	9	9	2	228
1993	65	31	10	8	2	205
1994	62	35	10	8	2	204
1995	62	32	9	8	2	181
1996	55	41	9	7	2	168
1997	56	40	9	6	2	154

*includes motorcycles

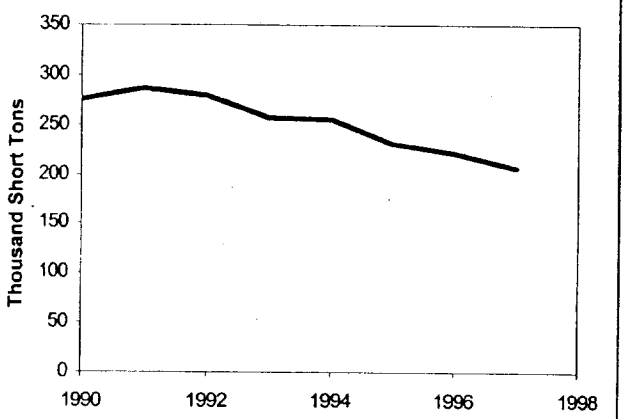
Source: U.S. Environmental Protection Agency, *National Air Pollutant Emissions Trends, 1900-1997* (Table A-5).

Table 3-25: $PM_{2.5}$ Emissions from On-Road Vehicles, 1990-1997

1990	275
1991	286
1992	280
1993	257
1994	256
1995	231
1996	221
1997	207

Source: U.S. Environmental Protection Agency, *National Air Pollutant Emissions Trends, 1900-1997* (Table A-6).

Figure 3-6: $PM_{2.5}$ Emissions from On-Road Vehicles



Diesel vehicles produce most of the $PM_{2.5}$ emissions from on-road vehicles.

Table 3-26: $PM_{2.5}$ Emissions by On-Road Vehicle Category (thousand short tons), 1970-1997

Year	Gas			Diesel		
	Light-Duty Vehicles*	Light-Duty Trucks	Heavy-Duty Vehicles	Light-Duty Vehicles	Light-Duty Trucks	Heavy-Duty Vehicles
1990	37	19	7	*8*	1	212
1991	38	21	6	*8*	1	221
1992	37	20	6	*8*	2	216
1993	38	20	7	*7*	1	192
1994	36	23	7	*7*	2	190
1995	36	20	6	*7*	2	169
1996	32	25	6	*6*	2	157
1997	32	25	*6*	*6*	2	144

*includes motorcycles

Source: U.S. Environmental Protection Agency, *National Air Pollutant Emissions Trends, 1900-1997* (Table A-6).

Table 3-27: SO_2 Emissions from On-Road Vehicles, 1940-1997

1940	3
1950	103
1960	114
1970	411
1980	521
1985	522
1986	527
1987	538
1988	553
1989	570
1990	542
1991	570
1992	578
1993	517
1994	301
1995	304
1996	316
1997	320

Source: U.S. Environmental Protection Agency. *National Air Pollutant Emissions Trends, 1900-1997* (Table A-4).

Figure 3-7: SO_2 Emissions from On-Road Vehicles

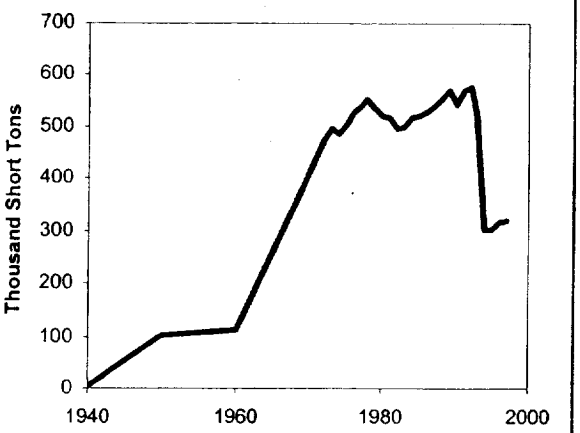


Table 3-28: SO_2 Emissions by On-Road Vehicle Category (thousand short tons), 1970-1997

Year	Gas			Diesel
	Light-Duty Vehicles*	Light-Duty Trucks	Heavy-Duty Vehicles	
1970	132	40	8	231
1975	158	48	9	288
1980	159	50	10	303
1985	146	55	11	311
1990	138	57	11	337
1991	143	59	10	358
1992	146	59	10	363
1993	147	60	11	299
1994	141	70	12	79
1995	143	71	11	80
1996	127	95	11	83
1997	129	96	11	84

*includes motorcycles

Source: U.S. Environmental Protection Agency. *National Air Pollutant Emissions Trends, 1900-1997* (Table A-4).

Table 3-29: Lead Emissions from On-Road Vehicles, 1940-1997

1970	171,961
1975	130,206
1980	60,501
1985	18,052
1986	10,245
1987	3,317
1988	2,566
1989	982
1990	421
1991	18
1992	18
1993	19
1994	19
1995	19
1996	20
1997	19

Source: U.S. Environmental Protection Agency. *National Air Pollutant Emission Trends, 1900-1996* (Table A-6).

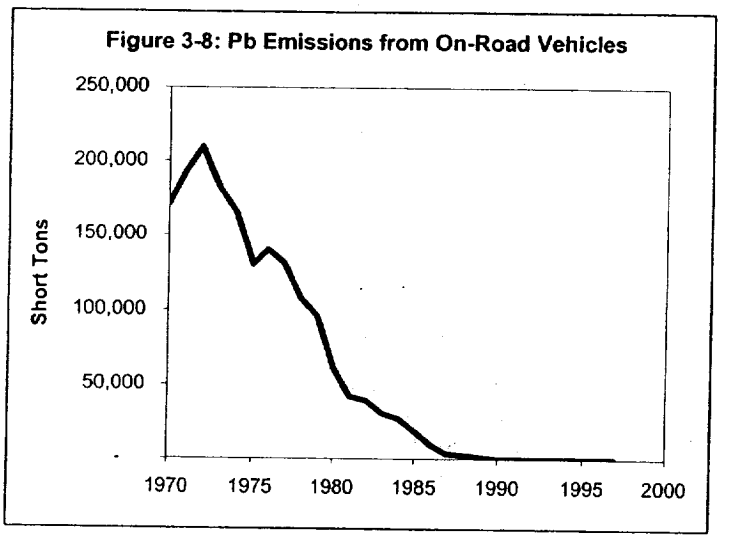


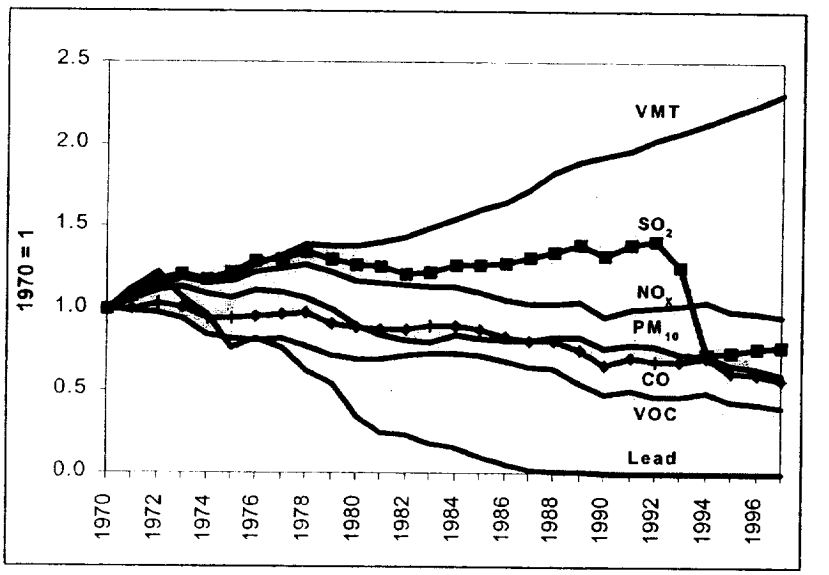
Table 3-30: Lead Emissions by On-Road Vehicle Category (short tons), 1970-1997

Year	Gas		
	Light-Duty Vehicles*	Light-Duty Trucks	Heavy-Duty Vehicles
1970	142,918	22,683	6,361
1975	106,868	19,440	3,898
1980	47,184	11,671	1,646
1985	13,637	4,061	354
1990	314	100	7
1991	13	4	0
1992	14	4	0
1993	14	5	0
1994	14	5	0
1995	14	5	0
1996	12	7	0
1997	12	7	0

Source: U.S. Environmental Protection Agency. *National Air Pollutant Emission Trends, 1900-1996* (Table A-6).

Despite increasing vehicle travel, emissions of all criteria pollutants from motor vehicles have fallen since 1970. These improvements stem from actions taken as a result of the Clean Air Act, such as improved vehicle technologies and cleaner burning fuels.

Figure 3-9: Change in Criteria Pollutant Emissions compared to Vehicle Travel, 1940-1997



TOXIC EMISSIONS

On-road vehicles are by far the largest source of toxic emissions, emitting about 1,389,111 short tons per year of hazardous air pollutants.

Source: U.S. Environmental Protection Agency. *National Toxics Inventory.* Referenced in: U.S. Environmental Protection Agency. *National Air Pollutant Emission Trends 1900-1996.* January 1998 (Table 8-1).

Table 3-31: Motor Vehicle Emissions of Toxic Pollutants, 1990

Hazardous Air Pollutant	Quantity Emitted (metric tons)	Percent of Total Emission
Benzene	158,149	60%
Formaldehyde	73,874	33%
1,3 Butadiene	27,972	56%

Source: U.S. Environmental Protection Agency. *Motor Vehicle-Related Air Toxics Study.* April 1993. http://www.epa.gov/OMSWWW/toxics.htm

FUGITIVE DUST EMISSIONS FROM ROADS

DESCRIPTION OF IMPACT

Vehicle travel kicks up dust and dirt from paved and unpaved road surfaces. Dust generated from road travel is called "fugitive" because it does not enter the atmosphere in a confined flow stream. Fugitive dust from travel on roads constitutes a large portion of national PM_{10} and $PM_{2.5}$ emissions.

Fugitive dust emissions are highest from unpaved roads. The quantity of dust emissions from a given section of unpaved road varies roughly linearly with the volume of traffic. When a vehicle traverses a segment of unpaved road; the force of the wheels on the road surface causes pulverization of surface material. Particles are lifted and dropped from the rolling wheels, and the road surface is exposed to strong air currents in turbulent shear with the surface. The turbulent wake behind the vehicle continues to act on the surface after the vehicle has passed.

Fugitive dust from paved roads consists primarily of mineral matter, similar to common sand and soil, mostly tracked or deposited onto the roadway by vehicle traffic itself. Vehicle carryout from unpaved areas is probably the largest single source of street deposit. It is notable that paved road mileage has been growing rapidly, as existing roads are paved at a much higher rate than new roads are built. As recently as around 1975, unpaved mileage exceeded paved mileage.

CAUSAL FACTORS

- Lane mileage, paved and unpaved
- VMT, by pavement type
- Topographical conditions (hills, valleys, etc.) affecting pollutant dispersion
- Climatic conditions (temperature, wind, rain, etc.) affecting pollutant dispersion and secondary pollutant formation
- Population density affecting potential exposure

INDICATORS OF ENVIRONMENTAL IMPACT

Fugitive dust from roads made up 44% of total PM_{10} emissions and 30% of $PM_{2.5}$ emissions in 1997.

Source: U.S. Environmental Protection Agency. *National Air Pollutant Emission Trends, 1900-1997* (Tables A-5 and A-6).

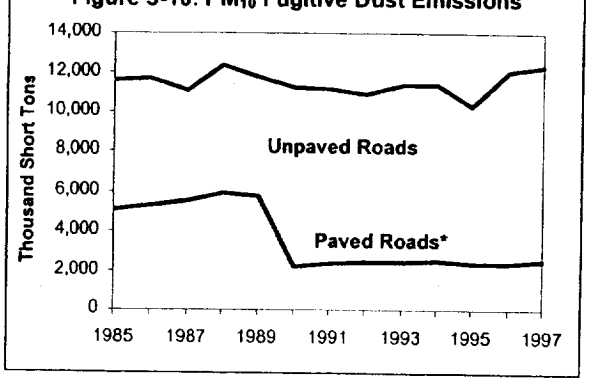
Although unpaved roads comprise about 39% of total road mileage in the U.S., they accounted for 83% of the PM_{10} emissions from road dust in 1997.

Table 3-32: PM_{10} Fugitive Dust, Emissions by Road Type, 1985-1997 (thousand short tons)

Year	Unpaved roads	Paved roads
1985	11,664	5,080
1990	11,234	2,248
1991	11,206	2,399
1992	10,918	2,423
1993	11,430	2,462
1994	11,370	2,538
1995	10,362	2,409
1996	12,060	2,390
1997	12,305	2,515

Note: Change in methodology for estimating PM_{10} emissions between 1985 and 1990.
Source: U.S. Environmental Protection Agency. *National Air Pollutant Emission Trends, 1900-1997* (Table A-5).

Figure 3-10: PM_{10} Fugitive Dust Emissions



*Note: Change in methodology for estimating PM_{10} emissions between 1985 and 1990.

GREENHOUSE GAS EMISSIONS

DESCRIPTION OF IMPACT

Motor vehicles are a significant user of fossil fuels, which release carbon dioxide in the combustion process. Since more carbon dioxide emissions are released as more fuel is consumed, vehicle fuel economy and levels of vehicle travel are the primary determinants of carbon emissions. Nationally, fuel economy by vehicle category (e.g., automobiles, light-duty trucks, etc.) has been stable in recent years, and there has been a shift toward more travel by less-fuel efficient categories of vehicles, such as sports utility vehicles and light trucks.

Motor vehicle travel also releases other greenhouse gases, like methane and nitrous oxide. Transportation-related criteria pollutants, including carbon monoxide, oxides of nitrogen, and nonmethane volatile organic compounds, indirectly affect climate because they alter atmospheric concentrations of carbon dioxide, methane, and ozone.

FACTORS THAT AFFECT IMPACT

- Vehicle miles of travel
- Vehicle fuel economy
- Type of fuel being used
- Vehicle technology

INDICATORS OF ENVIRONMENTAL IMPACT

CARBON DIOXIDE EMISSIONS

In 1996, carbon dioxide emissions from on-road vehicles accounted for approximately 341.1 million metric tons of carbon (MMTC). This equals about 76.6 percent of total CO_2 emissions from the transportation sector, or about 23.5 percent of CO_2 emissions from fossil fuel combustion. Carbon emissions from motor vehicles increased about 11 percent between 1990 and 1996.

Table 3-33: Carbon Dioxide Emissions by On-Road Vehicle Category (million metric tons of carbon)

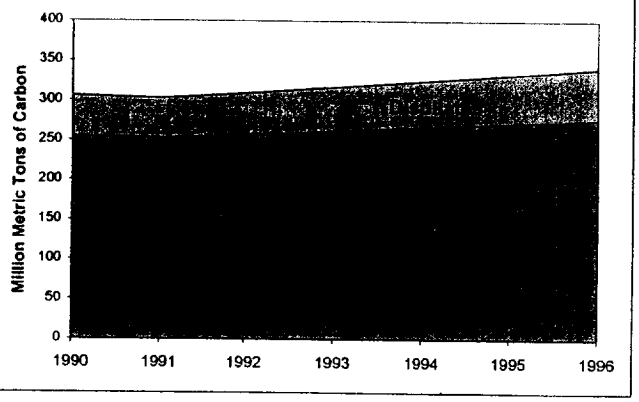
Year	Motor Gasoline					Distillate Fuel Oil (Diesel)					LPG	Total
	Passenger Cars *	Light Duty Trucks *	Other Trucks	Buses	Total Motor Gasoline	Passenger Cars	Light Duty Trucks	Other Trucks	Buses	Total Distillate Fuel Oil		
1990	167.7	74.9	11.3	0.6	254.5	2	2.5	45.3	2.2	52	0.3	306.8
1991	166.3	74.7	11.2	0.6	252.8	1.9	2.4	43.3	2.2	49.8	0.3	302.9
1992	170.4	74.6	11.2	0.6	256.8	2	2.5	45.1	2.3	51.9	0.3	309.0
1993	171.9	77.8	11.7	0.7	262.1	2	2.6	47.7	2.3	54.6	0.3	317.0
1994	171.0	84.2	10.4	0.9	266.5	2	2.8	51.7	2.3	58.8	0.3	325.6
1995	158.6	101.3	10.9	0.8	271.6	1.8	3.3	52.7	2.7	60.5	0.3	332.4
1996	161.8	103.4	11.2	0.8	277.2	1.9	3.4	55.5	2.8	63.6	0.3	341.1

*Note: In 1995, FHWA changed the definition of light duty trucks to include minivans and SUVs. Previously, they were included in the passenger car category, hence the drop in emissions for passenger cars from 1994 to 1995 which is, however, offset by a rise in light duty truck emissions.

Source: U.S. Environmental Protection Agency, Office of Policy, Planning and Evaluation. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-1996.* March 1998 (Table 2-6).

In contrast to criteria air pollutants, carbon dioxide emissions from motor vehicles have been rising. Total highway fuel use actually declined over the period 1979 to 1982, but has since been rising due to increases in vehicle travel that have more than offset increases in vehicle fuel economy. Although fuel economy of gasoline personal vehicles has improved in the U.S., from about 13.2 miles per gallon in 1970 to 20.2 miles per gallon in 1993, fuel economy has since been flat and is projected to decline, in part due to a shift from automobiles to less fuel efficient light-trucks.[12]

Figure 3-11: CO_2 Emissions from Motor Vehicles



NITROUS OXIDE EMISSIONS

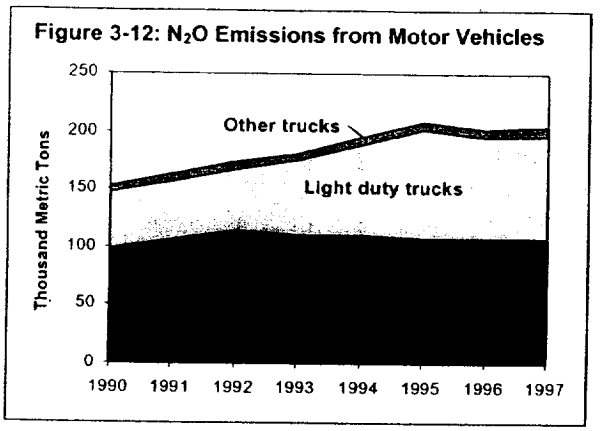
Motor vehicles emit approximately 22 percent of national emissions of nitrous oxide. Nitrous oxide emissions from motor vehicles increased by 33 percent between 1990 and 1997.

Table 3-34: Nitrous Oxide Emissions from Motor Vehicles (thousand metric tons)

Year	Passenger cars	Light duty trucks	Other trucks	Buses	Total Motor Vehicles
1990	99	48	6	<0.5	154
1991	106	51	6	<0.5	164
1992	115	53	6	<0.5	174
1993	111	64	6	<0.5	182
1994	111	78	7	<0.5	196
1995	108	94	7	<0.5	209
1996	108	87	7	<0.5	202
1997	108	89	8	<0.5	205

Source: U.S. Department of Energy, Energy Information Administration. *Emissions of Greenhouse Gases in the United States 1997.* October 1998 (Table 26).

[12] U.S. Department of Energy. *Transportation Energy Databook Edition 18.* 1998.



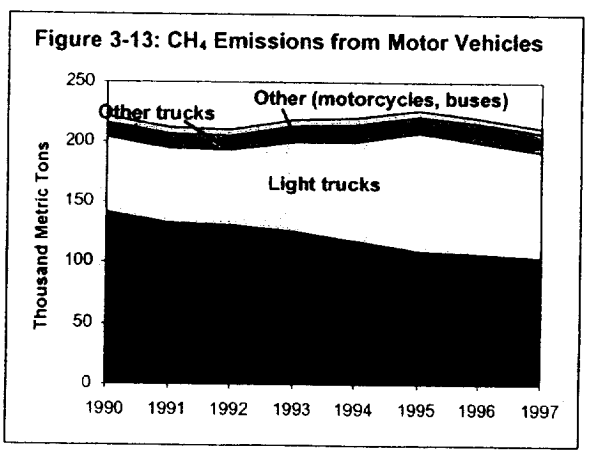
METHANE EMISSIONS

Motor vehicles emit less than 1 percent of methane emissions nationwide. Methane emissions from motor vehicles have been fairly stable since 1990

Table 3-35: Methane Emissions from Motor Vehicles (thousand metric tons)

Year	Passenger cars	Light duty trucks	Other trucks	Buses	Total Motor Vehicles
1990	141	63	12	1	222
1991	132	63	12	1	211
1992	131	63	12	1	211
1993	126	75	13	1	218
1994	117	84	14	1	220
1995	109	99	14	1	228
1996	107	94	15	1	220
1997	104	89	15	1	213

Source: U.S. Department of Energy, Energy Information Administration. *Emissions of Greenhouse Gases in the United States 1997.* October 1998 (Table 26).



EMISSIONS OF REFRIGERANT AGENTS FROM VEHICLE AIR CONDITIONERS

DESCRIPTION OF IMPACT

Automobile air conditioners are subject to significant leakage, with nearly all of the refrigerant leaking out over a 5-year time period. Until recently, the chlorofluorocarbon CFC-12 (also known as Freon-12) was the principal refrigerant agent used in automobile air conditioners. Other major end uses of CFC-12 include commercial air conditioning, refrigeration (refrigerators and freezers), and a blowing agent for foams, insulation, and packaging. CFCs are responsible for depletion of the stratospheric ozone layer. Stratospheric ozone, beneficial for its ability to absorb UV radiation, is, however, also a greenhouse gas. Gases that destroy stratospheric ozone thus have indirect cooling effects. Chlorine-containing chemicals such as CFCs tend to react with ozone, and the net effect on global climate is ambiguous.[13]

By signing the *Montreal Protocol on Substances that Deplete the Ozone Layer* and *Copenhagen Amendments*, the United States committed to eliminating the production of all CFCs by the end of 1995. On December 31, 1995, CFC-12 production essentially ended in the U.S. It is still legal to use existing stockpiles of CFC-12, but several companies have also developed new substitutes. The 1990 Clean Air Act Amendments (CAAA) directed EPA to develop regulations to maximize recycling, ban nonessential uses, develop labeling requirements, and examine safe alternatives. Recycling occurs in a service shop involves use of a machine to remove impurities and oil and then recharge the refrigerant into either the same car or a different car. Reclamation involves removal of all oil and impurities beyond that provided by on-site recycling equipment, and reclaimed refrigerant is essentially identical to new, unused refrigerant.

Hydrofluorocarbon HFC-134a became the standard automobile air conditioner refrigerant in 1994, and HFC emissions have been growing as CFCs gradually disappear from the automobile fleet. HFCs, which contain no chlorine, have no effect on ozone, but they are a greenhouse gas. Automobile air conditioners are the principal end-use for HFC-134a. As of 1994, practically all new automobiles were using HFC-134a as the refrigerant in their air conditioners, and many manufacturers now offer conversion packages through their dealerships.[14]

HFC-134a has a lifetime of 15 years and one molecule has a 100-year global warming potential 1,300 times that of one molecule of CO_2. The lack of chlorine in HFCs and their shorter atmospheric lifetimes reduce the indirect cooling effects of CFCs. Thus, HFC replacement compounds may be worse from a global climate perspective than their predecessors.

FACTORS THAT AFFECT IMPACT

- Quantity of refrigerant agent used
- Net global warming potential of refrigerant agent used
- Net ozone depleting potential of refrigerant agent used

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[13] U.S. Department of Energy. *Emissions of Greenhouse Gases in the United States 1995*. October 1998 (pp. 4-5).

[14] U.S. Department of Energy. *Emissions of Greenhouse Gases in the United States 1995*. October 1998 (pp. 57-58).

INDICATORS OF ENVIRONMENTAL IMPACT

CFC AND HFC EMISSIONS

Quantified data on the contribution of vehicle refrigerant agents to depletion of the ozone layer and global warming are not available.

About 24,000 metric tons of CFC-12 were released in 1997 from all sources (not only vehicles), down significantly from the pre-Montreal Protocol level of 113,000 metric tons. HFC-134 emissions are up significantly, however.

Table 3-36: Estimated U.S. Emissions of CFC-12 and HFC-134a (all sources), 1990-1997 (thousand metric tons of gas)

Year	CFC-12	HFC-134a
1990	113	1
1991	104	1
1992	81	1
1993	79	3
1994	58	5
1995	52	10
1996	36	14
1997	24	18

Source: U.S. Department of Energy, Energy Information Administration. *Emissions of Greenhouse Gases in the United States 1997.* October 1998 (Table 31).

NOISE

DESCRIPTION OF IMPACT

Noise associated with road transport comes from engine operations, pavement-wheel contact, aerodynamic effects, and vibrating structures. Heavy trucks and buses cause more noise per vehicle than cars. The findings of numerous research projects on the effects of noise and its wider repercussions indicate that an outdoor sound level of 65 dB(A) is "unacceptable", and an outdoor level of less than 55 dB(A) is desirable.[15] Noise can cause stress and other health problems and lower property values. It can also affect local habitats of species near roads.

CAUSAL FACTORS

- Level of road activity - traffic volumes
- Speed of traffic
- Proportion of heavy vehicles (one truck emits the equivalent noise of 28 to 60 cars)
- Population density near road.
- Existence and effectiveness of noise barriers
- Effectiveness of devices such as mufflers and quiet vehicles

[15] Organization for Economic Cooperation and Development. *Indicators for the Integration of Environmental Concerns into Transport Policies.* OECD Publications. 1993.

INDICATORS OF ENVIRONMENTAL IMPACT

EXPOSURE TO TRAFFIC NOISE

Noise levels are site specific and dissipate with increasing distance from the source; as a result, there are no national estimates of total noise generated by transportation. According to one estimate, 37.0% of the U.S. population was exposed to noise levels from road transport great enough to cause annoyance—defined as Leq greater than 55dB(A)—in 1980. Smaller portions of the U.S. population were exposed to daily noise levels from road transport great enough to cause other effects, such as communication interference, muscle/gland reaction, and changed motor coordination. A more recent estimate is not available.

Table 3-37: Percent of U.S. Population Exposed to Road Transportation Noise, 1980 Outdoor Sound Level in Leq [dB(A)]

>55 dB(A) Annoyance	>60 dB(A) Normal Speech Level	>65 dB(A) Communication Interference	>70 dB(A) Muscle/Gland Reaction	>75 dB(A) Changed Motor Coordination
37.0%	18.0%	7.0%	2.0%	0.4%

Source: Organization for Economic Cooperation and Development. *Indicators for the Integration of Environmental Concerns into Transport Policies.* OECD Publications. 1993.

NOISE BARRIERS CONSTRUCTED

Noise barriers are constructed to cut exposure to high levels of highway noise, particularly along interstate highways abutting residential areas. While construction of noise barriers suggests that highway noise is a problem, barrier construction is not an indicator of an adverse environment impact per se. More construction may indicate that noise problems are being reduced. Still, the cost of barrier construction provides an indication of the price being paid to reduce highway noise exposure.

Overall, about 1.5 billion dollars is known to have been spent on highway noise barrier construction (in 1995 dollars).

Table 3-38: Length of Noise Barriers Constructed (miles) and Cost

Year of Construction	Type I Barriers	Type II Barriers	All Other Types	Length, total	Cost (millions of 1995 dollars)
Unknown	6	0	N/A	6	N/A
1970-79	104	71	2	177	130
1980-89	422	130	15	567	624
1990	45	20	1	65	92
1991	79	20	2	101	142
1992	112	19	10	141	184
1993	60	22	3	85	112
1994	41	16	4	61	72
1995	78	31	6	115	141
1970-95	**947**	**329**	**43**	**1,318**	**1,497**

Note: Data are produced on a 3-year cycle. Miles have been converted from kilometers (as cited in source). Total may not match the sum of yearly estimates due to rounding.

Source: U.S. Department of Transportation, Bureau of Transportation Statistics. *National Transportation Statistics 1998.* Table 4-45.

A Type I barrier is built on a highway project to construct a new highway or to physically alter an existing highway. A Type II barrier is built to abate noise along an existing highway (often referred to as retrofit abatement), and is not mandatory. All other types of barriers are non-Federally funded.

HAZARDOUS MATERIALS INCIDENTS DURING TRANSPORT

DESCRIPTION OF INDICATORS

The potential for commodity releases during highway transportation is important to consider because of the large and growing role truck transport plays in domestic freight movement. In 1997, truck transport accounted for 32% of the ton-miles moved during domestic intercity transport, excluding pipelines.[16] Trucks carry over 60% of the hazardous materials transported in the U.S.[17]

Commodity spills of hazardous materials may impose substantial costs for product loss, carrier damage, property damage, evacuations, and response personnel and equipment. The number of hazardous material incidents is not necessarily indicative of the environmental impact of such incidents, since it may be possible to clean up most of the materials released. If not properly contained, however, hazardous materials incidents may cause environmental damage such as air and water pollution, damage to fish and wildlife, and habitat destruction. The environmental impact of any given hazardous materials spill is highly site-specific. It depends on the type and quantity of material spilled, amount recovered in cleanup, chemical properties (such as toxicity and combustibility), and impact area characteristics (such as climatic conditions, flora and fauna density, and local topography). It should be noted that while the overall impact of incidents may be small for the nation as a whole, any hazardous material spill may have severe impacts on flora and fauna in the location of occurrence.

FACTORS THAT AFFECT IMPACT

- Quantity of hazardous materials transported and distance transported
- Accident or spill rate
- Type (toxicity/hazard) and quantity of materials spilled
- Effectiveness of cleanup efforts
- Population density
- Sensitivity of local habitats/species

INDICATORS OF ENVIRONMENTAL IMPACT

No statistics were found regarding the number of species or acres nationwide affected by commodity spills or other hazardous materials incidents.

The Hazardous Materials Information System (HMIS) database, maintained by U.S. DOT/RSPA, contains a record of all reported hazardous materials incidents occurring during truck transport (except for intrastate only operators), including type of material spilled, number of injuries/fatalities, and estimated clean up costs.

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[16] U.S. Department of Transportation, Bureau of Transportation Statistics. *National Transportation Statistics 1998.* January 1999 (Table 1-11). www.bts.gov/btsprod/nts

[17] Atkinson, Robert B. and John Cairns, Jr. "Ecological Risks of Highways." In *Predicting Ecosystem Risk.* 1992.

Table 3-39: Highway Hazardous Materials Incident Totals, 1990-1997

Year	Number of Incidents	Gallons Released	Pounds Released	Cubic Feet Released	MilliCuries Released*	Clean Up & Product Loss Damages
1990	7,114	668,673.63	368,353.72	309,762.16	90.00	$9,637,302
1991	7,479	671,966.94	318,678.13	120,253.88	4.60	$10,990,231
1992	7,589	748,897.25	157,324.47	1,427,325.80	0	$14,148,560
1993	10,731	620,492.88	302,567.03	17,414.66	0	$11,060,161
1994	13,559	535,270.88	295,335.72	1,478.37	0	$12,224,619
1995	12,505	555,598.31	214,583.69	56,019.01	100,002.40	$12,285,402
1996	11,662	706,547.06	279,532.19	127,217.80	0	$13,978,567
1997	11,603	629,638.50	334,787.63	9,386.53	0.10	$12,714,625

* Due to multiple classes being involved in a single incident, the totals above may not correspond to the totals in other reports. + MilliCuries (mCi) are a measure of radioactivity.
Source: U.S. Department of Transportation, Research & Special Programs Administration (RSPA). *Hazardous Materials Information System.*

Figure 3-14: Highway Hazardous Materials Incidents, 1990-1997

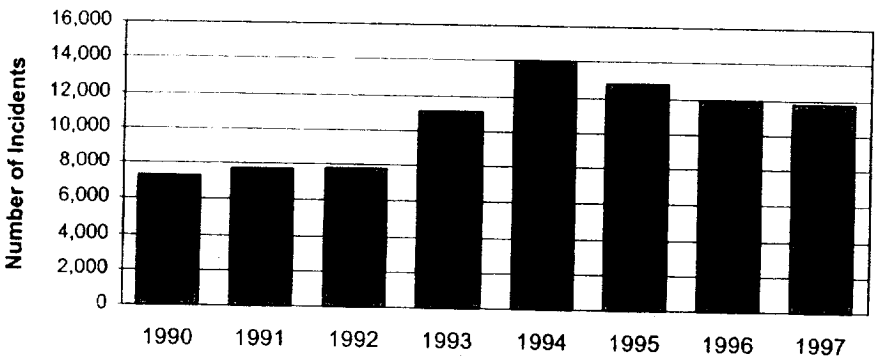


Table 3-40: Highway Hazardous Materials Incidents, 1997

Hazard Class	Number of Incidents*	Gallons Released	Pounds Released	Cubic Feet Released	MilliCuries Released+	Clean Up & Product Loss Damages
Corrosive Material	4,755	76,898.59	1,668.31	0	0	$2,166,970
Flammable - Combustible Liquid	4,711	403,180.56	8	0.13	0	$5,787,535
Poisonous Materials	923	4,337.93	1,654.14	0	0	$897,872
Oxidizer	377	6,752.97	143,042.52	0	0	$458,632
Miscellaneous Hazardous Material	371	70,792.37	139,023.16	0	0	$999,760
Combustible Liquid	278	38,439.23	0	0	0	$389,102
Nonflammable Compressed Gas	123	14,416.63	222.13	2,242.01	0	$210,898
Flammable Gas	101	5,613.64	0	7,024.08	0	$279,321
Organic Peroxide	96	224.82	19.45	0	0	$47,399
Flammable Solid	87	3,000.28	2,270.45	0	0	$88,732
Poisonous Gas	29	552.37	0	120.31	0	$82,701
Spontaneously Combustible	15	144.01	186.56	0	0	$771,210
Dangerous When Wet Material	15	240.13	45,725.94	0	0	$305,901
Radioactive Material	1	0	0	0	0.10	$8,000
Very Insensitive Explosive	4	0.63	932	0	0	$840
Infectious Substance (Etiologic)	4	0.13	0	0	0	$2
Other Regulated Material, Class D	1	17.88	0	0	0	$3,684
Explosive Mass Explosion Hazard	1	0	35	0	0	$0
Explosive Projection Hazard	1	5,020.25	0	0	0	$216,066
Explosive No Blast Hazard	1	0	0	0	0	$0
Forbidden	0	0	0	0	0	$0
Explosive Fire Hazard	0	0	0	0	0	$0
Extremely Insensitive Detonating	0	0	0	0	0	$0
Explosives, Class A	0	0	0	0	0	$0
Explosives, Class B	0	0	0	0	0	$0
Explosives, Class C	0	0	0	0	0	$0
Flammable Solid (Pre 1991)	0	0	0	0	0	$0
Irritating Material	0	0	0	0	0	$0
Other Regulated Material, Class A	0	0	0	0	0	$0
Other Regulated Material, Class B	0	0	0	0	0	$0
Other Regulated Material, Class C	0	0	0	0	0	$0
Other Regulated Material, Class E	0	0	0	0	0	$0
TOTALS	**11,603**	**629,638.50**	**334,787.63**	**9,386.53**	**0.10**	**$12,714,625**

* Includes only those incidents for which quantities of HazMat releases are known.
\+ MilliCuries (mCi) are a measure of radioactivity.

Note: The total number of incidents is not equal to the sum of incidents by hazard class, because one incident may be reported under two or more hazard classes.

Source: U.S. Department of Transportation, Research & Special Programs Administration (RSPA). *Hazardous Materials Information System.*

COLLISIONS WITH WILDLIFE

DESCRIPTION OF IMPACT

Vehicle collisions with wildlife are a concern because of the loss of animal life, damage to property, and injuries and fatalities for vehicle drivers and passengers. Although few national composite figures are available, many states track the number of animal-related incidents on their major roadways. The Highway Safety Information System (HSIS) tracks motor vehicle crashes and their cause in eight states — California, Illinois, Maine, Michigan, Minnesota, North Carolina, Washington, and Utah — and is a source of information on wildlife collisions.

Roads passing through wildlife habitat are a threat to wildlife, especially in the first several years after a new road is constructed. It may take several years for wildlife to adapt to changes such as a new roadway in their habitat. As a result, road mileage may have a significant impact on wildlife strikes, and may be a more important factor than the amount of vehicle travel. Vehicle miles of travel (VMT) likely has some relationship to wildlife strikes, but the exact nature of that relationship is unclear. In the case of a new road, the introduction of "new" VMT into a region generally results in increased strikes. Once the habitat adapts to the presence of the road, however, the impact of increased VMT is less clear. The size of the animal population in a given area is also a primary determinant of wildlife collisions.

There is little consensus regarding the most effective means of preventing collisions with wildlife. Wildlife often manages to circumvent protective fencing by jumping over, going around, or going through open gates and holes. Reflectors, lighting, underpasses dedicated to wildlife, mirrors and signage have been shown by some studies to be relatively ineffective at changing the behavior of both drivers and wildlife.[18]

FACTORS THAT AFFECT IMPACT

- Habitat fragmentation, barriers to crossing formed by roads
- Lack of driver education on wildlife hazards and alertness
- Gaps in barriers and fences due to human activities
- Distance between edge of road and forest/vegetation
- Visibility (alignment, lighting, etc.)
- Location of road relative to wildlife habitat (urban/ rural)

INDICATORS OF ENVIRONMENTAL IMPACT

NUMBER OF ANIMALS KILLED

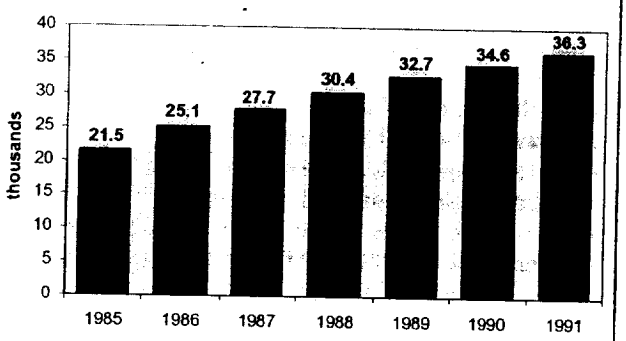
In the United States, roadkill losses are estimated to be at least 1 million animals per day due to conflict with traffic while crossing roads

Source: Tolley, R.S. and B.J. Turton. *Transport Systems, Policy and Planning: A Geographic Approach.* Longman Scientific and Technical. 1995.

[18] Fornwalt, et al., 1980; Colorado Division of Wildlife, 1980; California Department of Transportation, 1980; Lehtimaki, 1981.

A total of approximately 208,300 wildlife collisions with motor vehicles were reported in the Highway Safety Information System (HSIS) for 1985 to 1991 in five states — Illinois, Maine, Minnesota, Utah, and Michigan. Data from the five states shows a 69 percent increase in reported animal collisions over the 7-year period, from 21,479 in 1985 to 36,332 in 1991. The figure below shows the trend in the number of animal crashes.

Figure 3-15: Animal Collisions with Motor Vehicles



Although some crashes involved domestic animals, states that reported the type of animal involved in the crash found that most reported animal crashes involved deer. In Michigan, almost all the hit-animal crashes (99.7 percent) were deer related, and data from Minnesota indicate that over 90 percent of animal crashes involved deer. The greatest number of animal crashes by far occurred in November, which is the mating season for deer. The crash rate is substantially higher on two-lane rural roads than on urban roads; for the five states reporting to HSIS, 66 percent of animal crashes occurred on two-lane rural roads.

Source: U.S. Department of Transportation, Federal Highway Administration, Turner-Fairbanks Highway Research Center. "HSIS Summary Reports: Investigation of Crashes with Animals." March 1995 (FHWA-RD-94-156). http://tfhrc.gov/hsis/94-156.htm.

3.4 MAINTENANCE, SUPPORT, AND OPERATIONS

Operation and maintenance of highways involves various activities, such as application of de-icing chemicals and pesticides. Vehicle maintenance and support facilities include motor freight terminals, bus yards, fuel storage tanks, and auto fueling and service stations, all of which have associated environmental impacts.

HIGHWAY OPERATIONS AND MAINTENANCE

DESCRIPTION OF IMPACT

Highway operations and maintenance involve activities such as painting of bridges, re-striping of highways, de-icing of roadway facilities during winter weather conditions, and application of pesticides to roadside vegetation. Each of these activities is associated with potentially harmful environmental impacts, as shown in the text box below:

CONTAMINATION ENCOUNTERED IN HIGHWAY OPERATIONS AND MAINTENANCE
(NCHRP, 1993; based on telephone survey of 16 states[19])

- **Lead Paint**: All states reported that lead paint residues from bridges were a problem.
- **Solvents and Pesticides**: Four states had significant problems with solvents and pesticides at maintenance yards and with solvents as laboratory wastes, from asphalts in particular.
- **Salt**: Two states had problems with salt runoff from maintenance stockpiles contaminating groundwater.
- **General Maintenance**: Six states volunteered that they had problems at their maintenance facilities.

Deicing is a significant contributor to highway runoff problems, particularly in northern states where cold weather necessitates greater use of de-icing chemicals. Rock salt is the principal deicing agent used in winter road maintenance throughout the nation.

The use of road salt allows highway travel during snow conditions and is important for delivery of vital goods and services (including emergency support vehicles which save lives) to large segments of the country. Although salt is cheap and effective, it can cause adverse environmental effects. Environmental impacts of road salt include effects on roadside vegetation, harm to soil structure, and impacts on drinking water and aquatic life.[20] The effect of deicing runoff is not limited to roadside vegetation: 90% of the salt applied to the street of Buffalo, NY, for example, enters into the city sewerage system and then reaches Lake Ontario.[21]

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[19] States surveyed: AK, AZ, FL, IL, LA, MN, MO, MT, NH, NY, OR, PA, TN, TX, VA, WA.

[20] Transportation Research Board, National Research Council. *Highway Deicing: Comparing Salt and Calcium Magnesium Acetate.* Special Report 235, 1991.

[21] Tolley, R.S. and B.J. Turton. *Transport Systems, Policy and Planning: A Geographic Approach.* Longman Scientific and Technical. 1995.

FACTORS THAT AFFECT IMPACT

The actual extent of water contamination and habitat alteration arising from road salt use depends on highly site-specific conditions such as watershed characteristics, amount of runoff and/or snowmelt, and type of indigenous vegetation:

- Amount of roadway deicing agent applied
- Type of deicing agent used
- Climate/weather conditions (amount of snow, ice, rainfall)
- Amount of high salinity runoff/snowmelt that reaches bodies of water (based on runoff controls and local geography)
- Depth of groundwater table
- Sensitivity of nearby habitats

INDICATORS OF ENVIRONMENTAL IMPACT

ROAD SALTING

Specific outcomes, including wildlife habitat damage, reduced fish stocks, loss of unique natural features, and corrosion damage to vehicles from increased salinity, are not quantified nationally and no quantified data are available to estimate how much road salt enters groundwater, rivers, and lakes. Some information about impacts are known:

> Typically, 5-10% of trees along heavily traveled roads are affected by road salt application. Salting of a typical road could kill 1 to 25 roadside trees per year, depending on salt application rates and roadway proximity to trees.
>
> Source: Transportation Research Board, National Research Council. *Highway Deicing: Comparing Salt and Calcium Magnesium Acetate.* Special Report 235, 1991.

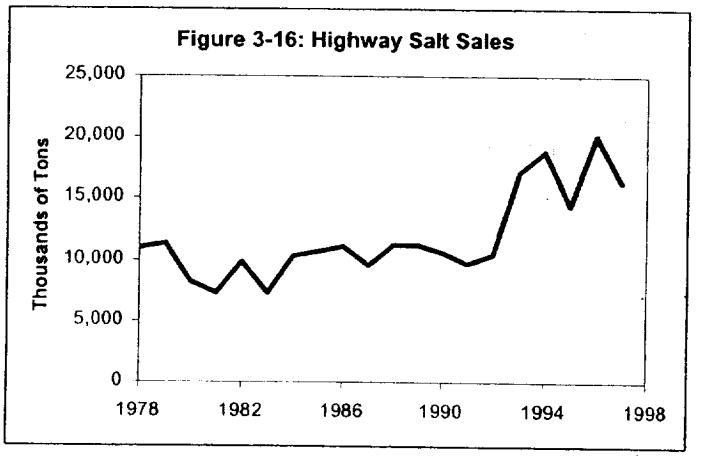
> In 1996, 3 states, compared to 4 states in 1994, reported wetlands impacts from salinity.
>
> Source: U.S. Environmental Protection Agency. *Appendices from the National Water Quality Inventory: 1996 Report to Congress.* www.epa.gov/OW/resources

In the past decade, 10 million tons of salt have been applied in a typical year, but applications from 1993 onwards have been significantly higher.

Table 3-41: Highway Salt Sales, 1970-1997

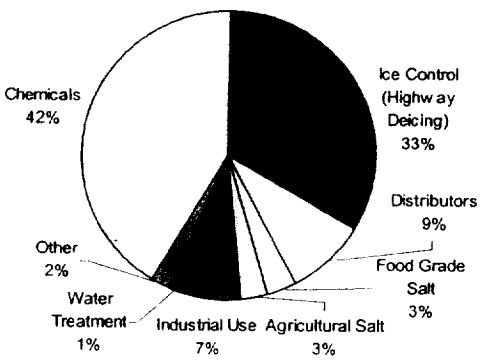
Year	Tons (000)
1978	10,927
1979	11,323
1980	8,108
1985	10,730
1986	11,057
1987	9,573
1988	11,202
1989	11,227
1990	10,528
1991	9,730
1992	10,457
1993	17,126
1994	18,885
1995	14,427
1996	20,117
1997	16,369

Source: Salt Institute, 1998. http://www.saltinstitute.org/33.html#highways



Nationally, road salt for ice control comprises about one-third of total salt use for all purposes.

Figure 3-17: Uses of Salt in the U.S., 1996



Source: U.S. Geological Survey. "Salt." *Minerals Information, 1996.* http://minerals.er.usgs.gov/minerals/pubs/commodity/salt/580496.pdf

MOTOR FREIGHT TERMINAL OPERATIONS: TANK TRUCK CLEANING, MAINTENANCE, AND REPAIR

DESCRIPTION OF IMPACT

Motor freight terminal operations include short and long haul truck activities (such as tank car unloading and cleaning), furnishing of terminal facilities for passenger or freight traffic, and cleaning and maintenance functions including equipment degreasing, exterior washing, and painting. Many of

these processes use materials that are hazardous or may in turn generate hazardous waste or wastewater. In addition, refueling operations impact the environment through spills, and through fuel tank vapors that are displaced when the tank is filled with liquid fuel. The actual impact of terminal activities on the environment depends on the type and volume of operations, levels of cleanliness, the type of wastes generated, and wastewater treatment systems in place.

Table 3-42: Typical Motor Freight Terminal Operations: Materials Used and Types of Waste Possibly Generated

Process/Operation	Materials Used	Types of Waste/Emissions
Unloading or Cleaning of Tank Cars	Solvents, alkaline cleaners	VOC Emissions Acid/alkaline wastes Toxic wastes Solvent wastes Residual tank contents
Rust Removal	Naval jelly, strong acids, strong alkalis	Acid/alkaline wastes
Painting	Enamels, lacquers, epoxies, alkyds, acrylics, primers, solvents	VOC Emissions Ignitable wastes Toxic wastes Paint wastes Solvent wastes
Paint Removal	Solvents, paint thinners, enamel, white spirits	Paint wastes Toxic wastes Solvent wastes
Exterior Washing	Solvents, cleaning solutions	VOC Emissions Solvent wastes Oil and grease
Equipment degreasing	Degreasers, engine cleaners, acids, alkalis, cleaning fluids	Ignitable waste Combustible solids Acid/alkaline wastes
Refueling	Gasoline, diesel fuel	Evaporative losses - VOCs Fuel drips and spills
Changing of batteries	Lead-acid batteries	Acid/alkaline wastes Batteries (lead acid)

Source: U.S. Environmental Protection Agency/RCRA Fact Sheet: Motor Freight/Railroad Terminal Operations, 1993. U.S. Environmental Protection Agency. *Profile of the Transportation Equipment Cleaning Industry.* 1995.

An important component of the transportation equipment cleaning industry is the cleaning of tank truck interiors. Although most truck tanks are in dedicated service (carrying only one commodity), many must be cleaned after every trip to prevent contamination of materials. A typical tank truck car has a volume of 3,500 to 8,000 gallons and generates about 500 to 1,000 gallons of wastewater during cleaning, resulting in the output of spent cleaning fluids, fugitive VOC emissions, water treatment system sludge, and tank residues. The disposal and treatment of tank heels can also be source of pollution for tank cleaning facilities. The typical heel volume of a tank truck car is 5 - 10 gallons per tank, and a facility's wastewater treatment system may be adversely affected by, or may not adequately treat, a slug of concentrated tank residue. Incompatible heels are usually segregated and resold to a reclaimer or shipped off-site for disposal. Heels that are composed of detergents, solvents,

acids, or alkalis can be stored on-site and used as a tank cleaning fluid or to neutralize other tank heels. There are 1,841 truck/land tank cleaning facilities in the U.S.[22]

Approximately 90% of transportation equipment cleaning facilities discharge wastewater to publicly owned treatment works or combined treatment works (privately owned by multiple facilities) after some amount of treatment. Some facilities discharge directly to surface waters under the National Pollution Discharge Elimination System (NPDES) permits or to underground injection wells under Safe Drinking Water Act permits. Allowable emissions could be tracked based on these permits, although actual emissions may vary.

FACTORS THAT AFFECT IMPACT

- Number of terminals
- Type and level of terminal operations
- Materials used during terminal operations
- Wastewater treatment capabilities

INDICATORS OF ENVIRONMENTAL IMPACT

Data on water quality impacts to streams, rivers, and lakes, and related habitat due to tank truck terminal operations are not available. Data on health effects from air pollution coming from terminals are also not available. National statistics are not readily available, although EPA's MOBILE model produces emissions factors for hydrocarbons due to refueling on a per mile basis.

WASTEWATER FROM BUS WASHING

75 percent of transit agencies surveyed collect and treat wastewater from bus washing operations. 65% of transit agencies wash their active bus fleets daily during summer months. 81% wash daily during the winter.

Source: Based on survey of TCRP survey (1995) of 120 geographically diverse transit agencies in the U.S. and Canada; 52 respondents. Transit Cooperative Research Program. *Transit Bus Service Line and Cleaning Functions*. 1995.

VOC EMISSIONS

Tank car and rail car cleaning operations emit 1.25 million pounds of VOCs per year. Data on other wastes generated from motor freight terminal operations have not been estimated at the national level.

Source: U.S. Environmental Protection Agency. *Profile of the Transportation Equipment Cleaning Industry*. 1995.

[22] Land facilities are those that clean any combination of the following equipment: tank trucks, rail tank cars, intermediate bulk carriers, intermodal tank containers. U.S. Environmental Protection Agency. *Profile of the Transportation Equipment Cleaning Industry*. 1995 (p. 7).

SERVICE STATIONS: PASSENGER VEHICLE CLEANING, MAINTENANCE, REPAIR, AND REFUELING

DESCRIPTION OF IMPACT

Facilities such as gas stations, maintenance shops, and service stations impact the environment through runoff of gas, oil, and dirt; waste releases to sewer systems; air emissions; and waste disposal. Fueling activities generate air emissions due to VOC losses during transfer. There are two types of refueling losses: "stage one" are losses associated with the refilling of underground storage tanks, and "stage two" occur during the transfer of fuel from pump to automobile gas tank. Both stage one and stage two losses are counted as stationary source emissions by EPA's Office of Air Quality Planning and Standards.

Relatively small amounts of waste and wastewater are generated from the washing, maintenance, and painting of motor vehicle exteriors. Typical hazardous wastes generated include spent solvents, spent caustics, strippers, paint chips, and paint sludges. Wastewater is generally treated on-site and then discharged to a public treatment works.

FACTORS THAT AFFECT IMPACT

- Number of maintenance facilities
- Type and level of maintenance operations
- Materials used during maintenance operations
- Wastewater treatment capabilities

INDICATORS OF ENVIRONMENTAL IMPACTS

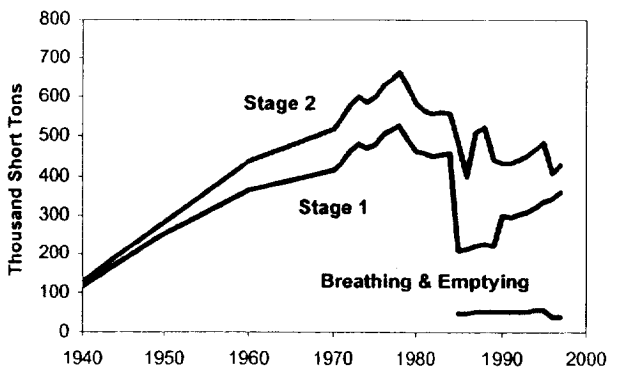
EMISSIONS FROM RELEASES OF FUEL AT SERVICE STATIONS

Table 3-43: VOC Emissions from Service Stations, 1940-1997

Year	Service Stations: Stage I	Service Stations: Stage II	Service Stations: Breathing & Emptying
1940	117	130	NA
1950	251	283	NA
1960	365	437	NA
1970	416	521	NA
1980	461	583	NA
1985	207	485	49
1990	300	433	52
1991	295	430	51
1992	303	442	52
1993	309	449	53
1994	322	467	55
1995	334	484	57
1996	341	406	37
1997	359	427	39

Source: U.S. Environmental Protection Agency. *National Air Pollutant Emissions Trends Report, 1900-1997* (Table A-3).

Figure 3-18: VOC Emissions from Service Stations



LEAKING UNDERGROUND STORAGE TANKS (USTs) CONTAINING FUEL

DESCRIPTION OF IMPACT

Underground storage tanks (USTs) are used to store fuel at gas stations and other facilities, as well as other chemicals. Leaking petroleum USTs can be a major source of groundwater contamination. Releases from tanks and piping occur from corrosion of older, unprotected steel tanks and piping, or from cracks in tanks made from other materials. Overfilling and spillage during refueling are also responsible for accidental releases. The UST regulations that EPA issued in 1988 established a number of corrective action requirements for UST owners and operators, including the requirement to clean up soil and groundwater as needed to protect human health and the environment. EPA regulations required that by 1998 all existing USTs have spill protection through catchment basins, automatic shutoff devices, overfill alarms, and mandatory corrosion protection for steel tanks and piping.

FACTORS THAT AFFECT IMPACT

- Number of leaking underground storage tanks (USTs)
- Type and quantity of materials released from leaking USTs
- Spill protection mechanisms
- Cleanup efforts initiated and completed
- Location of groundwater table
- Sensitivity of local ecosystems
- Treatment of drinking water

INDICATORS OF ENVIRONMENTAL IMPACT

As a result of these stringent regulations, there has been a decrease in the number of active petroleum USTs in the U.S. as petroleum UST systems have been closed. Data on number of active tanks and the cumulative number of closed tanks, releases reported, cleanups initiated and completed, and emergency responses are compiled in EPA's Corrective Action Measures reports (formerly called "STARS", Strategic Targeted Activities for Results System).

Table 3-44: Corrective Action Measures Reports for the U.S., 1996 - 1998

Time Period	# Active Tanks	Tanks Closed*	Confirmed Releases*	Cleanups Initiated*	Cleanups Completed*
1st Half FY 1996	1,093,018	1,043,437	314,720	241,787	141,185
2nd Half FY 1996	1,064,478	1,074,022	317,488	252,615	152,683
1st Half FY 1997	1,031,960	1,111,266	329,940	276,603	162,431
2nd Half FY 1997	969,652	1,150,824	341,773	292,446	178,297
1st Half FY 1998	919,540	1,186,341	358,269	301,842	192,065
2nd Half FY 1998	891,686	1,236,007	371,387	314,965	203,247

*Cumulative

Source: U.S. Environmental Protection Agency, Office of Underground Storage Tanks. "Corrective Actions Measures Archive." http://www.epa.gov/swerust1/cat/camarchv.htm

3.5 DISPOSAL OF VEHICLES AND PARTS

Motor vehicle disposal is the last phase in the lifecycle analysis of highway-related environmental impacts. Dismantling operations involve both automotive fluids and solids. Fluids, such as engine oil, antifreeze, and air conditioning refrigerant, are recovered to the extent possible and reprocessed for reuse or sent to energy recovery facilities. Many solid parts, such as radiators and catalytic converters contain valuable metal materials, which are removed for recycling or reuse. In addition, the dismantler will remove and recycle the battery, fuel tank, and tires to reduce shredder processing concerns.

SCRAPPAGE OF VEHICLES

DESCRIPTION OF IMPACT

There are an estimated 12,000 automobile scrappage/disassembly operations in the United States. When a vehicle is dismantled, fluids, including oil, antifreeze, and refrigerant, are drained and removed. Solid parts such as the radiator and catalytic converter are removed for recycling or reuse. The battery, fuel tank, and tires are also separated. If undamaged, parts are cleaned, tested, inventoried, and sold, and if damaged, are recycled with similar materials.

The remaining hulk is then flattened and shredded at one of the 200 shredding operations in North America and sorted into ferrous, nonferrous (8.7% of the whole vehicle), and residual components. The residue contains plastics, glass, textiles, metal fines, and dirt, which are generally all landfilled.

FACTORS THAT AFFECT IMPACT

- Number of vehicles scrapped
- Fraction disposed of properly (through recycling, recovery, etc.)
- Use of hazardous materials in vehicles
- Recovery rate of materials in scrapped vehicles

INDICATORS OF ENVIRONMENTAL IMPACT

Estimates are not available on the health and environmental impacts of landfilling or other disposal of scrapped vehicles.

VEHICLES SCRAPPED PER YEAR

Approximately 11.3 million motor vehicles were scrapped in 1996. Trends are shown below.

Table 3-45: Motor Vehicle Scrapped Annually* (thousands)

Year	Passenger Cars	Trucks	Motor Vehicles, total
1970	7,461	837	**8,298**
1975	5,669	908	**6,577**
1980	8,405	1,732	**10,137**
1985	7,729	2,100	**9,829**
1990	8,897	2,177	**11,074**
1991	8,565	2,284	**10,849**
1992	11,194	1,587	**12,781**
1993	7,366	1,048	**8,414**
1994	7,824	4,545	**12,369**
1995	7,414	2,918	**10,332**
1996	7,527	3,864	**11,391**

*Note: Figures represent vehicles that are not reregistered. Estimates July 1 to June 30 (e.g., 1970 data is from July 1, 1969 to June 30, 1970)

Source: U.S. Department of Transportation, Bureau of Transportation Statistics. *National Transportation Statistics 1998.* Table 4-45.

RECYCLING OF SCRAPPED VEHICLES

The U.S. boasts one of the most effective and prosperous vehicle recycling industries in the world. Approximately 94% of all scrapped vehicles are collected and recycled annually at one of the 12,000 scrappage/disassembly locations in the U.S.

At least 75% of the material collected from scrapped vehicles (steel, aluminum, copper) is recycled for raw material use, and 25% landfilled. This effort is estimated to result in approximately 11 million tons of recycled steel and 800,000 tons of recycled nonferrous metals, saving an estimated 85 million barrels of oil that would be used to manufacture new parts. Scrap vehicle waste comprises about 1.5% of total municipal landfill waste.

Source: U.S. Environmental Protection Agency. *Profile of the Motor Vehicle Assembly Industry.* EPA Office of Compliance Sector Notebook Project, September 1995.

MOTOR OIL DISPOSAL

DESCRIPTION OF IMPACT

Used motor oil contains high concentrations of detergents, metals, and other toxics. These materials degrade water quality when improperly disposed. One quart of used oil is enough to contaminate a million gallons of fresh water.

FACTORS THAT AFFECT IMPACT

- Quantity of oil used in motor vehicle operations.

EXH 14

DIVIDER

Paper No. 03-2946

Evaluation of Toll Options Using Quick-Response Analysis Tools

A Case Study of the Capital Beltway

Prepared for presentation at the TRB Annual Meeting in January 2003

Paper Word Count: 6,003
Abstract Word Count: 163

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November 16, 2002

DISCLAIMER: The views expressed in this paper or those of the author, and not necessarily those of the US Department of Transportation (U.S. DOT) or the Federal Highway Administration (FHWA)

Abstract

Evaluation of Toll Options Using Quick-Response Analysis Tools:

A Case Study of the Capital Beltway

Patrick DeCorla-Souza, AICP

Analysis tools in current use in transportation decision-making processes are not well suited for evaluating toll highway alternatives against more traditional "free" highway alternatives. This paper shows how existing analysis tools might be used in evaluating toll options. Using a case study, the paper demonstrates that relatively simple analytical procedures may be used to estimate the impacts of pricing alternatives and to generate information for use by local decisionmakers.

The case study also demonstrates that pricing alternatives can often accomplish the purpose of a major highway project more efficiently and more effectively than conventional alternatives that exclude pricing, while generating revenue to support bonds for project construction or to fund improved transit and paratransit services. With toll revenue to back bonds, project delays due to constrained funding can be avoided, and the public can be provided with superior mobility earlier and at lower public cost.

Evaluation of Toll Options Using Quick-Response Analysis Tools:

A Case Study of the Capital Beltway

Patrick DeCorla-Souza, AICP

1.0 INTRODUCTION

Major highway expansion projects in metropolitan areas in the U.S. are expensive. Yet they may be needed as solutions to traffic congestion as these areas grow and develop. In some areas, toll options are being proposed as a source of revenue to make them financially feasible. For example, a private company recently sent a proposal to the Virginia Department of Transportation to finance the expansion of the Capital Beltway in Northern Virginia (Washington, DC metropolitan area) by charging tolls to single-occupant vehicles on two lanes proposed to be added in each direction (1). Often such toll options must be evaluated within a short time frame, so that decision-makers can respond to private sector proposals. However, evaluation tools in current use in transportation decision-making processes are not well suited for evaluating such toll alternatives against more traditional "free" highway alternatives. This paper shows how quick-response analysis tools might be used in evaluating toll options. Using the Capital Beltway project (2) as a case study, the paper demonstrates how transportation performance and other impacts of toll options can be evaluated and compared to more traditional alternatives.

Two types of toll options have a reasonable chance of getting public acceptance:

- HOT Lanes, i.e. High Occupancy Toll lanes
- FAIR Lanes, i.e., Fast and Intertwined Regular lanes

These types of toll options, also known as "value pricing" options, are discussed below.

1.1 HOT Lanes

"HOT" is the acronym for "High Occupancy/Toll." On HOT lanes, low occupancy vehicles are charged a toll, while High-Occupancy Vehicles (HOVs) are allowed to use the lanes free or at a discounted toll rate. Tolls vary by time-of-day and are collected at highway speeds using electronic toll collection technology. There are no toll booths. Tolls may be set "dynamically," i.e., they may be increased or decreased every few minutes, to ensure that the lanes are fully utilized. Motorists are informed of the current toll rates through variable message signs placed in advance of the entrances to the HOT lanes.

HOT lanes can be introduced either by converting existing HOV lanes or by adding new lanes. They have been implemented in California and Texas. By maximizing the use of spare capacity on existing HOV lanes, HOT lanes can reduce congestion on general purpose lanes, and reduce the need for new highway capacity for unrestricted use. Variable tolls on new lanes ensure that new lanes will not get congested, and that spare capacity remaining after limited use by HOVs will be fully utilized.

1.2 FAIR Lanes

The new value pricing concept called FAIR (Fast and Intertwined Regular) lanes was developed to overcome equity concerns that sometimes surround efforts to implement variable tolls on previously untolled highway capacity (3). FAIR lanes involve separating congested freeway lanes into two sections, Fast lanes and Regular lanes. The separation may be done with methods as simple as using plastic pylons and lane striping. The Fast lanes would be electronically tolled, with tolls set dynamically, i.e., in real time, to ensure that traffic moves at the maximum allowable free-flow speed. Users of the Regular lanes would still face congested conditions, but would be eligible to receive credits if their vehicles had electronic toll tags. For example, if the current toll on the Fast lanes were $4.00, vehicles on the Regular lanes could get a credit amounting to $1.00, i.e., 25 percent of the current toll. The credits would be a form of compensation for giving up the right to use the lanes that had been converted to Fast lanes. Accumulated credits could be used as toll payments on days when a traveler chooses to use the Fast lanes, or as payments for transit or paratransit services, which would be subsidized using toll revenue from the Fast lanes.

FAIR lanes could increase vehicle throughput by as much as 50% on Fast lanes. The higher throughput occurs because freeway vehicle throughput under free flow conditions is significantly higher than when it is congested (4). FAIR lanes could increase person throughput even more with the provision of high quality transit and paratransit services. This in turn could lead to more efficient use of existing highway lanes, and thereby reduce the need for new highway capacity.

1.3 Lessons Learned from Implemented Projects

The SR 91 Express Lanes in Orange County, CA opened in December 1995 as a four-lane toll facility in the median

of a 10-mile section of one of the most heavily congested highways in the United States. The toll lanes are separated from the general purpose lanes by a painted buffer and plastic pylons. There are eight general purpose lanes, four in each direction.

As of November 1, 2001, tolls on the Express Lanes varied between $1 and $3.60 in the westbound direction and $1 and $4.75 in the eastbound direction, with the tolls changing by time of day to reflect the level of congestion delay avoided in the adjacent free lanes, and to maintain free-flow traffic conditions on the toll lanes. Traffic volumes for discrete time intervals during the day are monitored on a regular basis on the Express Lanes. When volumes approach levels at which free flow of traffic might be at risk, a new toll schedule is developed and published. To discourage additional traffic, tolls are raised for those time periods when volumes are close to the maximum volumes that can support free flow. All vehicles must have an electronic transponder to travel on the Express Lanes. Vehicles with three or more occupants pay a reduced toll. These vehicles go through a special toll collection lane for HOVs so that they can be identified as vehicles eligible for the discount.

During heavy congestion periods, 40 percent of total vehicular traffic is carried on the express lanes even though they comprise only one-third of the capacity (5), because throughput is higher under free flow conditions (4). Due to higher HOV use on the lanes, the percentage of person travel on the lanes is even higher.

Projects such as SR 91 Express Lanes have taught important lessons with regard to such "value pricing" toll options:

- They can work - they can reduce congestion and change travel behavior, and provide additional travel choices.
- They can provide much needed revenues for expansion of transportation services.
- They can be politically and publicly acceptable. Surveys of motorists on SR 91 have repeatedly shown a high level of support from all income groups. A recently completed public opinion survey in San Diego (6) found that both users and non-users of the dynamically priced I-15 HOT lanes strongly support the use of pricing. Support is high across all income groups, with the lowest income group expressing stronger support than the highest income group (80% vs. 70%).

2.0 ANALYSIS AND EVALUATION OF PRICING ALTERNATIVES

2.1 Available Analysis Tools

Through the Travel Model Improvement Program (TMIP), FHWA has been developing and disseminating advanced travel demand forecasting techniques to estimate the travel effects of pricing alternatives (7). Four-step travel demand models are being used in many cases to estimate traffic impacts of pricing alternatives, e.g., a recent study in Portland, OR (8). When results from four-step models are available, FHWA's Surface Transportation Efficiency Analysis Model (a.k.a. STEAM) may be used to generate estimates of mobility impacts (9). STEAM can also be used to generate estimates of a variety of environmental impacts from vehicle operation on the highway. These estimates are generated at the system level, to ensure that only net effects are reported. A pricing study in the Twin Cities, MN, has used STEAM to estimate the mobility and environmental impacts of alternative strategies (10).

However, the above procedures tend to be complex and often expensive to implement. In the time frame that government agencies must respond to private sector tolling proposals, such as the proposal for the Capital Beltway, it is not feasible to do extensive four-step modeling of pricing alternatives. Quick-response analysis tools, such as the tool demonstrated in this paper, are a feasible alternative. FHWA has developed quick-response analysis tools which can assist in travel demand and impact estimation. For example, FHWA's IMPACTS model (11) provides for estimation of impacts of toll alternatives. Other tools developed by FHWA, such as its Sketch Planning Analysis Spreadsheet Model (a.k.a. SPASM) (12) and its Spreadsheet Model for Induced Travel Estimation (a.k.a. SMITE) (13) may also be modified for use in evaluation of pricing alternatives. FHWA's SMITE model was modified for the case study analysis presented in this paper. The modified model is called SMITE-Managed Lanes (SMITE-ML).

2.2 Overview of SMITE

SMITE estimates "induced" traffic that might result from faster travel speeds, including new trips generated or attracted to new development, existing trips diverted from other destinations, and existing trips diverted from other modes of travel such as transit.

Goodwin (14) compared travel demand model forecasts, which accounted primarily for re-routed traffic, with observed traffic flows on nine improved urban roads and sixty-one rural roads in the U.K. He found that, for an average road improvement for which traffic growth is forecast by travel models, unpredicted traffic in the first year, over and above the forecast, was +5.7% for urban roads and +13.3% for rural roads. Based on his studies, he equates an additional 10% traffic to a demand elasticity, with respect to travel time, of -0.5.

However, researchers in the past have produced elasticity estimates as low as -0.2 (15). The wide range results from several factors, such as the relative importance of travel time component of the full user cost of the trip, the time frame of analysis, magnitude of new development induced, and length of trips served.

SMITE uses demand elasticity with respect to travel time to estimate induced travel. In order to develop an estimate of induced travel demand using demand elasticities, we must first estimate the reduction in the time "price" from the proposed action. This reduction, converted into a percentage reduction, can then be used with a demand elasticity estimate to provide an estimate of induced travel demand. However, one complication is that as total travel increases due to induced demand, the initial price reduction is slowly eroded. It is therefore necessary to go through a process of equilibration of demand and price. The change in travel time that occurs with increases in demand is easily modeled using speed-volume relationships (16, 17). By iteratively estimating induced travel demand and the resulting time price change, an equilibrium point can be found at which demand and price are in balance.

Figure 1 demonstrates the equilibration process graphically, for an improvement in highway speeds resulting from capacity expansion. Point A is the initial equilibrium point, i.e., the point at which demand and supply are in balance, prior to highway expansion. After highway expansion, travel time "price" is initially reduced to the level represented by point B. However, at that price, travel demand would increase to the level represented by point C on the demand curve. But at this higher demand level, the price would actually be much higher, as represented by point D on the price curve after highway expansion. At this price, demand would in reality be lower, as represented by point E on the demand curve. As the figure demonstrates, one might continue to follow this process and finally end up at point Q. At this point, demand and price are in balance.

An approximation of the procedure illustrated in Figure 1 has been incorporated into SMITE. For the demand curve, SMITE allows the user to provide demand elasticity estimates. Induced traffic associated with increases in highway speeds is calculated using a series of equations (18) approximating the equilibration process demonstrated graphically in Figure 1.

3.0 CASE STUDY ANALYSIS

The case study demonstrates application of quick-response analysis techniques using a speciallymodified version of SMITE called SMITE-Managed Lanes (SMITE-ML). SMITE-ML facilitates estimation of the impacts of toll options on existing or added lanes. Data for the case study demonstration were obtained from the Capital Beltway Study report (2). These data and other data needed as input into SMITE-ML are indicated in bold on the spreadsheet, which is available from www.fhwa.dot.gov/steam. Go to the Related Links page.

The proposed project is 14 miles long. The existing facility has 8 lanes, and the alternatives evaluated involved expansion to 10 lanes or 12 lanes.

3.1 Project Alternatives

Three conventional Build alternatives (i.e., without tolls) were evaluated in the Capital Beltway Study in comparison to the No Build alternative. These alternatives included:

- Alternative 1: Add one concurrent HOV lane in each direction.
- Alternative 2: Add one HOV lane in each direction, reconfiguring the cross-section in each direction to two local lanes and three inside Express lanes (including the HOV lane).
- Alternative 3: Add two barrier-separated HOV lanes in each direction, for a total of six lanes in each direction (four regular and two HOV).

In addition, three pricing alternatives were developed for the case study analysis presented in this paper. These pricing alternatives were variations on the No Build alternative and two of the three Build alternatives. The following

pricing alternatives were developed:

- Alternative 4: Divide the existing four-lane cross section in each direction into two sections of two lanes each, one local and the other priced express with free access for HOV and transit vehicles. Provide toll credits to motorists using regular lanes, as in the FAIR lanes concept. This is essentially the 8-lane No Build alternative with a pricing add-on.

- Alternative 5: Add one concurrent lane in each direction. Using barriers, divide the new 5-lane cross section into two sections - two regular lanes and three priced express lanes, with free access on the express lanes for carpool and transit vehicles. This is essentially the 10-lane Alternative 2 with a pricing add-on.

- Alternative 6: Add two barrier-separated priced express lanes in each direction, with free access on the express lanes for carpool and transit vehicles. This is essentially the 12-lane Alternative 3 with a pricing add-on.

Note that a pricing add-on to the 10-lane Alternative 1 was not evaluated. Barrier-separated priced lanes on a 10-lane cross-section are evaluated under Alternative 5.

For the pricing alternatives, tolls would be charged only during peak hours (6-10 am and 3-7 pm) on priced express lanes and would vary dynamically, to ensure that traffic flows freely at all times, including the peak hour of each peak period. This would ensure premium delay-free service for transit and paratransit riders, carpools and toll-paying vehicles. It is important to understand that the primary intent of pricing strategies is not to reduce mobility or freedom of travel, but to increase it by providing funding and uncongested travel conditions for better quality, cost-efficient alternative modes while instituting financial incentives to encourage use of these modes. In the alternatives developed, pricing revenues would fund high quality alternatives to solo-driving, including demand-responsive paratransit services, express bus or Bus Rapid Transit (BRT) services, and non-motorized options. And solo drivers willing to pay would enjoy a higher level of mobility.

3.2 Mode Choice Analysis

A "pivot point" mode choice model (19) has been incorporated into SMITE-ML. It was used to estimate impacts of the alternatives on peak period mode shares, pivoting off of estimated No Build mode shares in the year 2020. Impedance coefficients used in the model were those calibrated for the Washington, DC metropolitan area (19).

Travel corridor person trip demand estimates for the base case No Build alternative were needed as input to the model. These were obtained from the Capital Beltway Study (2), generated by the four-step model maintained by the Metropolitan Planning Organization (MPO). The Study report also provided No Build traffic forecasts for 10 separate sections of the freeway between interchanges. In the base case, with no widening, the MPO model estimated that the southern segment (about 3 miles long) would carry on average about 280,000 vehicles per day on the freeway. The middle segment (about 6 miles in length) would carry the highest volumes, about 310,000 vehicles per day. The lowest-volume segment to the north (about 5 miles in length) would carry about 250,000 daily vehicle trips.

The pivot point logit model estimated the changes in travel demand on alternative modes for each alternative, resulting from generalized user cost changes due to highway capacity improvements, tolls and new and improved transit and paratransit services. The model results reflected the effects of changes in congestion and financial inducements for use of alternative modes. Table 1 presents the results from this analysis for one of the three segments, the southern segment with mid-range traffic levels. For this segment, the model estimated:

- An additional 3,400 transit person trips for conventional Alternatives 1, 2 and 3.

- An additional 21,000 to 24,000 transit person trips for pricing Alternatives 4, 5 and 6.

The increase in transit trips with pricing amounts to about 10,500 to 12,000 round trips daily. This model estimate is not unreasonable, since it amounts to less than 10 percent of the current employment in the Tyson's Corner area, the major employment and commercial center located in the corridor. (Total employment in the area is 126,000, according to the Fairfax County Economic Development Authority's "Area Business Report", 2002). Moreover, employment is expected to grow significantly in the area by the forecast year 2020.

As shown in Table 1, carpool use estimated by the model ranged from an increase of about 14,000 person trips for

the conventional alternatives, to smaller increases of 8,000 to 12,000 person trips under the pricing alternatives. Note that pricing does not generate as much carpool use as conventional alternatives because some would-be carpool commuters are attracted to transit due to the superior transit services under pricing alternatives provided with funding from toll revenue.

3.2 Traffic Forecasts

The pricing alternatives tend to reduce vehicle demand on the freeway and in the corridor, relative to the base case No Build alternative. However, the reduced congestion on the freeway will cause diversions of traffic to the freeway from other routes and destinations, and may even induce additional development and consequent new trips in the corridor. SMITE-ML estimates increases in traffic from these sources. Traffic diverted from arterials to the expanded freeway is first estimated by redistributing traffic such that relative levels of congestion on the freeway and the arterials stay the same. This technique is based on principles in NCHRP Report No. 255 (20).

An elasticity of demand with respect to travel time of -0.2 was used to estimate "induced" travel. This demand elasticity is at the lower end of the range found in the literature (15). It reflects the paucity of vacant land available for increased development in the corridor, the relatively large proportion of short trips, as well as the fact that mode choice changes which contribute to induced travel are already accounted for using pivot point mode choice analysis. The results are presented in Table 2 for the southern segment of the freeway.

It should be noted that, for restricted lanes and priced lanes, the induced demand calculation was suppressed. Induced carpool usage is already estimated by the mode choice analysis. Peak period HOV use on the restricted lanes was estimated assuming that 90% of HOV demand estimated by the pivot point mode choice model would use the lanes. Single-occupant vehicle (SOV) volumes in priced lanes were estimated to be equal to the spare vehicle capacity that would be available on the lanes at a Level of Service C, i.e., about 75% of absolute capacity. Price would be used to regulate the level of travel demand in order to maintain service at Level of Service C.

Note that the restricted lanes and priced lanes would be open to all traffic during off-peak times, free of charge. Therefore, on a daily basis, Alternatives 3 and 6 carry relatively higher volumes of traffic. They have far more capacity available for unrestricted use, i.e., two lanes in each direction. Due to the larger number of new lanes available and used in peak periods by both HOVs and priced SOVs with Alternative 6, diverted and induced traffic is significant, increasing vehicle volumes daily on the freeway by almost 30,000 above the No Build volumes for that segment, and by about 12,000 for the corridor as a whole. On the other hand, with pricing Alternative 4, vehicle volumes are reduced by more than 30,000 vehicles daily on the freeway as well as corridor-wide. This occurs because Alternative 4 shifts many peak period trips to carpools and transit. But it does not encourage significant diversions or new traffic, because no capacity increase is involved.

3.4 Speed, Delay and Toll Revenue Estimates

Table 3 presents estimates of speed, delay and toll revenues per mile for the southern freeway segment. For restricted lanes and priced lanes, vehicle restrictions or variable pricing dampen peak demand and tend to maintain free-flow speeds in the peak periods. The speed estimates are used to estimate delay reductions relative to the base case No Build alternative. SMITE-ML also estimates the value of travel time savings for both "previous" travelers as well as diverted or "induced" travelers. The conversion of time savings to a monetary value was based on the average value of time of $9.00 per person hour, obtained by applying an inflation factor to the value estimated by US DOT (21). Results are presented in Table 4.

Table 3 also shows estimates of tolls paid by SOVs in the priced lanes. The average toll rate per mile was estimated using the estimate of average time saved per mile by vehicles in the priced lanes, and converting it to a monetary value. This value would roughly be equivalent to the toll that those ineligible for free service would be willing to pay.

Note that peak period toll rates would actually be much higher than suggested by this methodology, because peak period speed differentials are much higher than the average daily speed differentials estimated by SMITE-ML. (All pricing alternatives only propose to toll vehicles during the peak periods.) Also, toll rates may actually be higher than that indicated even by peak speed differentials, because toll-payers generally value their time more highly than the average motorist. That is why they choose to pay the toll. For example, commuters in the toll lanes in the median of SR 91 in Orange County, CA, value their time at $13 to $16 per hour (22). SMITE-ML multiplies the conservative estimates of average toll rates by the estimated number of toll-paying vehicles during peak periods (at Level of Service C), to provide a conservative estimate of daily toll revenues, as shown in Table 5. Annual revenues over all three segments are presented in Table 5. They are estimated assuming that tolls would be charged on 250 weekdays

a year.

3.5 Estimates of Social Costs and Benefits

Table 4 presents estimates of benefits associated with the alternatives, for the southern segment of the freeway.

Construction delay costs

First, the Table presents excess delay per mile due to construction activities during project implementation. It was assumed that delays would increase by 100% above prior recurring congestion delay, over a period of 250 days. According to a recent study of the impacts of temporary losses of highway capacity by Oak Ridge National Laboratory (23), non-recurring delay on U.S. freeways and principal arterials in 1999 amounted to 2.02 billion vehicle hours, while work zone delays on freeways alone amounted to 0.48 billion vehicle hours. Various studies, such as those done by the Texas Transportation Institute (24), suggest that recurring delay is equal to or less than non-recurring delay. Thus, work zones region-wide add at least 25% to recurring delays on regional networks, and perhaps more if delays on principal arterials are considered. Since we can safely assume that no more than 25% of a region's network is in 11 work zone status at any one time, this suggests that the assumption of 100% increase in delay on a specific facility due to construction is a conservative assumption.

External Costs

The increase in external costs per mile (including air pollution, noise and crashes) due to increased traffic were estimated using an estimated cost of 6 cents per vehicle mile for traffic in excess of the No Build alternative. These costs per vehicle mile were calculated based on the low-range nationwide estimates of these costs, amounting to $153.7 billion, and nationwide vehicle miles of travel amounting to 2.7 trillion in the year 2000 (25). The low-range estimates were used to ensure conservative estimates of benefits from pricing. Pricing tends to lower external costs, and therefore increase social benefits, since vehicle miles of travel are reduced relative to alternatives providing the same amount of capacity free of charge.

User Benefits

Assuming an average vehicle occupancy of 1.33, travel time delay costs amount to $12.00 per vehicle hour. In addition to the value of travel time saved by reduced delays, motorists save fuel as a result of reduced accelerations and decelerations. FHWA's Highway Economic Requirements System (HERS) model (26) estimates fuel consumption in relation to speeds. Based on the HERS model equations, ECONorthwest (27) calculated excess fuel consumed per minute of delay. On a facility with a free-flow speed of 60 mph, excess fuel consumed ranges from 0.037 gallons per minute of delay for a small car to 0.073 gallons per minute of delay for a sports utility vehicle (SUV). This equates to an added fuel cost of about 7 cents per minute of delay, including about 2 cents in gas taxes, assuming about $1.40 per gallon at the pump.

Since fuel taxes are a transfer, savings to motorists are losses to government agencies, and there is no net change in societal benefit from gas tax savings. Therefore, in computing societal benefits for the alternatives, changes in gas tax receipts were ignored. At 5 cents per minute of delay, fuel costs amount to $3.00 per vehicle hour of delay. Thus, fuel consumption costs from delay amount to about 25% of the travel time delay costs of $12.00 per vehicle hour.

In addition to time and fuel, motorists may incur crash cost savings when delay is reduced, as experience with the toll lanes on SR 91 suggests (22). However, due to lack of definitive data, and to ensure conservative estimates of benefits from pricing, these possible savings from pricing have been ignored for this case study.

3.6 Evaluation of Analysis Results

Table 5 presents key evaluation information for the six alternatives for all three freeway segments combined.

Delay Reduced

Table 5 first presents the delay reduction estimates (in person hours daily) for each of the six alternatives. The pricing alternatives reduce significantly more delay than alternatives with the same physical configuration but no pricing. Table 5 suggests that pricing Alternative 4, which does not increase capacity, is still able to reduce delay significantly.

Delay reduced amounts to more than 75% of the delay reduction with conventional Alternative 1, which does increase capacity by one lane in each direction. Thus, if funding is not available in a timely fashion for capacity improvement alternatives, this alternative could be a very good interim solution. Alternative 5, which involves the same amount of new capacity and the same configuration as conventional Alternative 2, reduces delay by about 50% more than Alternative 2. Similarly, Alternative 6, which involves the same amount of new capacity and the same configuration as conventional Alternative 3, reduces delay by almost 50% more than Alternative 3.

Cost per Hour of Delay Reduced

The bottom line of Table 5 also presents the cost of each alternative per hour of delay reduced. As the table shows, the most cost-effective alternative with regard to delay reduction is Alternative 4. It costs only about $3 per hour of delay reduced. On the other hand, the conventional Alternatives 1, 2 and 3 and pricing Alternative 5 are the least cost-effective. They cost about $9 to 13 per hour of delay reduced.

Toll Revenue

Gross annual toll revenue is relatively lower for Alternative 6 primarily because toll rates are lower, since the four regular lanes are less congested and travel time saved by taking the priced lanes is correspondingly lower. Revenues shown in the Table are gross revenues. For Alternative 4, approximately 25% of the revenue will be needed to pay for credits to motorists in the regular lanes, assuming a credit payout of 25% of the toll rate.

Transit Subsidy

Estimates of new transit trips from the mode choice model (see Table 1) were used to calculate new transit subsidies that would be needed to support service for the new trips and provide discount fares. Additional public subsidies were estimated at 50 cents per passenger mile, based on nationwide subsidies of $23.5 billion supporting 50 billion passenger miles annually (28). Estimates of new transit trips were used to calculate new transit subsidies that would be needed to support service for the new trips and provide discount fares. Table 5 shows the resulting transit subsidy estimates. Transit use under the pricing alternatives is about two and one-half times its use under the conventional alternatives. This results in a need for new public subsidies for transit which are about eight times the new subsidies needed for the conventional alternatives.

Annualized Public Costs

Table 5 presents estimates of annualized highway facility construction and right-of-way costs based on estimates from the Study report (2). These are then aggregated with annualized transit subsidy and pricing infrastructure and operation costs, to get total annualized public costs. Total annualized public costs, including capital costs for highway facilities, is higher for the pricing Alternatives 5 and 6, relative to the comparable "no pricing" Alternatives 2 and 3, primarily because of the larger transit subsidies needed.

Net Financial Impact

Despite the very conservative assumptions that were used in estimating toll revenue, the pricing alternatives bring in gross toll revenues estimated at about 70-75% of the new public subsidy needs for transit under Alternatives 4 and 5, and about 25% of that needed for Alternative 6. If alternative sources can be found for transit funding, the toll revenue will be available to provide a source of funding to support construction bonds for the highway improvements.

Net Benefits

The estimated excess travel delay costs during project construction and external costs from increases in vehicular travel relative to the No Build alternative were subtracted from estimates of user benefits (i.e., time and fuel savings) to get net annual benefits. The present value of benefits over a 20-year period was estimated assuming a 7% discount rate (29).

Net Present Value

The present value of public costs for a 20-year period is then subtracted from the present value of benefits aggregated over all three segments, to get net present value. The pricing alternatives all demonstrate significant

positive net present values, ranging from $517 million to $ 1.7 billion. Only one of the three conventional alternatives, Alternative 3, has a positive net present value amounting to $138 million. However, this is much lower than any of the pricing alternatives.

4.0 CONCLUSIONS AND RECOMMENDATIONS

This paper has demonstrated that relatively simple analytical procedures may be used to estimate the impacts of pricing alternatives and generate information in a timely fashion for use by local decision-makers. The case study has also demonstrated that pricing alternatives can often accomplish the purpose of a major highway project more efficiently and more effectively than conventional alternatives that exclude pricing, while generating net revenues to support alternative modes, bonds for timely project construction, and other transportation priorities. Delays due to constrained funding can be avoided, more transportation choices can be provided, and the public can get superior mobility earlier and at lower public cost.

ACKNOWLEDGEMENTS

The author would like to acknowledge valuable comments received from Dr. Kiran Bhatt of K.T. Analytics, Dr. Bruce Spear of FHWA, and anonymous reviewers from the TRB Committee on Taxation and Finance. However the author alone is responsible for any errors or omissions, and the views expressed are those of the author and not necessarily those of the U.S. DOT or the FHWA.

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LIST OF TABLES AND FIGURES

FIGURE 1. EQUILIBRATING DEMAND AND PRICE

TABLE 1. TRAVEL DEMAND ESTIMATES FOR TRAVEL CORRIDOR - SOUTHERN SEGMENT
TABLE 2. ESTIMATES OF DIVERTED AND INDUCED TRAFFIC - SOUTHERN SEGMENT
TABLE 3. AVERAGE DAILY SPEED, DELAY AND TOLL REVENUE PER MILE - SOUTHERN SEGMENT
TABLE 4. SOCIAL COSTS AND BENEFITS PER MILE - SOUTHERN SEGMENT TABLE 5. SUMMARY OF IMPACTS OF ALTERNATIVES

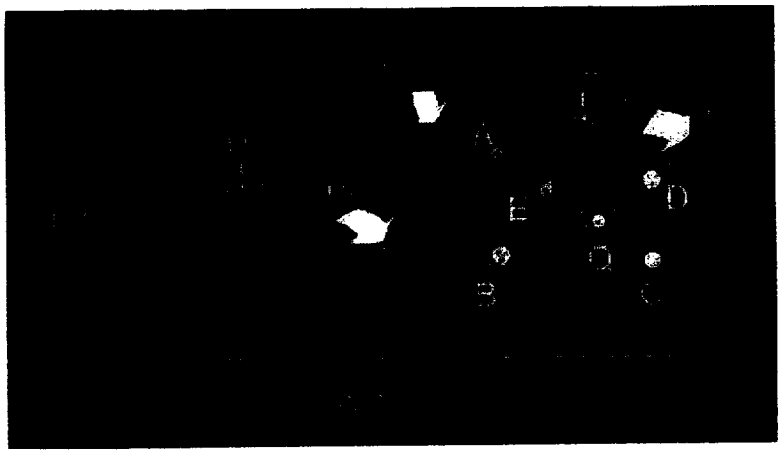


TABLE 1. TRAVEL DEMAND ESTIMATES FOR TRAVEL CORRIDOR – SOUTHERN SEGMENT

	No Build	Conventional Alternatives			Pricing Alternatives		
		No 1	No 2	No 3	No 4	No 5	No 6
Total daily person trips	445,000	445,000	445,000	445,000	445,000	445,000	445,000
Total initial daily vehicle trips	333,689	323,011	323,011	323,011	304,509	306,356	309,371
Peak period mode shares:							
(prior to induced travel)							
Solo driver	80.00%	72.34%	72.34%	72.34%	63.94%	65.11%	67.01%
Carpool	16.00%	22.13%	22.13%	22.13%	21.30%	20.61%	19.48%
Transit	4.00%	5.53%	5.53%	5.53%	14.76%	14.29%	13.51%
Peak period person trips:							
(prior to induced travel)							
Solo driver	178,000	160,952	160,952	160,952	142,266	144,864	149,103
Carpool	35,600	49,238	49,238	49,238	47,383	45,849	43,345
Transit	8,900	12,310	12,310	12,310	32,851	31,787	30,051
Total	222,500	222,500	222,500	222,500	222,500	222,500	222,500
Induced vehicle trips	0	12,558	14,442	18,112	-556	6,474	36,251
Total daily vehicle trips	333,689	335,570	337,453	341,123	303,954	312,830	345,622
Freeway daily vehicle trips	280,299	289,488	292,094	297,620	249,723	268,079	309,107
Arterial daily vehicle trips	53,390	46,081	45,359	43,503	54,231	44,751	36,515

TABLE 2. ESTIMATES OF DIVERTED AND INDUCED TRAFFIC - SOUTHERN SEGMENT

	Alternative 1			Alternative 2			Alternative 3		
	GP	HOV	Total	GP	HOV	Total	GP	HOV	Total
Freeway:									
Initial traffic volume	229,307	40,314	269,621	229,608	40,013	269,621	211,478	58,143	269,621
Diverted traffic volume	8,159	0	8,159	8,959	0	8,959	11,011	0	11,011
Induced traffic volume	11,709	0	11,709	13,514	0	13,514	16,988	0	16,988
Total traffic volume after improvement	249,174	40,314	289,488	252,081	40,013	292,094	239,478	58,143	297,620
Corridorwide:									
Initial traffic volume	282,697	40,314	323,011	282,998	40,013	323,011	264,869	58,143	323,011
Diverted traffic volume	0	0	0	0	0	0	0	0	0
Induced traffic volume	12,558	0	12,558	14,442	0	14,442	18,112	0	18,112
Total traffic volume after improvement	295,256	40,314	335,570	297,440	40,013	337,453	282,981	58,143	341,123
Percent change in traffic volume	4.44%	0.00%	3.89%	5.10%	0.00%	4.47%	6.84%	0.00%	5.61%

	Alternative 4			Alternative 5			Alternative 6		
	GP	Priced	Total	GP	Priced	Total	GP	Priced	Total
Freeway:									
Initial traffic volume	143,580	107,539	251,119	105,234	147,731	252,966	163,395	92,585	255,980
Diverted traffic volume	(946)	0	(946)	9,632	0	9,632	18,705	0	18,705
Induced traffic volume	(450)	0	(450)	5,482	0	5,482	34,422	0	34,422
Total traffic volume after improvement	142,184	107,539	249,723	120,348	147,731	268,079	216,522	92,585	309,107
Corridorwide:									
Initial traffic volume	196,970	107,539	304,509	158,625	147,731	306,356	216,786	92,585	309,371
Diverted traffic volume	0	0	0	0	0	0	0	0	0
Induced traffic volume	(556)	0	(556)	6,474	0	6,474	36,251	0	36,251
Total traffic volume after improvement	196,415	107,539	303,954	165,099	147,731	312,830	253,037	92,585	345,622
Percent change in traffic volume	-0.28%	0.00%	-0.18%	4.08%	0.00%	2.11%	16.72%	0.00%	11.72%

TABLE 3. AVERAGE DAILY SPEEDS, DELAY AND TOLL REVENUE PER MILE - SOUTHERN SEGMENT

	Alternative 1			Alternative 2			Alternative 3		
	GP	HOV	Total	GP	HOV	Total	GP	HOV	Total
Travel speeds (mph)									
Freeway:									
Initial speed before improvement (mph)	20.44	20.44		20.44	20.44		20.44	20.44	
Final speed after improvement (mph)	25.28	53.39		25.86	53.39		27.49	57.88	
Arterials:									
Initial speed before improvement (mph)	12.03			12.03			12.03		
Final speed after improvement (mph)	14.22			14.44			14.98		
Travel delay reduced (person hours)	4,097	2,655	6,751	4,488	2,640	7,128	5,096	3,685	8,

	Alternative 4			Alternative 5			Alternative 6		
	GP	Priced	Total	GP	Priced	Total	GP	Priced	Total
Travel speeds (mph)									
Freeway:									
Initial speed before improvement (mph)	20.44	20.44		20.44	20.44		20.44	20.44	
Final speed after improvement (mph)	20.04	46.46		27.19	46.46		34.09	46.46	
Arterials:									
Initial speed before improvement (mph)	12.03			12.03			12.03		
Final speed after improvement (mph)	11.78			14.62			16.85		
Travel delay reduced (person hours)	-404	5,300	4,895	4,271	6,560	10,831	8,213	4,517	12,

Average daily travel time per mile and tolls paid			
Time saved on restricted lanes (min/mile)	1.70	0.91	
Value of time saved on priced lanes ($/mile)	$0.26	$0.14	$
Number of vehicles paying a toll	34,174	62,454	37
Total daily revenue per mile	$8,726	$8,571	$2

TABLE 4. SOCIAL COSTS AND BENEFITS PER MILE -SOUTHERN SEGMENT

	Alternative 1			Alternative 2			Alternative 3		
	GP	HOV	Total	GP	HOV	Total	GP	HOV	Total
Travel delay costs per mile during construction									
Project year delay per vehicle mile without construction (min.)			0.96			0.96			0.96
Project year freeway daily traffic volume			186,866			186,866			186,866
Total added delay per mile over the construction period (person hours)			745,154			745,154			745,154
Daily external costs per mile resulting from net induced travel									
Total corridor traffic change			1,880			3,764			7,434
Reasonable cost per mile			$113			$226			$446
User Benefits per Mile									
Daily delay reduction benefits	$36,870	$23,891	$60,761	$40,395	$23,760	$64,156	$45,862	$33,165	$79,028
Daily fuel savings	$9,217	$5,973	$15,190	$10,099	$5,940	$16,039	$11,466	$8,291	$19,757
Total daily user benefits per mile	$46,087	$29,864	$75,951	$50,494	$29,700	$80,194	$57,328	$41,457	$98,785

	Alternative 4			Alternative 5			Alternative 6		
	GP	Priced	Total	GP	Priced	Total	GP	Priced	Total
Travel delay costs per mile during construction									
Project year delay per vehicle mile without construction (min.)			0.96			0.96			0.96
Project year freeway daily traffic volume			186,866			186,866			186,866
Total added delay per mile during construction period (person hours)			14,903			745,154			745,154
Daily external costs per mile resulting from net induced travel									
Total corridor VMT change			(29,736)			(20,859)			11,932
Reasonable cost per mile			($1,784)			(1,252)			$716
User Benefits per Mile									
Daily delay reduction benefits	($3,639)	$47,696	$44,057	$38,442	$59,036	$97,478	$73,920	$40,651	$114,571
Daily fuel savings	($910)	$11,924	$11,014	$9,610	$14,759	$24,369	$18,480	$10,163	$28,643
Total daily user benefits per mile	($4,548)	$59,620	$55,071	$48,052	$73,795	$121,847	$92,400	$50,814	$143,214

TABLE 5. SUMMARY OF IMPACTS OF ALTERNATIVES

	Conventional Alternatives			Pricing Alternatives		
	No 1	No 2	No 3	No 4	No 5	No 6
Total travel delay reduced daily (person hours)	89,221	94,490	118,597	68,962	143,520	173,343
Gross annual revenues from tolls (mil.$)	$0	$0	$0	$28	$31	$9
Total annualized costs for pricing (mil.$)	$0	$0	$0	$3	$3	$3
Annual transit subsidy increase (mil.$)	$5	$5	$5	$42	$40	$37
Annualized highway facility cost (mil $)	$250	$303	$272	$14	$303	$272
Total annualized public cost (mil $)	$255	$308	$277	$59	$346	$312
Present value of benefits (Mil.$)	$2,279	$2,420	$3,075	$2,053	$4,184	$5,073
Present value of costs (mil. $)	$2,704	$3,266	$2,937	$625	$3,667	$3,306
Net present value (mil. $)	-$425.22	-$845.84	$137.56	$1,428	$516.88	$1,766.32
Cost per hour of congestion delay reduced	$11	$13	$9	$3	$9	$7

This page last modified on December 2, 2002

FHWA

United States Department of Transportation - **Federal Highway Administration**

EXH 15

Auwider

Toll road will not be exempt from state laws

Boxer, Feinstein get provision out of bill

By Toby Eckert
COPLEY NEWS SERVICE

WASHINGTON — California's two U.S. senators recently blocked a move to exempt from state laws part of a controversial Orange County toll road that could cross into North County.

Language that would have granted the exemption to the proposed Foothill South Extension was stripped from a defense authorization bill at the request of Democratic Sens. Barbara Boxer and Dianne Feinstein.

A route favored by proponents of the project, which would connect the SR 241 Toll Road to Interstate 5 in the San Clemente area, would go through parts of San Onofre State Beach Park and Camp Pendleton. Both are federal property, with the state leasing the beach parkland from the federal government.

Supporters of the route fear the California Legislature will restrict the construction of roads through state parks and sought the federal exemption.

The toll road project is opposed by environmentalists and has drawn the concern of the Marine Corps commandant, aides to Boxer and Feinstein said.

"It would have impacts on some of Southern California's last remaining open spaces, including habitat for a number of endangered species," the senators said in a joint letter to the Senate Armed Services Committee. "Serious questions also remain about the need for the road and the economic sensibility of the project.

"All of these factors should be considered under California's existing health, safety, transportation, labor, and environmental laws," they said.

The Transportation Corridor Agencies, which operate Orange County's public toll road system, sought the exemption.

"Our concern was that the state Legislature . . . could have precluded us from keeping all of our options open. We intend to comply with all state and federal regulations," said Clare Climaco, a spokeswoman for the agencies.

The exemption was favored by Rep. Ken Calvert, R-Riverside, a member of the House Armed Services Committee. Calvert wants to help ease traffic congestion in the region, an aide said.

But the language was dropped from the defense legislation during negotiations between the House and Senate. The bill was sent to President Bush for his signature Wednesday.

Several routes are being considered for the 16-mile Foothill South Extension. But the route preferred by proponents would go through San Onofre State Beach and Camp Pendleton.

Climaco said the route would pass through an inland part of the beach park.

The Sierra Club and the Surfrider Foundation, both environmental groups, are opposed to the plan.

In their letter, Feinstein and Boxer said the Marine Corps commandant, Gen. J.L. Jones, also "has expressed concerns that this road will unduly encroach upon operations at Camp Pendleton and undermine military readiness."

In a letter to the administrator of the Environmental Protection Agency, the commandant wrote that the road alignments under consideration would "have a detrimental impact that is unacceptable on the ability of Camp Pendleton to carry out its training mission," the senators said.

Climaco said the toll-road agency is working with the Marine Corps to ensure there would be "no impact on their ability to conduct military exercises."

UNION-TRIBUNE

EXH 16

dinner

RECD 28 AUG 1995

San Joaquin Hills Corridor Agency
Chairman: John Cox, Newport Beach

Foothill/Eastern Corridor Agency
Chairman: Gene Wiener, Yorba Linda

TRANSPORTATION CORRIDOR AGENCIES

William Woollett, Jr., Executive Director
Wally Kreutzer, Deputy Director, Finance & Administration
Greg Hanks, Deputy Director, Design & Construction

December 17, 1991

Lt. Colonel Cliff O. Myers II
Community Planning and Liaison Office
Rm 212, Bldg 1160
Marine Corps Base Camp Pendleton
CA 92005-5001

SUBJECT: STATEMENT OF INTENT REGARDING FOOTHILL TRANSPORTATION CORRIDOR, OSO PARKWAY TO INTERSTATE 5, MODIFIED C ALIGNMENT

Dear Lt. Colonel Myers:

Please find enclosed four copies for execution of the Statement of Intent between the United States Marine Corps, the Transportation Corridor Agency, City of San Clemente and the California Department of Parks and Recreation regarding the Foothill Transportation Corridor, Oso Parkway to Interstate 5, Modified C Alignment. Please note the revisions to Paragraph A (last sentence) and Paragraph E (last sentence).

Please have all four copies signed by the Commanding General and return all four copies to the Transportation Corridor Agencies (TCA) to the attention of Laura Coley Eisenberg, Senior Environmental Analyst. The TCA will forward a signed original to you for your files once all other parties have executed the statement.

The TCA appreciates the cooperative spirit in which this statement has been developed, and looks forward to working with the Marine Corps in the future on this project. If you have any questions regarding the statement, please feel free to contact me at (714) 557-3298.

Sincerely,

William Woollett, Jr.
Executive Director

Enclosures

cc: Joe Anderson, San Clemente
Scott Diehl, City of San Clemente
Mike Parness, City of San Clemente
Ken Jones, Parks & Recreation

345 Clinton Street, Costa Mesa, CA 92626 714/557-3298 FAX 714/556-9111

San Joaquin Hills Corridor Agency
Chairman: John Cox, Newport Beach

Foothill/Eastern Corridor Agency
Chairman: Gene Wiener, Yorba Linda

TRANSPORTATION CORRIDOR AGENCIES

William Woollett, Jr., Executive Director
Wally Kreutzen, Deputy Director, Finance & Administration
Greg Hanks, Deputy Director, Design & Construction

STATEMENT OF INTENT

THIS STATEMENT OF INTENT is made and entered into this 4th day of March, 1992, by and among the Foothill/Eastern Transportation Corridor Agency ("Agency"), the City of San Clemente ("San Clemente"), the California Department of Parks and Recreation ("State Parks") and the United States Marine Corps ("Marine Corps"), respecting the Foothill Transportation Corridor, Oso Parkway to Interstate 5 ("FTC-South"). This Statement of Intent is effective only in the event that the FTC-South, Modified C Alignment Alternative, as shown on Exhibit A, attached hereto, is certified as environmentally superior and selected by the Foothill/Eastern Transportation Corridor Agency Board of Directors ("Board") as the locally preferred alternative. As each party is desirous of resolving outstanding issues regarding the Modified C Alignment, each party agrees as follows:

RECITALS

A. Camp Pendleton is opposed to any alignment alternative that would encroach upon the Base, and thus negatively impact the national defence mission with which it is entrusted. However, should the FTC-South, Modified C Alignment become identified as the "environmentally preferred alternative" through the NEPA Environmental Impact Statement, Camp Pendleton can support that alignment if certain conditions are met. First, Camp Pendleton must receive, at no cost to the Department of Defense, full mitigation for negative impacts to operational and mission performance capabilities. Second, any needed environmental mitigation must be accomplished at no expense to the Department of Defense, and with no new dedication of Base property to environmental purposes or for state park system. Third, the Marine Corps shall receive fair market value compensation for all transfers of real property interest and severance damages affecting Camp Pendleton property, which result directly or indirectly from adoption of the FTC-South, Modified C Alignment. Additionally should the Modified C Alignment be selected, it is the intent of the Marine Corps to seek special legislation authorizing acceptance of compensation, for real property rights granted, in the form of cash or property/improvements in kind.

B. State Parks, in carrying out its mission to preserve and protect natural, cultural and aesthetic resources and to provide recreation opportunities for the public, operates San Onofre State Beach on land leased from Marine Corps Base Camp Pendleton. In recognition of its mission, State Parks has opposed and will continue to oppose the FTC-South, Modified C Alignment Alternative, which impacts

345 Clinton Street, Costa Mesa, CA 92626 714/557-3298 FAX 714/557-9104

Members: Anaheim Costa Mesa County of Orange Dana Point Irvine Lake Forest Laguna Hills Laguna Niguel Mission Viejo Orange Newport Beach Santa Ana San Clemente San Juan Capistrano Tustin Yorba Linda

state beach lands. For this reason, State Parks does not believe the FTC-South, Modified C Alignment is the environmentally superior alternative. However, if the FTC-South, Modified C Alignment Alternative is selected through the Environmental Impact Report/Environmental Impact Statement ("EIR/EIS") review process, State Parks recognizes its role in obtaining appropriate compensation and mitigation to offset parks losses attributable to the FTC-South, Modified C Alignment. All mitigations that are agreed to in this Statement of Intent shall be incorporated into, and become part of, the Final EIR/EIS documents that are certified for the project. Therefore State Parks consents to participate in this Statement of Intent to resolve outstanding issues relative to the FTC-South, Modified C Alignment, concurrent with the EIR/EIS review process.

C. San Clemente generally accepts the need for additional transportation infrastructure to address the growing needs in Orange County and to this end conceptually supports the FTC-South.

San Clemente believes adequate mitigation cannot be identified to address the detrimental social, economic and environmental impacts related to the FTC-South, BX Alignment Alternative [illegible] any value provided by the FTC-South would be offset by these negative impacts San Clemente is and will continue to be unalterably opposed to the FTC-South, BX Alignment Alternative.

San Clemente will endorse the FTC-South, Modified C Alignment Alternative as the environmentally superior alternative conditioned upon a mitigation program that is sensitive to the needs of the citizens of San Clemente. In this regard San Clemente will work with Agency, Marine Corps and State Parks to minimize the negative impacts of the Modified C Alignment while providing offsetting benefits.

D. Due to the present and future planned development in southern Orange County, an immediate need exists to provide an additional north-south highway. The Agency has studied this need, and has determined that the environmentally superior alternative for providing this north-south highway is to construct the FTC-South, Modified C Alignment. In declaring the Modified C Alignment Alternative environmentally superior, the Agency recognizes that there are outstanding issues to be resolved. The Agency wishes to cooperate and resolve all of these issues, and in this regard agrees to participate in this Statement of Intent.

E. In view of the foregoing, Agency, San Clemente, State Parks and Marine Corps ("all parties") agree on the need for an Issue Resolution Process ("Process"). All parties also agree to take all reasonable and necessary actions to support this Statement of Intent.

PROCEDURE

Therefore, the parties agree to the following Process:

1. The C Alignment Committee: The C Alignment Committee ("Committee") as formed by the Agency, San Clemente, Marine Corps and State Parks shall be the forum for resolution of all outstanding issues. The Committee shall met on a regular basis to discuss the following:

a. Mitigation. The parameters for additional mitigation shall be established and agreed to by the Committee prior to initiation of negotiation procedures.

b. Final Design for Modified C Alignment. The Committee shall have the opportunity to review and comment on final design plans for the Modified C Alignment Alternative.

c. Scope of Analysis for EIS. The Committee shall have the opportunity to provide input on the scope of analysis for the EIS.

d. Termination. Any signatory to this statement may withdraw from the statement by providing a notice to withdraw, in writing and 30 days prior to the effective date, to the other signatory agencies.

TIMETABLE

The Process shall be concurrent with the EIR review process.

Robert B. Johnston
Lt.General Robert B. Johnston
Commanding General
Marine Corps Base Camp Pendleton

B. Jones
Kenneth B. Jones
Regional Director
California Department of Parks and Recreation

Attest:

Myrna Erwin
City Clerk of the City of San Clemente

Joe Anderson
Mayor
City of San Clemente

William Woollett
William Woollett, Jr.
Executive Director
Foothill/Eastern Transportation Corridor Agency

LCE:12/2/91 R8

EXH 17
divider

417.8-663

NT(R)
13233

AGREEMENT OF LEASE

between

STATE OF CALIFORNIA

DEPARTMENT OF PARKS AND RECREATION

and

UNITED STATES OF AMERICA

(Consisting of Part I and Part II)

07204378
72-4378

AGREEMENT OF LEASE

NO. _____

PART I

INDEX

ARTICLE	PAGE
1. LEASED PROPERTY	2
2. TERM	3
3. USE	3
4. RENT	3
5. LOCAL GOVERNMENT REPRESENTATIVE	3
6. PRIOR LEASE	4
7. EXECUTION	4

AGREEMENT OF LEASE

PART I

THIS NEGOTIATED LEASE between the STATE OF CALIFORNIA, DEPARTMENT OF PARKS AND RECREATION (hereinafter referred to as "Lessee"), whose address is 1416 Ninth Street, Sacramento, California 95811, and the UNITED STATES OF AMERICA (hereinafter referred to as "Government"), consisting of this PART I, and of PART II containing "General Provisions" which is attached hereto and made a part hereof.

WITNESSETH:

WHEREAS, the Government owns and the Department of the Navy has jurisdiction, administration, custody, and control of that certain property known and identified as the U. S. Marine Corps Base, Camp Pendleton, California (hereinafter referred to as "Base"); and

WHEREAS, the Secretary of the Navy has determined that portions of the Base, more particularly described in Article 1 of this Lease, are not excess property, are not for the time being required for continuous military use or for purposes of providing security for the President of the United States, and are available for the use by Lessee for the purposes hereinafter set forth; and

WHEREAS, both parties recognize that all the land comprising Camp Pendleton is vital to the National Security and, with the exception of the "Leased Property" described in Article 1 of this Lease and certain security zones, must be retained exclusively for military training so long as Camp Pendleton is required for the National Defense as a training base for the Marine Corps; and

WHEREAS, this Lease is made under the authority of Section 2667 of Title 10 of the U. S. Code;

NOW THEREFORE, in consideration of the premises and of the terms and conditions hereinafter set forth, the Government and Lessee hereby agree as follows:

ARTICLE 1. LEASED PROPERTY

The Government hereby leases to the Lessee certain portions of the Base, Camp Pendleton, California, consisting of three parcels hereinafter called the "Leased Property," said three parcels of land in the County of Orange and the County of San Diego, State of California being portions of fractional Section 25, Township 8 South, Range 7 West San Bernardino Base and Meridian, and portions of Sections 25, 26, 35 and 36, Township 8 South, Range 7 West; Sections 1, 2, 10, 11, 12, 14, 23 and 24, Township 9 South, Range 7 West; Sections 29, 30, 31, 32 and 33, Township 9 South, Range 6 West, Sections 3 and 4, Township 10 South, Range 6 West of Rancho Santa Margarita, according to Record of Survey Map 794, filed January 17, 1940, in the Office of the County Recorder of said San Diego County, more particularly described in Exhibit A and delineated on the map marked Exhibit B bearing the legend "Proposed Lease to State of California, C.F. 8/29/71," both exhibits which are attached hereto and incorporated by reference herein.

Provided, however, that this Lease shall not be effective as to that area known as the Enlisted Men's Beach and the supporting inland area thereto located in Parcel 2 of Exhibit "A" and specially delineated in Exhibit "B" hereto, and the Government shall have exclusive use of that area and all facilities thereon, unless and until such time as an alternative site mutually acceptable to the Government and Lessee is located, comparable facilities are installed thereon, and relocation to the alternative site is accomplished. Lessee agrees that it shall bear all costs in connection with preparation of and relocation to such alternative site, and all costs incurred in the installation of comparable facilities.

Provided, further, that this Lease shall not be effective as to any portion of the Leased Property which is presently out-leased by the Government for agricultural purposes until such time as such agricultural lease terminates, notice of which will be promptly given in writing by

the Local Government Representative to this Lessee in each instance. It is further agreed between the Government and Lessee that upon termination of any existing agricultural lease the Government shall have the right to enter into further agricultural leasing of the area involved, subject to the consent of the Lessee herein in each instance.

ARTICLE 2. TERM

The term of this Lease shall be for a period of fifty (50) years and shall begin on September 1, 1971 and end on August 31, 2021 unless sooner terminated in accordance with the provisions of Article D, or E of PART II of this Lease.

ARTICLE 3. USE

The Leased Property shall be used, maintained, protected and preserved by the Lessee in accordance with good management practices as a public park and not otherwise, such use to include any incidental uses that arise out of or are related to public recreation.

Provided, however, that the operation of all facilities on the Leased Property shall be conducted without regard to race, color, religion, or national origin, and any form of segregation or discrimination on the basis of race, color, religion, or national origin, in the operation of any of said facilities shall be deemed good and sufficient grounds upon which to effect a termination of this Lease.

ARTICLE 4. RENT

The Lessee shall pay to the Government as rent for the use of the Leased Property the sum of One Dollar ($1.00) for the term of this Lease, receipt of which is hereby acknowledged.

ARTICLE 5. LOCAL GOVERNMENT REPRESENTATIVE

The Commanding Officer, Western Division, Naval Facilities Engineering Command, San Bruno, California 94066 (or his successor) is hereby designated as Local Government Representative, and shall,

under the direction of the Commander, Naval Facilities Engineering Command, acting under the direction of the Secretary of the Navy, Washington, D. C., be responsible for the administration of this Lease, and shall exercise general supervision thereof insofar as the interests of the government are concerned, provided, however, that the Lessee agrees to consult with, and obtain the approval of, the Commanding General, Marine Corps Base, in any and all matters affecting the administration, mission or security of the Marine Corps Base, Camp Pendleton, including, but not limited to, the matters set forth in Part II of this Lease.

ARTICLE 6. PRIOR LEASE

This Lease supersedes the Lease between the same parties hereto dated March 30, 1971 and designated NF(R)-11681.

ARTICLE 7. EXECUTION

IN WITNESS WHEREOF, the parties hereto have duly executed this Lease, effective as of 1 September 1971.

WITNESS:

DATE 31 August 1971

UNITED STATES OF AMERICA

By

W. S. Spangler
Captain, CEC, USN
Deputy Commander for Facilities Management
Naval Facilities Engineering Command

APPROVED
DEPARTMENT OF GENERAL SERVICES

By

WITNESS:
APPROVED AS TO FORM

DEPARTMENTAL COUNSEL

STATE OF CALIFORNIA
DEPARTMENT OF PARKS
AND RECREATION

By

DEPUTY DIRECTOR

Contract 04-999-929

Appropriation Ch. 266/71, Item 207 FY 1971/72

Function or Fund General, Support

Line Item Allotment 4-72 999999 226.01

Amount of Estimate $1.00

Unencumbered Remainder $25,645.00

I Hereby Certify upon my own personal knowledge that budgeted funds are available for the period and purpose of the expenditure state above. (After T.B.A. No. _____ or D.R. No. _____).

Accounting Officer

AGREEMENT OF LEASE

NO. _____

PART II

GENERAL PROVISIONS

INDEX

ARTICLES	PAGE
A. GENERAL MAINTENANCE OBLIGATION	1
B. REPRESENTATIONS	1
C. SUBJECTION TO EXISTING AND FUTURE EASEMENTS AND RIGHTS OF WAY	1
D. TERMINATION BY GOVERNMENT	2
E. TERMINATION BY LESSEE	3
F. SURRENDER	3
G. INSTALLATION OF IMPROVEMENTS - REMOVAL AND RESTORATION	3
H. RESERVATIONS BY THE GOVERNMENT	4
I. INDEMNIFICATION BY LESSEE/GOVERNMENT NON-LIABILITY	5
J. UTILITIES AND SERVICES	5
K. LIENS	6
L. ACCESS	6
M. DISPUTES	7
N. COVENANT AGAINST FEES	8
O. OFFICIALS NOT TO BENEFIT	8
P. FAILURE OF GOVERNMENT TO INSIST ON COMPLIANCE	8
Q. ASSIGNMENT OR SUBLETTING	9
R. GOVERNMENT RULES AND REGULATIONS	9
S. NOTICES	10

AGREEMENT OF LEASE

between

STATE OF CALIFORNIA

DEPARTMENT OF PARKS AND RECREATION

and

UNITED STATES OF AMERICA

PART II

GENERAL PROVISIONS

A. GENERAL MAINTENANCE OBLIGATION

Lessee, at its own expense, shall so protect, preserve, maintain, and repair the Leased Property and any and all improvements constructed or installed thereon that the same will at all times be kept in good condition and repair.

B. REPRESENTATIONS

Lessee has examined, knows and accepts the condition and state of repair of the Leased Property and the Base of which it forms a part, and acknowledges that the Government has made no representation concerning such condition and state of repair, nor any agreement or promise to alter, improve, adapt, repair, or keep in repair the same, or any item thereof, which has not been fully set forth in this Lease which contains all of the agreements made and entered into between the Lessee and the Government.

C. SUBJECTION TO EXISTING AND FUTURE EASEMENTS AND RIGHTS OF WAY

This Lease is subject to all outstanding easements and rights of way for location of any type of facility over, across, in and upon the Leased Property, or any portion thereof, and to the right of the government, after consultation with Lessee as to location, to grant such additional easements and rights of way over, across, in and

upon the Leased Property as it shall determine to be in the public interest; Provided, that any such additional easement or right of way shall be located so as not to unreasonably interfere with the use of the Lessee's improvements erected on the Leased Property; and Provided, further, that any such additional easement or right of way shall be conditioned on the assumption by the Grantee thereof of liability to Lessee for such damages as Lessee shall suffer for property destroyed or property rendered unusable on account of Grantee's exercise of its rights thereunder. There is hereby reserved to the holders of such easements and rights of way as are presently outstanding or which may hereafter be granted, to any workers officially engaged in the construction, installation, maintenance, operation, repair, or replacement of facilities located thereon, and to any Federal, State, or local official engaged in the official inspection thereof, such reasonable rights of ingress and egress over the Leased Property as shall be necessary for the performance of their duties with regard to such facilities:

D. TERMINATION BY GOVERNMENT

This Lease may be terminated by the Government at any time: (1) during any mobilization or any national emergency, present or future, declared by the President or Congress, (2) in the interest of national defense, (3) upon closure of the Base, (4) in the event the Leased Property or a major part thereof becomes excess, or (5) upon a determination by the Local Government Representative that: (a) the Leased Property is no longer used for the purpose set forth in Article 3 of Part I hereof, or (b) if after 30 days' notice of default in any of the obligations under this Lease, the Lessee has failed to cure such default.

E. TERMINATION BY LESSEE

Lessee shall have the right to terminate this Lease upon ninety (90) days' written notice to the Local Government Representative.

F. SURRENDER

Upon the expiration of this Lease or its prior termination provided herein, Lessee shall quietly and peacefully remove itself and its property from the Leased Property and surrender the possession of the Leased Property to the Government; Provided, in the event the Government shall terminate this Lease, Lessee shall be allowed a reasonable period of time, as determined by the Local Government Representative in accordance with the circumstances surrounding the termination, in which to remove all of its property from and terminate its operations on the Leased Property. During such period prior to surrender, all obligations assumed by Lessee under this Lease shall remain in full force and effect.

G. INSTALLATION OF IMPROVEMENTS - REMOVAL AND RESTORATION

Lessee shall have the right hereunder to make and install on the Leased Property such improvements as shall be required in connection with the uses permitted under Article 3 of Part I hereof, including buildings, trails, roadways, utility lines, campsites, picnic grounds, and the like; Provided, however, that agreement shall be reached between Lessee and the government as to the location and plans for any proposed improvements prior to the commencement of any installation thereof.

Title to any and all improvements made or installed on the Leased Property by Lessee hereunder shall remain in Lessee during the term of this Lease, and Lessee may, at its option, remove all, or part of

the improvements made or installed on the Leased Property by it; Provided, however, such right of removal shall be exercised either:

(a) prior to expiration of the Lease term; or

(b) prior to the effective date of any termination of the Lease by the Government, pursuant to the provisions of this Lease governing such termination, when the Government shall have given Lessee sufficient notice of such termination to permit the effecting of such removal; or

(c) within a reasonable time after the effective date of the termination by the Government, when the advance notice thereof given by the Government is insufficient to permit such removal to be accomplished prior to said effective date; and

Provided, further, that following any such removal Lessee shall, to the extent the Government shall require and direct, restore the Leased Property to the same or as good condition as existed when this Lease became effective.

If Lessee shall fail to exercise the aforesaid rights of removal of improvements within the time prescribed, such improvements shall be deemed to have been abandoned by Lessee and may be used or disposed of by the Government in any manner whatsoever, without any liability to account to Lessee therefor.

H. RESERVATIONS BY THE GOVERNMENT

The Government specifically reserves and excepts from this Lease the following: (1) all rights to water and to minerals or other non-renewable natural resources, located on or underlying the Leased Property, (2) rights of ingress and egress and the use of such portion of the Leased Property as may be necessary to extract or develop the aforesaid water and natural resources, (3) existing and such other

rights of way as may be necessary for access to and maintenance of existing water and sewer lines, power lines, water wells and telephone lines, (4) such rights of way as may be necessary in the future for the establishment of uses similar to those mentioned in the preceding item, provided the location thereof does not unreasonably interfere with the use of Lessee's improvements erected on the leased property.

The reservation respecting water and natural resources is intended to include the prohibition against any use thereof by the Lessee. However, water on the leased property may be made available to the Lessee to the extent and upon such terms and conditions as are approved by the Government from time to time.

I. INDEMNIFICATION BY LESSEE/GOVERNMENT NON-LIABILITY

Except for occurrences during or resulting from a formal military exercise as provided for under paragraph L, the Lessee, insofar as it is legally able to do so, covenants that it will indemnify, save, and hold harmless the Government, its officers, agents, and employees for and from any and all liability or claims for loss of or damage to any property owned by or in the custody of Lessee, its officers, agents, servants, employees, subtenants, licensees, or invitees, or for the death of or injury to any of the same which may arise out of or be attributable to the condition, state of repair, or Lessee's use and occupancy of the Leased Property, whether or not the same shall be occasioned by the negligence or lack of diligence of Government, its officers, agents, servants, or employees.

J. UTILITIES AND SERVICES

It is expressly understood and agreed that utilities and services will not be furnished the Lessee from Government sources at the Base. Lessee shall, at its sole cost and expense, obtain all utilities and services which it may require in connection with its use of the Leased Property from non-Government sources within or outside the Base.

Lessee shall have the right to make necessary utility connections and install and maintain transmission lines upon or adjacent to the Leased Property at such locations within the Base as are approved by the Commanding General of the Base.

K. LIENS

Lessee shall promptly discharge or cause to be discharged any valid lien, right in rem, claim or demand of any kind, except one in favor of the Government which at any time may arise or exist with respect to the Leased Property or materials or equipment furnished therefor, or any part thereof, and if the same shall not be promptly discharged by Lessee, the Government may discharge, or cause to be discharged, the same at the expense of Lessee.

L. ACCESS

The Government shall have access to the Leased Property at all reasonable times for any purposes not inconsistent with the use thereof by Lessee, including but not limited to, the purpose of inspection, and in addition thereto, the Government expressly reserves the right to use all or any part of the Leased Property, upon such notice as shall hereafter be specified, for the purpose of conducting formal military training exercises. In the event the Government shall schedule a formal military training exercise requiring the use of all or a substantial portion of the Leased Property, the Government shall give the Lessee five (5) days' notice except where military necessity requires a shorter clearance period in which case not less than forty-eight (48) hours' notice may be given. Upon receipt of such notice, and prior to the beginning of said scheduled training exercise, the Lessee shall cause the Leased Property to be cleared of all persons occupying the Leased Property under the authorization of the Lessee, together with their personal property, and shall continue to exclude such persons and personal property from the

Leased Property during the said training exercise. Recognizing that the availability for training purposes of the land comprising Camp Pendleton (including the Leased Property) is vital to the National Security, to the extent it can legally do so, the Lessee further agrees to indemnify, save and hold harmless the Government, its officers, agents, and employees, for and from any liability or claims for loss of or damage to any property owned by or in the custody of Lessee, its officers, agents, subtenants, servants, employees, contractors, licensees or invitees, or for the death of or injury to any of the same which may arise from or be attributable to the conduct, after notice as provided herein, of a formal military training exercise.

M. DISPUTES

Any dispute concerning a question of fact which is not disposed of by agreement shall be decided by the Commander, Naval Facilities Engineering Command, who shall reduce his decision to writing and mail or furnish a copy thereof to Lessee. Within thirty (30) days from the receipt of such copy Lessee may appeal by mailing or otherwise furnishing the Commander, Naval Facilities Engineering Command, Washington, D. C. 20390, via the Local Government Representative, a written appeal addressed to the Secretary of the Navy, and the decision of the Secretary or his duly authorized representative for the hearing of such appeals shall, unless determined by a court of competent jurisdiction to have been fraudulent or capricious or arbitrary or so grossly erroneous as necessarily to imply bad faith, or not supported by substantial evidence, be final and conclusive; Provided, that if no such appeal is taken, the decision of the Commander, Naval Facilities Engineering Command, shall be final and conclusive. In connection

with any appeal pending under this clause, the Lessee shall be afforded an opportunity to be heard and to offer evidence in support of its appeal. Pending final decision of a dispute hereunder, Lessee shall proceed diligently with the performance of its obligations under this Lease and in accordance with the decision of the Commander, Naval Facilities Engineering Command. The term, "Commander, Naval Facilities Engineering Command," as used herein, shall include his duly appointed successor or his representative specifically designated for this purpose.

N. COVENANT AGAINST FEES

Lessee warrants that no person or agency has been employed or retained to solicit or secure this Lease upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial agencies maintained by Lessee for the purpose of securing business. For breach or violation of this warranty, the Government shall have the right to annul this Lease without liability or in its discretion to require Lessee to pay, in addition to the rental or consideration, the full amount of such commission, percentage, brokerage, or contingent fee.

O. OFFICIALS NOT TO BENEFIT

No Member of or Delegate to Congress, or Resident Commissioner shall be admitted to any share or part of this Lease, or to any benefit to arise therefrom.

P. FAILURE OF GOVERNMENT TO INSIST ON COMPLIANCE

The failure of the Government to insist, in any one or more instances, upon performance of any of the terms, covenants or conditions of this Lease shall not be construed as a waiver or relinquishment of the

Government's right to the future performance of any such terms, covenants or conditions of this Lease shall not be construed as a waiver or relinquishment of the Government's right to the future performance of any such terms, covenants or conditions, and Lessee's obligations in respect to such future performance shall continue in full force and effect.

Q. ASSIGNMENT OR SUBLETTING

Lessee shall not transfer or assign this Lease or any interest therein nor sublet to any third party or parties any portion of the Leased Property or rights therein without the prior written consent of the Government. Under any assignment made, with or without consent, the assignee shall be deemed to have assumed all of the obligations of Lessee hereunder, but no assignment shall relieve the assignor of any of Lessee's obligations hereunder except for an extension of the Lease term beginning after such assignment, and then only if the Government shall have consented thereto. Nothing herein contained shall prohibit the sale of food and camping supplied or the furnishing of services by the Lessee or its concessionaires incidental to use of the Leased Property for recreational purposes.

R. GOVERNMENT RULES AND REGULATIONS

The existence of the military camps, helicopter landing areas, and security zones indicated on Exhibit "B" hereto and located on or near the boundaries of the Leased Property require restrictions on the use of the adjacent Leased Property, in such manner and to such extent as may be directed by the Government.

Lessee shall also comply with such rules and regulations regarding Base safety, security, ingress, and egress as may be prescribed from time to time by the Commanding General of the Base; and Lessee shall

make every reasonable effort, including the installation of suitable fencing and identification markers, to prevent trespassing by unauthorized persons from the Leased Property to adjacent portions of the Base. Lessee shall not undertake any project requiring modification of the terrain without prior approval of the Commanding General of the Base.

S. NOTICES

No notice, order, direction, determination, requirement, consent, or approval under this Lease shall be of any effect unless in writing. All notices required under this Lease shall be addressed to Lessee, 1416 Ninth Street, Sacramento, California 95811, or to the Local Government Representative at the address specified in Article 5 of Part I of this Lease, or to the Commanding General, U. S. Marine Corps Base, Camp Pendleton, California 92055, as may be appropriate, or at such other address as may from time to time be agreed upon by the parties hereto.

The Government hereby leases to the Lessee the following described portions of the U. S. Marine Corps Base, Camp Pendleton, California, consisting of three parcels hereinafter called the "Leased Property", said three parcels of land in the County of Orange and the County of San Diego, State of California being portions of fractional Section 25, Township 8 South, Range 7 West San Bernardino Base and Meridian, and portions of Sections 25, 26, 35 and 36, Township 8 South, Range 7 West; Sections 1, 2, 10, 11, 12, 14, 23 and 24, Township 9 South, Range 7 West; Sections 29, 30, 31, 32 and 33, Township 9 South, Range 6 West, Sections 3 and 4, Township 10 South, Range 6 West of Rancho Santa Margarita, according to Record of Survey Map 794, filed January 17, 1940, in the Office of the County Recorder of said San Diego County more particularly described as follows:

Parcel 1 Inland Area

For point of reference, commence at the intersection of the Westerly line of said Rancho Santa Margarita with the Northeasterly right of way line of Highway Interstate 5, said Westerly line of Rancho Santa Margarita being also the line common to the Counties of Orange and San Diego; thence northeasterly along said Rancho boundary line 4,434 feet to the true point of BEGINNING; thence continuing with the Westerly line of Rancho Santa Margarita 16,315.43 feet to an angle point therein; thence southeasterly along said boundary 1,700 feet more or less to an intersection with the westerly line of fractional Section 25, Township 8 South, Range 7 West, San Bernardino Meridian; thence northerly along the West line of said Section 25, 550 feet more or less to the Northwest corner thereof; thence easterly along the North line of said Section 25, 1,600 feet; thence southerly in a straight line along the easterly bank of Cristianitos Creek, but staying west of Cristianitos Road, 4,400 feet;

The Government hereby leases to the Lessee the following described portions of the U. S. Marine Corps Base, Camp Pendleton, California, consisting of three parcels hereinafter called the "Leased Property", said three parcels of land in the County of Orange and the County of San Diego, State of California being portions of fractional Section 25, Township 8 South, Range 7 West San Bernardino Base and Meridian, and portions of Sections 25, 26, 35 and 36, Township 8 South, Range 7 West; Sections 1, 2, 10, 11, 12, 14, 23 and 24, Township 9 South, Range 7 West; Sections 29, 30, 31, 32 and 33, Township 9 South, Range 6 West, Sections 3 and 4, Township 10 South, Range 6 West of Rancho Santa Margarita, according to Record of Survey Map 794, filed January 17, 1940, in the Office of the County Recorder of said San Diego County more particularly described as follows:

Parcel 1 Inland Area

For point of reference, commence at the intersection of the Westerly line of said Rancho Santa Margarita with the Northeasterly right of way line of Highway Interstate 5, said Westerly line of Rancho Santa Margarita being also the line common to the Counties of Orange and San Diego; thence northeasterly along said Rancho boundary line 4,434 feet to the true point of BEGINNING; thence continuing with the Westerly line of Rancho Santa Margarita 16,315.43 feet to an angle point therein; thence southeasterly along said boundary 1,700 feet more or less to an intersection with the westerly line of fractional Section 25, Township 8 South, Range 7 West, San Bernardino Meridian; thence northerly along the West line of said Section 25, 550 feet more or less to the Northwest corner thereof; thence easterly along the North line of said Section 25, 1,600 feet; thence southerly in a straight line along the easterly bank of Cristianitos Creek, but staying west of Cristianitos Road, 4,400 feet; thence westerly, at right angles, 250 feet; thence southerly, at right angles, 400 feet; thence southwesterly 1,000 feet; thence southerly, along the toe of the slope on the west side of Cristianitos Creek, 4,600 feet; thence southeasterly 800 feet to point on the southwesterly side of Cristianitos Road; thence northeasterly in a straight line, parallel with said road 1,300 feet; thence southerly, staying to the west of the service road to the Sewage Disposal Ponds, 3,000 feet; thence westerly 1,000 feet; thence southeasterly 850 feet; thence easterly, along the south side of the Sewage Disposal Ponds, 900 feet more or less to the toe of the slope on the easterly side of San Mateo Valley; thence, generally following the toe of the slope on the easterly side of San Mateo Valley, southerly 3,500 feet; southwesterly 6,600 feet; more southwesterly, 1,100 feet; southerly 1,300 feet more or less to an intersection with the northeasterly right-of-way line of said Highway Interstate 5 at point along the northerly approach lane of Basilone Road Interchange; thence along the northwesterly right-of-way line of Highway Interstate 5, 3,370 feet, more or less, to a point; thence in a northerly direction, leaving said Highway Interstate 5, North 26° 0' 56" West; 762.95 feet; thence North 820 feet; thence North 34° 0' 0" East 1,770 feet; thence North 19° 0' 0" East, 1,990 feet; thence North 61° 02' 39" West, 1,250 feet; thence North 73° 09' 09" West, 530.24 feet to the northwesterly boundary of said Rancho Santa Margarita Y Las Flores, the true point of beginning, containing 2,380 acres, more or less.

EXHIBIT "A"

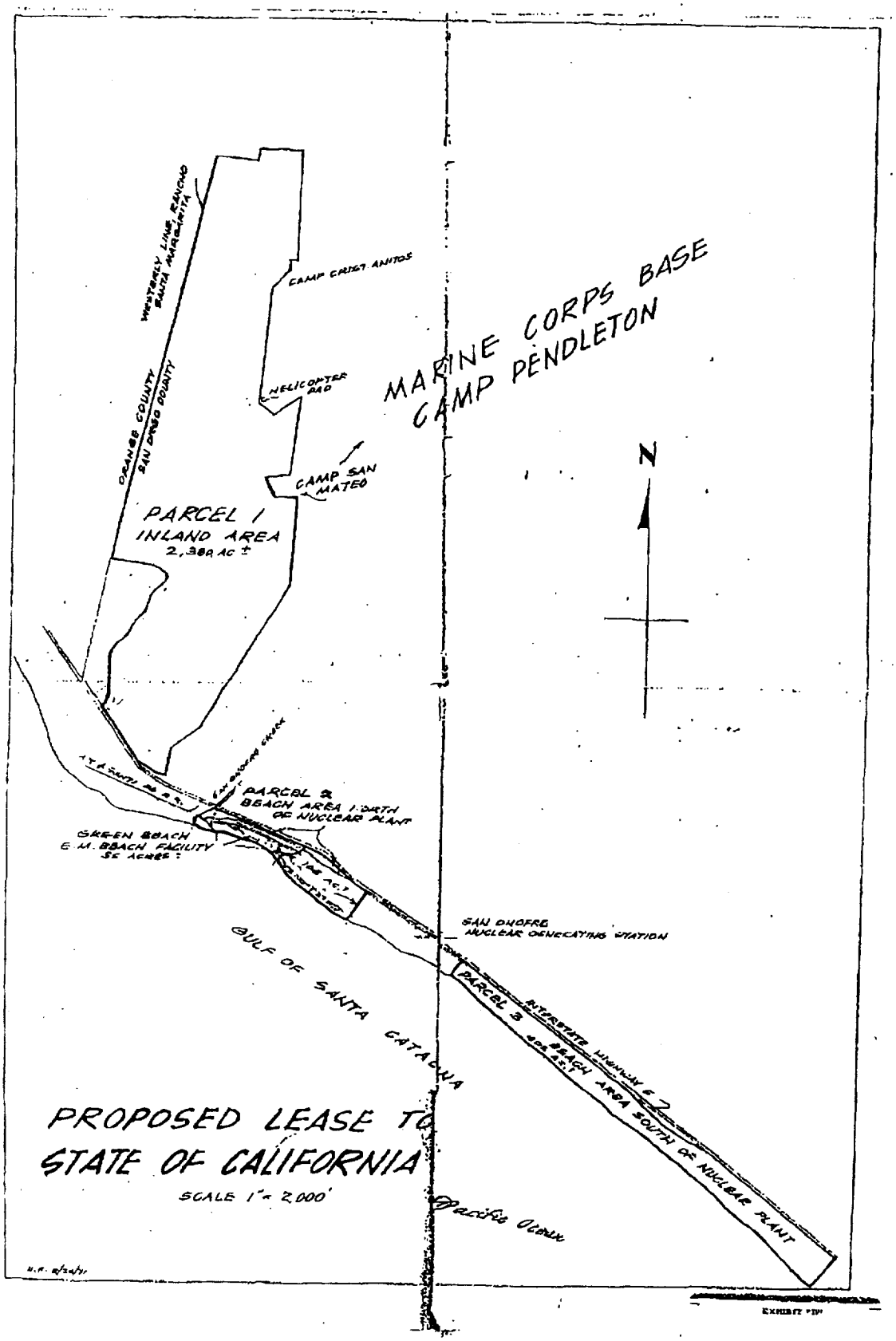
Parcel 2 Beach Area North of Nuclear Plant

BEGINNING at the intersection of the Northwesterly line of an easement for construction and operation of a nuclear generating station, granted to Southern California Edison Company and San Diego Gas and Electric Company, with the Mean High Tide line of the Pacific Ocean, said point of intersection being the most Westerly corner of said easement; thence northeasterly along said northwesterly line of said easement, 1,400 feet more or less to an intersection with the Southwesterly right-of-way line of Highway Interstate 5; thence northwesterly along said Southwesterly right-of-way line 6,500 feet more or less to the Westerly bank of San Onofre Creek; thence southwesterly along said Westerly Bank of said creek, 900 feet more or less to the Northeasterly right-of-way line of the Atchison Topeka and Santa Fe Rail way Company line; thence southerly to the Mean High Tide line of the Pacific Ocean; thence along said Mean High Tide line to the point of BEGINNING, containing 160 acres more or less.

Parcel 3 Beach Area South of Nuclear Plant

BEGINNING at the intersection of the Southeasterly line of an easement for construction and operation of a nuclear generating station, granted to Southern California Edison Company and San Diego Gas and Electric Company, with the Mean High Tide line of the Pacific Ocean, said point of intersection being the most Southerly corner of said easement; thence northeasterly 1,000 feet more or less to an intersection with the Southwesterly right-of-way line of Highway Interstate 5; thence southeasterly along said Southwesterly right-of-way line of said Interstate 5 to an intersection with a line lying 18,220 feet southeasterly from said Southeasterly line of said nuclear generating station; thence southwesterly at right angles to said highway right-of-way line 1,500 feet more or less to the Mean High Tide line of the Pacific Ocean; thence northwesterly along said Mean High Tide line to the point of BEGINNING, containing 405 acres more or less.

TOGETHER WITH the right of ingress and egress between Parcels 2 and 3 across that portion of the easement for construction and operation of a nuclear generating station granted to Southern California Edison Company and San Diego Gas and Electric Company lying between the Quay Wall of said station and the Mean High Tide line.


MARINE CORPS BASE
CAMP PENDLETON
N
WESTERLY LINE RANCHO SANTA MARGARITA
ORANGE COUNTY
SAN DIEGO COUNTY
CAMP CRISTY ANITOS
HELICOPTER PAD
CAMP SAN MATEO
PARCEL 1
INLAND AREA
2,388 AC ±
PARCEL 2
BEACH AREA 1.24TH OF NUCLEAR PLANT
GREEN BEACH
E.M. BEACH FACILITY
SAN ONOFRE
NUCLEAR GENERATING STATION
PARCEL 3
BEACH AREA SOUTH OF NUCLEAR PLANT
INTERSTATE HIGHWAY 5
GULF OF SANTA CATALINA
PROPOSED LEASE TO
STATE OF CALIFORNIA
SCALE 1" = 2,000'
Pacific Ocean

Exh 18

Divine

THE RANCHO MISSION VIEJO LAND CONSERVANCY

TABLE OF CONTENTS

DOCUMENT	TAB
Executive Summary	1
Articles	2
Bylaws	3
Deed of Conservation Easement	4
Irrevocable Offer of Dedication dated as of April 24, 1990	5
Irrevocable Offer of Dedication dated as of May 22, 1990	6

EXECUTIVE SUMMARY OF THE RANCHO MISSION VIEJO LAND CONSERVANCY DOCUMENTS

1. Introduction. The following is a brief description of the documents which establish and provide for the operation of the Rancho Mission Viejo Land Conservancy (the "Conservancy"). For a more detailed understanding of the specific provisions of the documents, please see the documents themselves which appear behind numbered tabs following this Executive Summary. The Conservancy is a nonprofit, public benefit corporation organized under the laws of the State of California. Certain real property comprising approximately 1,400 acres (the "Reserve Area") located partially in the City of San Clemente, California (the "City"), and partially in the unincorporated area of Orange County, California (the "County") is owned by Santa Margarita Company ("SMC"), the trust for the benefit of Richard J. O'Neill (the "RJO Trust"), the trust for the benefit of Alice O'Neill Avery (the "AOA Trust"), San Juan Partnership No. I, a California limited partnership ("SJP") and the Moiso Living Trust (the "Moiso Trust"). SMC, the AOA Trust, the RJO Trust, SJP and the Moiso Trust are referred to collectively in this Summary as the "Ranch Entities." The Ranch Entities have conveyed a Deed of Conservation Easement (the "Conservation Easement") over the Reserve Area to the Conservancy.

The primary purpose of the Conservancy will be to carry out the purposes of the Conservation Easement, i.e. to identify, preserve and protect the open space, ecological features and values of the Reserve Area. The Ranch Entities have made irrevocable continuing offers of dedication (the "Irrevocable Offers") of that portion of the Reserve Area within the County to the County and that portion within the City to the City. The Irrevocable Offers provide that if the Conservancy ceases to function, the fee interest in the respective portions of the Reserve Area may be accepted by the City and the County. The following is a summary of the Articles and Bylaws of the Conservancy, the Conservation Easement and the Irrevocable Offers.

2. Articles of Incorporation of the Rancho Mission Viejo Land Conservancy.

a. Purpose. The Conservancy will be organized as a nonprofit corporation under the Nonprofit Public Benefit Corporation Law of the State of California. The specific purpose of the Conservancy will be to preserve the Reserve Area for educational, ecological, recreational, scenic, and open space uses, and to receive, administer and maintain the Conservation Easement.

b. Section 501(c)(3). The Conservancy will be organized and operated exclusively for charitable purposes within the meaning of Section 501(c)(3) of the Internal Revenue Code of 1986.

c. Activities/Earnings. The Conservancy will not carry on propaganda or otherwise attempt to influence legislation; nor will it participate in or intervene in any political campaign on behalf of any candidate for public office. The property of the Conservancy will be irrevocably dedicated for charitable purposes, and no part of the net earnings of the Conservancy will inure to the benefit of any director, member or officer of the Conservancy.

d. Tax-Exempt Status of Conservancy.

(i) Public Charity Classification. Consistent with the charitable and public purposes of the Conservancy, it will apply to the Internal Revenue Service (the "IRS") for recognition of its status as a tax-exempt public charity. To qualify as a public charity, the Conservancy must establish that it will obtain at least one-third (1/3) of its total support over a four year period from the public. This is called the public support test. Publicly supported charitable organizations must generally continue to meet this test on each annual tax return with respect to the four year period immediately preceding the date of the return in order to maintain their public charity status.

Public support is carefully measured by the IRS through the organization's annual tax return. Small contributions from individuals, corporations and trusts are considered contributions from the general public. Contributions from an individual or entity which in the aggregate exceed 2% of the total contributions received by the Conservancy during the four year period are included in full in the denominator as part of the total contributions received, but are includable in the numerator only to the extent the amount does not exceed 2% of the total support reported in the denominator. Contributions received from other public charities or governmental units are considered contributions from the general public and are not subject to the 2% limit. Investment income is not treated as a contributions from the public but is included in the denominator of the public support test.

Care must be taken to ensure that the Conservancy receives more than one-third (1/3) of its support from the general public during its first four years and thereafter to meet the public support test. The Conservancy's application for tax-exempt status will reflect this assumption. Contributions from individuals and entities must, therefore, be carefully monitored by the Conservancy.

(ii) Unusual Grant. The Conservancy has already received the contribution of the Conservation Easement (discussed below). The Conservation Easement has a significant value which must be reported to the IRS and which could adversely affect the Conservancy's ability to meet the public support test. Tax counsel has advised the Conservancy to submit a separate request to the IRS to treat the contribution of the easement as an "unusual grant" in connection with the Conservancy's application for tax-exempt status. If the IRS approves this request, the value of the easement will be excluded entirely from the public support test (described in Section 7.8). The board of directors of the Conservancy will be advised of the IRS response.

(iii) Tax Deductibility of Contributions. As a public charity, contributions to the Conservancy will be deductible for federal and state income tax purposes, subject to the normal limits on charitable deductions. There are no special limitations on contributions to the Conservancy by its officers and directors. Contributions from officers and directors will be treated as contributions from the public, subject to the limitations on large contributions discussed above.

(iv) General. Specific questions regarding the tax status of the Conservancy or particular contributions should be referred to tax counsel.

3. Bylaws of the Rancho Mission Viejo Land Conservancy.

a. Members. Membership in the Conservancy will be divided into three classes. The Class A membership will be held by SMC or its designee, the Class B membership will be held by the County and the Class C membership will be held by the City (collectively, the "Members"). A Member will not be able to transfer its membership without the unanimous written consent of all other Members.

b. Annual Meetings/Election of Directors. The Members will hold annual meetings to elect directors and to transact any other business which may come before such meetings. The assent of a majority of the voting power of the Members shall be required for approval of any action taken by the Members. However, the affirmative vote of all of the Members will be required with respect to the following matters: (i) amendment of the Bylaws; (ii) amendment of the Articles; (iii) acceptance of open space easements, conservation easements, or fee interests in real property, except as to those within the Reserve Area; or (iv) any action which would cause the Conservancy to "cease to function" for the purposes of the Irrevocable Offer.

c. Election of Directors. The Board of Directors (the "Board") shall consist of nine directors; the Class A Member (Santa Margarita Company or designee) shall elect five directors; the Class B Member (the County) shall elect three directors; the Class C Member (the City) shall elect one director. Each director must be a person with a demonstrated interest and background in an area related to the purposes of the Conservancy. Specific examples of such qualifications are persons with an interest in the preservation or protection of the plants, animals or other aspects of the ecosystem naturally occurring within the Reserve Area.

d. Meetings of the Board. Meetings of the Board shall be open to the general public. Prior to each regular and special meeting, a notice will be posted to provide the general public with the opportunity to attend such meetings. The notice will include an agenda containing a brief general description of each item of business to be transacted at such meeting. The agenda will provide an opportunity for members of the general public to address the Board.

4. Deed of Conservation Easement.

a. Basic Structure. The Conservation Easement provides for the conveyance by the Ranch Entities to the Conservancy of an easement over the Reserve Area for conservation purposes.

b. Purpose. The purpose of the Conservation Easement is to identify, preserve and protect in perpetuity the open space and significant ecological features and values of the Reserve Area. The intent of the Conservation Easement is to confine the use of the Reserve Area to activities which are consistent with the foregoing purpose.

c. Rights of the Conservancy. The Conservation Easement grants to the Conservancy the right to enter upon the Reserve Area for the following purposes: (i) to enforce the rights granted in the Conservation Easement; (ii) to observe, study and make scientific observations of the Reserve Areas ecosystem; and (iii) to determine whether the Ranch Entities' use of the Reserve Area is in compliance with the terms of the Conservation Easement. The Conservation Easement also grants the Conservancy the right to: (i) enjoin any activity on, or use of, the Reserve Area which is inconsistent with the provisions of the Conservation Easement, and to enforce the provisions of the Conservation Easement; (ii) construct fencing as may be necessary to exclude livestock from areas of scientific research, so long as the Conservancy has received the Ranch Entities' prior written consent to such fencing; and (iii) construct such improvements as may be necessary to protect the conservation values or maintain the resources protected by the Conservation Easement, so long as

the Conservancy has received the Ranch Entities' prior written approval for such improvements.

d. Reserved Rights. The Ranch Entities reserved the following uses and practices from the grant of the Conservation Easement, and these practices may not be prevented or limited: (i) maintenance and repair of the existing fences and roads in the Reserve Area; (ii) ranching, in a manner consistent with the maintenance of soil composition, structure and productivity to the extent that such activities do not conflict with the purposes of the Conservation Easement; however, the Conservancy shall contract for a study of the effects of cattle grazing on the Reserve Area grasslands, and the Ranch Entities shall implement any ranching management changes recommended in such study; (iii) horseback rides and encampments on an occasional basis (provided that no more than six encampments aggregating no more than twelve days shall occur in any calendar year); (iv) construction and maintenance of a regional hiking and equestrian trail across the southern portion of the Reserve Area; or (v) cooperation in the location of utilities and public improvements, including roads, on and across the Reserve Area as may be necessary to serve land within or outside the Reserve Area, subject to the approval and consent of the Conservancy and the County.

e. Prohibited Uses. Uses and practices within the Reserve Area which are inconsistent with the purposes of the Conservation Easement shall be prohibited. Such prohibited uses include, but are not limited to, the following: (i) damage or impairment of the natural ecological values of the Reserve Area; (ii) planting of commercial agricultural crops; (iii) introduction of non-native plant or animal species except cattle; (iv) hunting or trapping; (v) commercial, retail or industrial uses of the Reserve Area, including the construction or placement of any mobile homes, trailers, signs, billboards or other advertising material; (vi) use of motor vehicles; (vii) dumping of ashes, trash, garbage or other unsightly or toxic materials; or (viii) removal, destruction or cutting of trees or plants.

f. Access. The Deed of Conservation Easement will not carry a right of access to the general public to any portion of the Reserve Area . However, the Conservancy shall develop an access management plan to further the purposes of the Conservation Easement and to provide opportunities for public education and research. The plan shall provide for access by groups in the company of a trained guide (for day trips only) and for the adoption of rules and regulations governing the nature, timing and extent of such access.

g. Monitoring. The Conservancy shall conduct annual monitoring of the conservation values within the Reserve Area. Such monitoring shall be done in accordance with a systematic and routine form or checklist designed to facilitate the identification of trends and changes of the conservation values over time. A copy of each monitoring report shall be given to the County and the City.

5. Irrevocable Offers of Dedication.

a. Basic Structure. The Irrevocable Offers were made by the Ranch Entities to the City and the County as to the portions of the Reserve Area within their respective jurisdictions. The Irrevocable Offers provide that if the Conservancy ever ceases to function or fails to continue to carry out the purposes of the Conservation Easement, the Irrevocable Offers to dedicate the Reserve Area may be accepted by the City and County.

b. Acceptance of Offer. The City and the County may accept the Irrevocable Offers only if the Conservancy (1) has not been established by September 1, 1990, or (2) has been established but has ceased to function, and either of the following events has occurred: (i) the United States Department of Transportation has approved the Foothill Transportation Corridor alignment; or (ii) ten years have elapsed since the date of recordation of the Offer.

c. Reservation of Easements and Other Rights. The Ranch Entities reserved the following easements and other rights from the Irrevocable Offers: (i) an aviation fuel pipeline easement; (ii) an SDG&E easement; and (iii) the rights to all minerals, coal, oil, gas, petroleum and other hydrocarbon substances in and under the Reserve Area but without the right of surface entry.

State of California

OFFICE OF THE SECRETARY OF STATE

1567408

CORPORATION DIVISION

I, *MARCH FONG EU*, Secretary of State of the State of California, hereby certify:

That the annexed transcript has been compared with the corporate record on file in this office, of which it purports to be a copy, and that same is full, true and correct.

IN WITNESS WHEREOF, I execute this certificate and affix the Great Seal of the State of California this

APR 25 1990

March Fong Eu

Secretary of State

1567408

ENDORSED
FILED
in the office of the Secretary of State
of the State of California

APR 25 1990

MARCH FONG EU, Secretary of State

ARTICLES OF INCORPORATION

THE RANCHO MISSION VIEJO LAND CONSERVANCY

ARTICLE I

The name of this corporation is The Rancho Mission Viejo Land Conservancy.

ARTICLE II

A. This corporation is a nonprofit public benefit corporation and is not organized for the private gain of any person. It is organized under the Nonprofit Public Benefit Corporation Law for charitable purposes.

B. The specific purposes for which this corporation is organized include, but are not limited to, the preservation and enhancement of land in the County of Orange, State of California, for educational, ecological, recreational, scenic, and open space uses, and to receive, administer and maintain one or more conservation easements.

ARTICLE III

The name and address in the State of California of this corporation's initial agent for service of process is:

Name: Richard J. O'Neill
Address: 28811 Ortega Highway

San Juan Capistrano, CA 92693

ARTICLE IV

A. This corporation is organized and operated exclusively for charitable purposes within the meaning of Section 501(c)(3) of the Internal Revenue Code of 1986.

B. Notwithstanding any other provision of these Articles, this corporation shall not, except to an insubstantial degree, engage in any activities or exercise any powers that are not in furtherance of the purposes of this corporation, and this corporation shall not carry on any other activities not permitted to be carried on (i) by a corporation exempt from federal income

tax under Section 501(c)(3) of the Internal Revenue Code of 1986, or (ii) by a corporation, contributions to which are deductible under Section 170(c)(2) of said Code, or the corresponding provisions of any future internal revenue statute of the United States.

C. No substantial part of the activities of this corporation shall consist of carrying on propaganda or otherwise attempting to influence legislation; nor shall this corporation participate in, or intervene in (including the publishing or distributing of statements), any political campaign on behalf of any candidate for public office.

ARTICLE V

The property of this corporation is irrevocably dedicated to charitable purposes, and no part of the net earnings of this corporation shall inure to the benefit of any director, member, or officer of this corporation, or to any private person. Upon the dissolution or winding up of this corporation, any assets remaining after payment of, or provision for payment of, all debts and liabilities of this corporation, shall be distributed to a nonprofit fund, foundation or corporation which is organized and operated exclusively for charitable purposes and which has established its tax-exempt status under Section 501(c)(3) of the Internal Revenue Code of 1986.

IN WITNESS WHEREOF, for the purpose of forming this corporation, the undersigned, constituting the sole incorporator of this corporation has executed these Articles of Incorporation on April 24, 1990.

Richard J. O'Neill
Incorporator

I hereby declare that I am the person who executed the foregoing Articles of Incorporation, which execution is my act and deed.

Richard J. O'Neill
Incorporator

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BYLAWS

OF

THE RANCHO MISSION VIEJO LAND CONSERVANCY

ARTICLE I

Name and Location

The name of this Corporation is The Rancho Mission Viejo Land Conservancy. The principal office of the Corporation is 28811 Ortega Highway, P.O. Box 9, San Juan Capistrano, County of Orange, California. The Board of Directors of the Corporation ("Board") is hereby granted full power and authority to change said principal office from one location to another within the County.

ARTICLE II

Organization; Purposes

Section 2.01 - Organization. This Corporation is organized under the Nonprofit Public Benefit Corporation Law of the State of California for the charitable purposes specified in Article II, Paragraph B of the Articles of Incorporation of the Corporation.

Section 2.02 - Purposes. The specific purposes for which this Corporation is organized include, but are not limited to, the preservation and enhancement of land in the County of Orange, State of California, for educational, ecological, recreational, scenic, and open space uses, and to receive, administer and maintain one or more conservation easements.

ARTICLE III

Members

Section 3.01 - Membership. Membership in the Corporation shall be divided into three classes, Class A, Class B and Class C, which memberships shall be held by the following three persons or their permitted transferees ("Members"):

(a) Class A - The San Juan Company, a California limited partnership;

(b) Class B - County of Orange; and

(c) Class C - City of San Clemente.

Section 3.02 - Transfer of Membership.

(a) No Member may transfer its membership in the Corporation without the written consent of all of the Members, except as provided in Section 3.02(b), below.

(b) The San Juan Company and its permitted transferees (or in the event of the death or incapacity of an individual Member, his executor, conservator of the person, or personal representative) may transfer such Member's membership, without the consent of any other Member, to (i) any person related to Alice O'Neill Avery or Richard J. O'Neill by blood, marriage or adoption (a "Family Member"), (ii) a trust for the primary benefit of a Family Member or Family Members (a "Family Trust"), or (iii) a corporation, partnership or other entity of which in excess of 50% of the voting power or like controlling interests are held by such Member, Family Members or Family Trusts. A transfer of membership in the Corporation by the Class A Member shall be made in a writing delivered to the Secretary-Treasurer of the Corporation, dated and signed by (i) the individual Class A Member, if any, or his executor, conservator of the person or personal representative, (ii) any Trustee of a Family Trust which is a Class A Member, (iii) the chief executive officer of a corporate Class A Member, or any person authorized by said corporate Member's Board of Directors to act on behalf of said corporation, or (iv) any General Partner of a Class A Member which is a general partnership or a limited partnership. Said transfer of membership by the Class A Member shall be effective upon delivery of the above-described instrument of transfer to the Secretary-Treasurer of the Corporation.

(c) Except as provided in Section 3.02(b), a transfer of membership in the Corporation by a Member shall not be effective until the instrument of transfer and the written consents of all of the Members are delivered to the Secretary-Treasurer of the Corporation. A transfer of membership in the Corporation by the Class B Member shall be made in a writing dated and authorized by the Board of Supervisors of the County of Orange. A transfer of membership in the Corporation by the Class C Member shall be made in a writing dated and authorized by the City Council of San Clemente.

ARTICLE IV

Meetings of the Members

Section 4.01 - Annual Meetings. Annual meetings of the Members of the Corporation for the purpose of electing directors and for the transaction of such other proper business as may come before such meetings shall be held on the dates and at the times determined by the Board by resolution of the Board.

Section 4.02 - Notice of Annual Meetings.

(a) An agenda containing a brief general description of each item of business to be transacted at an annual meeting shall be posted at least seventy-two (72) hours before each such annual meeting, in a location that is freely accessible to the public. Such agenda shall provide an opportunity for members of the public to directly address the meeting of the Members on matters within the authority of the Members to act, provided that no action shall be taken on any matter not appearing on the posted agenda for any such annual meeting of the Members unless such matter is otherwise authorized by Section 4.02(b) of these Bylaws. The Members shall adopt reasonable regulations limiting the total amount of time allocated to public testimony and for each individual speaker at annual meetings.

(b) Notwithstanding the foregoing provisions of Section 4.02(a), the Members may take action on items of business not appearing on the posted agenda for an annual meeting upon a determination by the two-thirds (2/3) vote of the number of Members as fixed by these Bylaws, or, if less than two-thirds (2/3) of the number of such Members are present, then by the unanimous vote of such Members are then present, that the need to take such action arose subsequent to the agenda for said annual meeting being posted.

Section 4.03 - Special Meetings. Special meetings of the Members for any lawful purpose may be called by any Member. Upon written request to the Chairman of the Board, President, Vice President or Secretary by any Member desiring to call a special meeting of the Members, the appropriate officer shall cause notice to be delivered to the Members within twenty (20) days after receipt of such request that a meeting will be held at a time fixed by the Board not less than thirty-five (35) nor more than ninety (90) days after the receipt of the request.

Section 4.04 - Notice of Special Meetings. Written notice of special meetings of the Members shall be delivered by mail or personally, such that such notice is received at least 24 hours before the time of any such special meeting, to each local newspaper of general circulation, radio or television station

which shall have requested the delivery of such notice in writing. Such notice shall be posted at least twenty-four (24) hours prior to such special meeting in a location that is freely accessible to members of the public. The notice shall specify the time and place of such special meeting and the specific items of business to be transacted. The Members shall not conduct any business other than that which appears on such notice.

Section 4.05 - Waiver of Notice. The transactions of any meeting of Members, however called and noticed, and wherever held, are as valid as though had at a meeting duly held after regular call and notice if a quorum is present, and if, either before or after the meeting, each of the persons entitled to vote not present in person, signs a written waiver of notice or a consent to the holding of the meeting or an approval of the minutes thereof. All such waivers, consents and approvals shall be filed within the Corporation records or made a part of the minutes of the meeting.

Section 4.06 - Place of Meeting. All meetings of the Members shall be held at the principal office of the Corporation unless a different meeting place shall be fixed from time to time by resolution of the Board.

Section 4.07 - Open and Public. All meetings of the Members shall be open and public, and all persons shall be permitted to attend.

Section 4.08 - Quorum. The presence at the meeting of Members entitled to cast a majority of the total voting power of the Members shall constitute a quorum for any action except as otherwise provided in the Articles or these Bylaws.

Section 4.09 - Approval of the Members.

(a) Notwithstanding anything to the contrary herein, the affirmative vote of all of the Members shall be required with respect to approval of the following matters:

(i) amendment of these Bylaws;

(ii) amendment of the Articles;

(iii) acceptance of open space easements, conservation easements, or fee interests in real property, except those as to the areas within the approximately 1181 acre parcel of property known as the "Talega Reserve Area";

(iv) any action which would cause the Corporation to "cease to function" as that term is used in the Irrevocable Offer of Dedication of the Talega Reserve Area dated April 24, 1990, executed by the owners of the Talega Reserve Area in favor of the County of Orange; or

(v) Assignment to any person or entity (other than the County of Orange or the City of San Clemente) of the conservation easement granted to this Corporation in the Deed of Conservation Easement dated April 24, 1990.

(b) Unless otherwise expressly required herein, the vote of a majority of the voting power of the Members shall be sufficient for approval of any action required or permitted to be taken by the Members. On any matter on which the Members are entitled to vote, the Class A Member shall have five votes, the Class B Member shall have three votes and the Class C Member shall have one vote. In addition, approval of a majority of the voting power of the Members shall be required for any mortgage, deed of trust, pledge or other hypothecation of all or any part of the Corporation's property for the purpose of securing the payment or performance of any contract or obligation.

ARTICLE V

Election of Directors

Section 5.01 - Number, Election by Class and Qualification of Directors.

(a) The Board shall consist of nine directors to be elected as follows: (i) the Class A Member shall be entitled to elect five directors; (ii) the Class B Member shall be entitled to elect three directors; and (iii) the Class C Member shall be entitled to elect one director.

(b) A person may serve as a director without being a Member of the Corporation.

(c) Each director shall be a person with a demonstrated interest and background in an area related to the purposes of the Corporation or an area related to the purposes of the conservation easement granted to the Corporation over the Talega Reserve Area. Examples of the foregoing qualifications are persons with an interest in the preservation or protection of the plants, animals or other aspects of the ecosystem naturally occurring within the Talega Reserve Area.

Section 5.02 - Election and Term of Office.

(a) Until the holding of the first meeting of the Members pursuant to Article IV hereof, the incorporator of the Corporation may do whatever is necessary and proper to perfect the organization of the Corporation, including the adoption of these Bylaws. All positions on the Board shall be filled at the first meeting.

(b) All directors shall be elected at each annual meeting of the Members to hold office until the next annual meeting.

(c) All directors shall hold office until their respective successors are elected.

Section 5.03 - No Cumulative Voting. There shall be no cumulative voting with respect to the election of directors, with each Member only being entitled to vote for the directors to be elected by such Member as set forth under Section 5.01(a).

Section 5.04 - Removal of Directors. At any meeting of the Members of which notice has been properly given as provided in these Bylaws, any director or directors may be removed, either with or without cause by, and only by, the affirmative vote of the Member which elected such director or directors.

Section 5.05 - Vacancies.

(a) A vacancy or vacancies shall be deemed to exist on the Board in case of the death, resignation or removal of any director.

(b) Vacancies on the Board, may be filled only by approval of the Member which elected the director whose position has been vacated, and each director so elected shall hold office until his successor is elected at an annual meeting of Members, or at a special meeting called for that purpose.

Section 5.06 - Public Access Subcommittee. There shall be a Public Access Subcommittee of the board of directors consisting of three directors. The board of directors by majority vote shall appoint to the Public Access Subcommittee one director elected by each of the Class A Member, the Class B Member and the Class C Member.

The Board of Directors shall prescribe the manner of proceedings of the Public Access Subcommittee. The provisions of these bylaws with respect to notice and conduct of meetings of the board shall govern the Public Access Subcommittee and action by the Public Access Subcommittee. The Public Access

Subcommittee shall have all of the authority of the board with respect to access by the public to the Talega Reserve Area, consistent with the provisions of the Deed of Conservation Easement to the corporation of a conservation easement over the Talega Reserve Area. Any director on the Public Access Subcommittee may request that the board review and approve or disapprove any act or failure to act of the Public Access Subcommittee.

ARTICLE VI

Meetings of the Board

Section 6.01 - Regular Meetings. Regular meetings of the Board shall be held at such place and day and hour as shall be determined by resolution of the Board, provided, should said day fall upon a weekend or legal holiday, then the meeting which otherwise would be held on said day shall be held at the same time on the next day thereafter ensuing which is not a weekend or legal holiday.

Section 6.02 - Notice of Regular Meetings.

(a) An agenda containing a brief general description of each item of business to be transacted at a regular meeting shall be posted at least seventy-two (72) hours before each such regular meeting, in a location that is freely accessible to the public. Such agenda shall provide an opportunity for members of the public to directly address the Board on matters within the authority of the Board to act, provided that no action shall be taken on any matter not appearing on the posted agenda for any such meeting of the Board unless such matter is otherwise authorized by Section 6.02(b) of these Bylaws. The Board shall adopt reasonable regulations limiting the total amount of time allocated to public testimony and for each individual speaker at regular meetings.

(b) Notwithstanding the foregoing provisions of Section 6.02(a), the Board may take action on items of business not appearing on the posted agenda for a regular meeting under the following circumstances:

(1) Upon a determination by the vote of a majority of the number of directors as fixed by these Bylaws that an emergency situation exists, as defined in Section 6.05 of these Bylaws.

(2) Upon a determination by the two-thirds (2/3) vote of the number of directors as fixed by these Bylaws, or, if less than two-thirds (2/3) of the number of such directors are

present, then by the unanimous vote of such directors as are then present, that the need to take such action arose subsequent to the agenda for said regular meeting being posted.

(3) Such item(s) of business was posted on an agenda pursuant to this Section for a prior meeting of the Board, such prior meeting having occurred not more than five (5) calendar days prior to the date action is taken on such item(s), and at such prior meeting said item(s) was, by decision of the Board, continued to the meeting at which such action is being taken.

Section 6.03 - Special Meetings. Special meetings of the Board may be called at any time by the Chairman or by a majority of the number of directors as fixed by these Bylaws.

Section 6.04 - Notice of Special Meetings. Written notice of special meetings shall be delivered by mail or personally, such that such notice is received at least 24 hours before the time of any such special meeting, to each director and to each local newspaper of general circulation, radio or television station which shall have requested the delivery of such notice in writing. Such notice shall be posted at least twenty-four (24) hours prior to such special meeting in a location that is freely accessible to members of the public. The notice shall specify the time and place of such special meeting and the specific items of business to be transacted. The Board shall not conduct any business other than that which appears on such notice.

Section 6.05 - Emergency Meetings. Emergency meetings of the Board may be held should a majority of the directors of the Board determine that a work stoppage, crippling disaster or other activity severely impairs public health, safety or both.

Section 6.06 - Notice of Emergency Meetings. The Chairman, or if he is then unavailable, any director, shall notify by telephone each local newspaper of general circulation and radio or television station which has requested notice of special meetings at least one hour prior to any emergency meeting.

Section 6.07 - Posting of Emergency Meeting Actions. As soon as possible after any emergency meeting, and for a minimum of ten days thereafter, there shall be posted in a public place the minutes of such emergency meeting, a list of persons who the Chairman notified or attempted to notify prior to such emergency meeting, a copy of any roll call votes taken and a description of any actions taken at such meeting.

Section 6.08 - Place of Meetings. All meetings of the Board shall be held at a meeting place designated in the notice of the meeting.

Section 6.09 - Open and Public. All meetings of the Board shall be open and public, and all persons shall be permitted to attend, except as otherwise provided by Section 6.10 of these Bylaws.

Section 6.10 - Closed Sessions. Notwithstanding any of the foregoing provisions of these Bylaws, the Board may hold a closed session in any of the following circumstances:

(a) to meet with its negotiator prior to the purchase, sale, exchange, or lease of real property by or for the Conservancy in order to give instructions to the negotiator regarding the price and terms of payment for such purchase, sale or lease. However, prior to such closed session the Board shall hold an open public session in which it identifies the real property or real properties which the negotiations may concern and the person or persons with whom its negotiator may negotiate; and

(b) based on advice of its counsel, to confer with, or receive advice from its legal counsel regarding pending litigation when discussion in open session concerning such matters would prejudice the position of the Board or the Conservancy in said litigation.

Section 6.11 - Adjournment. A majority of the directors present, whether or not a quorum is present, may adjourn any meeting to another time and place. If a Board meeting is adjourned for more than twenty-four (24) hours, notice of any adjournment to another time and place shall be given prior to the time of the adjourned meeting to the directors who were not present at the time of adjournment.

Section 6.12 - Quorum. A majority of the number of directors as fixed by these Bylaws shall be necessary to constitute a quorum for the transaction of business, except to adjourn as hereinbefore provided. Every act or decision made or done by a majority of the directors present at a meeting duly held at which a quorum is present shall be regarded as the act of the Board. A meeting at which a quorum is initially present may continue to transact business notwithstanding the withdrawal of directors, if any action taken is approved by at least a majority of the required quorum for such meeting or such greater number as is required by the California Corporations Code.

Section 6.13 - Telephonic Attendance. Members of the Board may participate in a meeting through use of video teleconferencing equipment. If the Board elects to use video teleconferencing, it shall post agendas of all video teleconference locations in a place freely accessible to the public and in a manner which shall protect the opportunity of the public to attend and participate in meetings of the Board pursuant to the provisions of these Bylaws. Participation in a meeting pursuant to this Section 6.13 constitutes presence in person at such meeting.

Section 6.14 - Presiding Officer. The members of the Board shall elect one of their number to act as Chairman. The Chairman shall preside at all meetings of the Board.

Section 6.15 - Compensation. Without the vote or written assent of a majority of the total voting power of the Corporation, the Board shall not pay compensation to directors or to officers of the Corporation for services performed in the conduct of the Corporation's business; provided, however, the Board may cause a director or officer to be reimbursed for expenses incurred in carrying on the business of the Corporation. Nothing herein contained shall be construed to preclude any director or officer from serving the Corporation as agent, counsel, or in any capacity other than as such director or officer and receiving compensation therefor.

ARTICLE VII

Officers

Section 7.01 - Officers. The officers shall be a President, a Vice President, and a Secretary-Treasurer, which officers shall be appointed by and hold office at the pleasure of the Board. Any two (2) or more of such offices may be held by the same person. All offices may be held by someone who is not a member of the Board.

Section 7.02 - Appointment to Office. The officers of the Corporation shall serve at the will of the Board and shall be appointed at such times and for such terms as determined by the Board.

Section 7.03 - Subordinate Officers. The Board may appoint such other officers as the business of the Corporation may require, each of whom shall hold office for such period, have such authority and perform such duties as are provided in these Bylaws or as the Board may from time to time determine.

Section 7.04 - Removal and Resignation.

(a) Any officer may be removed, either with or without cause, by the vote of a majority of all the directors then in office.

(b) Any officer may resign at any time by giving written notice to the Board or to the President or to the Secretary of the Corporation. Any such resignation shall take effect as of the date of the receipt of such notice or at any later time specified therein; and, unless otherwise specified therein, the acceptance of such resignation shall not be necessary to make it effective.

Section 7.05 - Vacancies. A vacancy in any office because of death, resignation, removal, disqualification or any other cause shall be filled in the manner prescribed in these Bylaws for regular appointments to such office.

Section 7.06 - President. The President shall be the chief executive officer of the Corporation and shall, subject to the control of the Board, have general supervision, direction and control of the business and officers of the Corporation. The President may, but need not, be the Chairman of the Board. He shall be an ex-officio member of all standing committees, if any, and shall have the general powers and duties of management usually vested in the office of the President of a corporation, and shall have other powers and duties as may be prescribed by the Board or these Bylaws.

Section 7.07 - Vice President. In the absence or disability of the President, the Vice President shall perform all the duties of the President, and when so acting, shall have all the powers of, and be subject to all the restrictions upon, the office of President. The Vice President shall have such other powers and perform such other duties as from time to time may be prescribed for him by the Board or these Bylaws.

Section 7.08 - Secretary-Treasurer.

(a) The Secretary-Treasurer shall keep, or cause to be kept, a book of minutes at the principal office or such other place as the Board may order, of all meetings and proceedings of the Board and its committees and of the Members, with the time and place of the holding of same, whether annual or special, and if special, how authorized, the notice thereof given, the names of those present or represented at Members' meetings and the proceedings thereof.

(b) The Secretary-Treasurer shall keep, or cause to be kept, at the principal office, a membership register showing the following:

(i) the names and addresses of all members of the Board; and

(ii) the names of the Members and their addresses.

(c) The Secretary-Treasurer shall give, or cause to be given, notice of all meetings of the Members and of the Board required by these Bylaws or by law to be given, and he shall keep the seal of the Corporation in safe custody, and shall have such other powers and perform such other duties as may be prescribed by the Board or by these Bylaws.

(d) The Secretary-Treasurer shall keep and maintain, or cause to be kept and maintained, adequate and correct records of accounts of the properties and business transactions of the Corporation. The books and records of account shall at all reasonable times be open to inspection by any director or, upon written demand for a purpose reasonably related to such person's interests as a Member, by any Member.

(e) The Secretary-Treasurer shall deposit all monies and other valuables in the name and to the credit of the Corporation with such depositories as may be designated by the Board. He shall disburse the funds of the Corporation as may be ordered by the Board, shall render to the President and directors, whenever they request it, an account of all of his transactions as Secretary-Treasurer and of the financial condition of the Corporation, and shall have such other powers and perform such other duties as may be prescribed by the Board or these Bylaws.

ARTICLE VIII

Indemnification of Directors, Officers and Employees

(a) To the maximum extent permitted by and in accordance with the requirements and procedures of Section 5238 of the California Corporations Code or any successor statute thereof, as interpreted by the judiciary from time to time, the Corporation shall reimburse, indemnify and hold harmless each present and future director, officer, employee or other "agent" of the Corporation (as such term is defined in said Section 5238(a) or any successor statute thereof) and each person who, at the request of the Corporation, acts as a director, officer, employee or agent of another foreign or domestic corporation, partnership, joint venture or other enterprise

(hereinafter in this Section referred to as the "Corporation representative"), from and against all loss, cost, liability and expense which may be imposed upon or reasonably incurred by such Corporation representative including reasonable settlement payments, in connection with any claim, action, suit or proceeding, or threat thereof, made or instituted, in which such Corporation representative may be involved or be made a party by reason of being or having been a Corporation representative or by reason of any action alleged to have been taken or omitted by such Corporation representative in such capacity.

(b) The right of indemnification provided in this Article VIII shall inure to each Corporation representative whether or not the claim asserted is based on matters which arose in whole or in part prior to the adoption of these Bylaws, and in the event of the death of the Corporation representative, shall extend to the legal representatives of such person.

(c) The right of indemnification provided in this Article VIII shall not be exclusive of any other rights to which any person, or any other individual, may be entitled as a matter of law, under any agreement or otherwise.

ARTICLE IX

Inspection of Records

Section 9.01 - Inspection By Members. The books and records of account, and minutes of meetings of the Members, of the Board and any committees of the Board, shall be made available for inspection and copying by any Member or his duly-appointed representative, at any reasonable time during normal business hours or under other reasonable circumstances and for a purpose reasonably related to such person's interests as a Member, at the principal office of the Corporation or such other place as the Board shall prescribe, all as provided in the California Corporations Code.

Section 9.02 - Inspection By Directors. Every director shall have the absolute right at any reasonable time to inspect all books, records and documents of the Corporation, all as provided in the California Corporations Code.

ARTICLE X

Miscellaneous

Section 10.01 - Singular Includes Plural. Wherever the context of these Bylaws requires the same, the singular shall include the plural and the masculine shall include the feminine.

Section 10.02 - Fiscal Year. The fiscal year of the Corporation shall begin on the first day of January and end on the thirty-first (31st) day of December of each year, except that the first fiscal year shall begin on the date of incorporation. However, the fiscal year of the Corporation is subject to change from time to time as the Board shall determine.

CERTIFICATE OF SECRETARY

I, the undersigned, do hereby certify:

(1) That I am the duly elected and acting secretary of The Rancho Mission Viejo Land Conservancy, a California nonprofit public benefit corporation; and

(2) That the foregoing Bylaws, comprising ___ pages, constitute the original Bylaws of said corporation as duly adopted on _____, 1990.

IN WITNESS WHEREOF, I have hereunto subscribed my name and affixed the seal of said corporation this ____ day of _____, 1990.

_____

RECORDING REQUESTED BY
FIRST AMERICAN TITLE INS. CO.

Not Compared to Original

RECORDING REQUESTED BY AND WHEN
RECORDED RETURN TO:

Pettis, Tester, Kruse & Krinsky
18881 Von Karman, 16th Floor
Irvine, CA 92715
Attention: Bruce Tester, Esq.

RECORDED IN OFFICIAL RECORDS
OF ORANGE COUNTY, CALIFORNIA

4:00
PM MAY 29 1990

Lee A. Branch Recorder

90-286034 $ 59.00 C14

(Space Above This Line for Recorder's Use Only)

DEED OF CONSERVATION EASEMENT

This Deed of Conservation Easement (the "Deed"), made by Anthony R. Moiso and Melinda R. Moiso, as Trustees of the Moiso Living Trust under Declaration of Trust dated February 7, 1985 ("The Moiso Living Trust"), Anthony R. Moiso as Special Trustee and Richard J. O'Neill as Trustee under Declaration of Trust dated April 18, 1968 for the benefit of Richard J. O'Neill ("Richard J. O'Neill Trust"), Anthony R. Moiso as Special Trustee and Richard J. O'Neill as Trustee under Declaration of Trust for the benefit of Alice O'Neill Avery ("Alice O'Neill Avery Trust"), Santa Margarita Company, a California corporation ("SMC"), San Juan Partnership No. I, a California limited partnership ("San Juan Partnership"), The San Juan Company, a California limited partnership ("San Juan Company") (hereinafter The Moiso Living Trust, Richard J. O'Neill Trust, Alice O'Neill Avery Trust, SMC, San Juan Partnership and San Juan Company collectively shall be referred to as the "Rancho Mission Viejo Entities"), and Arvida/JMB Partners, L.P.-II, a Delaware limited partnership ("Arvida/JMB") (hereinafter the Rancho Mission Viejo Entities and Arvida/JMB collectively shall be referred to as "Grantor") and THE RANCHO MISSION VIEJO LAND CONSERVANCY, a California non-profit corporation (hereinafter referred to as the "Grantee").

RECITALS

A. Grantor is the owner of certain real property (the "Easement Area") in Orange County, California, which property is more particularly described in Exhibit A attached hereto and incorporated herein by reference. The Easement Area is sometimes referred to herein as the "Talega Reserve Area."

B. Grantee is organized to preserve and enhance natural areas for aesthetic, scientific, charitable and educational purposes, and is qualified under California Civil Code Section 815.3 to acquire and hold conservation easements.

C. The Easement Area is currently in a substantially undisturbed and natural state and has significant ecological, scientific and aesthetic value.

D. The Easement Area provides significant, relatively natural habitat for plants and wildlife, including high quality stands of native grassland.

E. The Easement Area is part of an approximately 40,000 acre area of land in Orange County, generally known as "Rancho Mission Viejo", which has been under the ownership of Grantor and related parties for over 100 years.

F. Those entities collectively comprising Grantor each own separate portions of the Easement Area in fee and are collectively executing and delivering this Deed, as opposed to individually executing virtually identical deeds, solely for administrative convenience. Rancho Mission Viejo Entities are conveying this Easement over the portions owned by them on behalf of Arvida/JMB and for good and valuable consideration received from Arvida/JMB.

G. There has been substantial public testimony presented to the County of Orange ("County") and the City of San Clemente ("City") concerning the value of the Talega Reserve Area and expressing a desire that the Talega Reserve Area should remain in a natural condition.

H. The Easement Area's natural elements, ecological, scientific and aesthetic values are of great importance to the people of the State of California, the people of the County of Orange, Grantor and Grantee, and are worthy of protection and preservation.

I. The parties desire that the Easement Area's ecological elements, scientific and aesthetic features and values be preserved and maintained in perpetuity by the continuation of such uses in the Easement Area as may be conducted consistent with the conservation values protected herein.

J. The County has considerable expertise in the management of natural resources and can be a beneficial contributor in discussions on appropriate uses of and public access to the Easement Area.

K. Grantor and Grantee recognize that a transportation corridor is being planned and may be located in proximity to the Easement Area and have determined that the corridor will not be inconsistent with the protection of conservation values within the Easement Area.

L. Subject to the provisions of Section 3(b) below, Grantor intends that the conservation values of the Easement Area be preserved and maintained by the continuation of land use patterns existing at the time of this grant that do not significantly impair or interfere with those values, including, without limitation, those relating to ranching.

M. Grantor, as the owner in fee of the Easement Area, owns the rights to identify, preserve and protect in perpetuity the natural ecosystems, natural elements and the great scientific and aesthetic values of the Easement Area.

N. This Deed has been reviewed and approved by County as satisfying pertinent portions of Condition No. 16 of the ZC86-31P Conditions of Approval as revised by ZC89-06.

O. This Deed has been reviewed by the City as satisfying pertinent portions of Condition No. 12 of the Specific Plan Amendment 89-109 Conditions of Approval as revised by Resolution No. 89-129 of the City Council of the City of San Clemente.

P. Arvida/JMB holds title to those portions of the Talega Reserve Area within the City of San Clemente and depicted on Exhibit B hereto (the "City Reserve Area") pursuant to a "Holding Agreement" recorded May 10, 1989, as Instrument No. 89-248116 (the "Holding Agreement") entered into between SMC and Arvida/JMB's predecessors-in-interest, Arvida Talega Limited Partnership. The Holding Agreement provides that Arvida/JMB holds the City Reserve Area as agent for the benefit of SMC and that Arvida/JMB shall have no power or authority to deal with the City Reserve Area without the explicit written consent of SMC. SMC desires to consent to the execution and delivery of this Deed by Arvida/JMB.

NOW, THEREFORE, in consideration of the mutual covenants contained herein and other good and valuable consideration, the receipt of which is hereby acknowledged, and pursuant to the laws of the State of California, and in particular, Section 815 et.seq. of the Civil Code, Grantor hereby grants and conveys to Grantee, THE RANCHO MISSION VIEJO LAND CONSERVANCY, a California non-profit corporation, a perpetual, irrevocable conservation easement in gross (the "Easement) consisting of the rights hereinafter enumerated over and across the Easement Area. Grantor further grants and conveys to the County of Orange the contingent interest set forth in Section 10 hereof.

1. Purpose. It is the purpose of the Easement to identify, preserve and protect in perpetuity the open space and significant, relatively natural, ecological features and values of the Easement Area. Grantor intends that the Easement will confine the use of the Easement Area to such activities that are consistent with that purpose.

2. Rights of Grantee. The following rights are conveyed by the Easement:

a. The right to identify, preserve and protect in perpetuity and to restore the open space and significant, relatively natural, ecological features and values of the Easement Area.

b. The right to enter upon the Easement Area for the following purposes and, subject to the requirements of Section 2.c.:

(i) to enforce the rights herein granted;

(ii) to observe, study and make scientific observations of the Easement Area ecosystem; and

(iii) to determine whether Grantor's use of the Easement Area is in compliance with the terms of this Deed.

c. Grantee's right of access described in Section 2.b. shall be exercised as follows:

(i) Access shall be by means of existing roads and trails or other routes and access points as may be reasonably approved by Grantor from time to time;

(ii) Exercise of the access right shall not unreasonably interfere with any use by Grantor of the Easement Area in a manner consistent with the provisions of this Deed; and

(iii) No less than 24 hours in advance of the intended time of entry, Grantee shall provide the Rancho Mission Viejo Ranch Manager (telephone number (714) 831-6450 or any subsequent phone number specified by Grantor) with prior notice of the anticipated time of entry, the purpose for which Grantee requires access, and the number of individuals who will require access. No prior notice shall be required for entry by Grantee to prevent violations of the restrictions set forth herein.

d. The right to enjoin any activity on, or use of, the Easement Area which is inconsistent with the provisions of this Deed, and to enforce, pursuant to the terms and

provisions of this Deed, the restoration of such areas or features of the Easement Area as may be damaged by such activities.

e. The right to construct fencing as may be necessary to exclude livestock from areas of scientific research so long as Grantee has received Grantor's prior written consent to such fencing, the aggregate area fenced does not exceed fifty (50) acres, and the fencing does not interfere with grazing areas. Grantor's written consent shall not be unreasonably withheld or delayed.

f. The right to construct such improvements as may be necessary to protect the conservation values or maintain the resources protected by the Easement so long as Grantee has received Grantor's prior written approval for such improvements and so long as such improvements do not interfere with Grantor's use of the Easement Area in a manner consistent with the provisions of this Deed. Grantor's written consent to the proposed improvement shall not be unreasonably withheld or delayed.

3. Reserved Rights. The following uses and practices, though not an exhaustive recital of consistent uses and practices, are reserved by Grantor from the grant of the Easement, and these practices, as well as all others not in conflict with this Easement, may not be precluded, prevented or limited:

a. To maintain and repair the existing fences and roads in the Easement Area.

b. To carry on ranching in a manner consistent with the maintenance of soil composition, structure and productivity and to the extent that such activities do not conflict with the provisions of this Deed. Grantor believes that the Easement Area exists in its current state partly because of the responsible grazing practices of the historical owners of the Easement Area. Grantee shall contract for a study of the effects of cattle grazing on the Talega Reserve Area grasslands and Grantor shall implement any ranching management changes recommended in such study.

c. To conduct horseback rides and encampments on an occasional basis as has been the historical practice on Rancho Mission Viejo. Grantor shall use reasonable efforts to provide at least 30 days prior notice to Grantee of the anticipated time of entry; provided that no more than six encampments aggregating no more than twelve days shall occur in any calendar year; and provided further that Grantor shall clean up and restore any area used for such encampments.

d. To cooperate in the location of utilities and public improvements, including roads, on and across the Easement Area as may be necessary to serve land within or outside the Easement Area, subject to the approval and consent of Grantee and County and subject to the approval and consent of City as to any such utilities and public improvements proposed to be located within the City Reserve Area. Such easements shall include, but not be limited to new easements (i) for above-ground and below-ground electrical transmission facilities and for the maintenance of and access to such facilities and (ii) aviation fuel pipeline purposes generally as shown on Exhibit B.

e. To allow continued use of the Easement Area for purposes of any easements of record prior to the date hereof.

f. To allow the construction and maintenance of a regional hiking and equestrian trail (the "Equestrian Trail") across the southern portion of the Easement Area, subject to the provisions of Section 13 and as specified in County's Condition Number 5 of the ZC86-31P Conditions of Approval.

4. Prohibited Uses. The following uses and practices on the Easement Area are inconsistent with the purposes of the Easement and shall be prohibited unless otherwise permitted in the exercise of Grantor's reserved rights:

a. The damage or impairment of natural ecological values or the destruction of other significant conservation interests in the violation of the Easement, except as otherwise provided by this Deed.

b. The planting of commercial agricultural crops or the conversion of native vegetation to new or exotic species.

c. The introduction of non-native plant or animal species except cattle.

d. Hunting or trapping.

e. Use of the Easement Area for the purpose of recreational, residential, commercial, retail or industrial development except as otherwise specifically permitted herein (e.g. the riding and hiking trail referred to in Paragraph 3(f) hereof).

f. The construction or placement of any mobilehomes, trailers, signs, billboards or other advertising material or any other structures except as otherwise provided herein.

g. The use of motor vehicles, except as incidental to and as needed for the purposes permitted by this Deed.

h. The dumping of ashes, trash, garbage or other unsightly, offensive or toxic material.

i. The removal, destruction or cutting of trees or plants, except for artichoke thistle and other trees or plants agreed to by Grantor and Grantee or as otherwise permitted by this Deed.

j. The storage or use of biocides and agricultural chemicals except as may be necessary to protect the native vegetation which is of conservation value and threatened by the invasion of exotic material from outside the Easement Area.

k. The changing of the topography through the placing of soil, dredging soils, landfill or other material.

l. Filling, excavating, dredging, mining, drilling or removal of topsoil, sand, gravel, rock, minerals or other materials.

m. The alteration or manipulation of existing patterns of water drainage or of water quality.

n. Plowing, drilling seed, or any other farming activity which would disturb the soil surface.

5. Amending Reserved Rights and Prohibited Uses. The Easement shall not be changed or amended without the unanimous consent of the Grantor, Grantee, County and City.

6. Grantee's Remedies. In addition to any and all other remedies available to Grantee in law or in equity, Grantor intends that the remedies set forth in this section shall be available to the Grantee and County and to the City as to the City Reserve Area. (References to "Grantee" in this Section 6 shall include the County and shall include the City as to the City Reserve Area unless otherwise specified):

a. If the Grantee determines that Grantor is in violation of the Easement or that a violation is threatened, Grantee shall give written notice to Grantor of such violation and request corrective action sufficient to cure the violation and, where the violation involves injury to the area resulting from any use or activity inconsistent with the provisions of this Deed, to restore the portion of the area so injured. If the Grantor fails to cure the violation within thirty (30) days after

receipt of notice thereof from Grantee, fails to begin curing the violation within the thirty (30) day period, or under circumstances where the violation cannot reasonably be cured within said period, or fails to continue diligently to cure such violation until finally cured, Grantee may bring an action in law as described below.

b. If Grantor undertakes any activity in violation of the provisions of this Deed, the Grantee shall have the right to enforce the restoration of that portion of the Easement Area affected by such activity to the condition that existed prior to the undertaking of such unauthorized activity. In such case, the costs of such restoration shall be borne by Grantor.

c. The Grantee, after not less than forty-five (45) days prior written notice to the Grantor, County and City, shall have the right to enter the Easement Area and restore that portion of the Easement Area affected by such activity and bring it to the condition that existed prior to the undertaking of such activity. Such unilateral action by the Grantee shall not prejudice any subsequent judicial proceeding nor shall such improvement preclude the Grantee from requesting reimbursement for the restoration costs.

7. Consent and Notice. Whenever express agreement or consent is required by this document from either the Grantor, Grantee, County or City, the initiating party shall give written notice and detailed information to the other party by registered or certified mail. The receiving party shall have thirty (30) days from the receipt of such notice to review the proposed activity and to notify the initiating party of any objections thereto. Agreement or consent shall not be unreasonably withheld or delayed. Any objections to activities proposed by the Grantor, for which the Grantee's, County's or City's consent is required, shall be based upon a finding that the activity is inconsistent with the provisions of this Deed. Failure to respond within thirty (30) days of the receipt of said notice shall constitute consent to the proposed activity. Permission to carry out, or failure to object to, any proposed use or activity shall not constitute consent for any subsequent use or activity of the same or a different nature.

8. Distribution of Notices. Any notice called for in the Easement shall be sent by hand delivery or by registered or certified mail as follows:

To Grantee at:

The Rancho Mission Viejo
Land Conservancy
28811 Ortega Highway
P.O. Box 9
San Juan Capistrano, CA 92693

To Grantor at:

Santa Margarita Company
30211 Avenida de las Banderas
Rancho Santa Margarita, CA 92668
Attention: Richard Broming

To County of Orange at:

Director, EMA
County of Orange
P.O. Box 4048
12 Civic Center Plaza
Santa Ana, CA 92702-4048

To City of San Clemente at:

City of San Clemente
City Hall
100 Avenida Presidio
San Clemente, CA 92672
Attention: City Manager

or such other address as either party may inform the other of from time to time; and the notice shall be deemed to be received on the date evidenced by hand delivery, registered mail or certified mail receipt. Unless notified in writing otherwise by any of the individuals or entities comprising Grantor, SMC is designated as the recipient of any notices on behalf of Grantor.

9. Taxes. Grantor agrees to pay any and all real property taxes and assessments levied by competent authority on the Easement Area, except that Grantor shall have no obligation to pay any taxes or assessments which may be levied against the Easement itself as opposed to the underlying fee. The foregoing notwithstanding, Grantee is authorized but not obligated to pay, upon three (3) days prior written notice to Grantor, any taxes and assessments owing to prevent delinquency and foreclosure. The obligation created by such payment shall bear interest until paid by Grantor at the maximum rate allowed by law.

10. Assignment.

a. The Easement is not assignable without Grantor's prior written consent, except that if Grantee ceases to function (as that term is defined in Section 1.4 of the Irrevocable Offer of Dedication to County being recorded concurrently herewith), and if Grantee fails to offer the Easement to County as hereinafter set forth in this Section 10, this Easement shall thereupon become the property of and vested in County without the necessity of recording any further instrument of conveyance. If County determines not to retain the Easement, County shall first offer the Easement to City and then, upon City's refusal, to an organization which is qualified at the time of transfer as an eligible donee under Internal Revenue Code Section 170(h)(3) or its successor, or any regulations issued thereunder.

b. In the event of termination of Grantee's corporate existence, assignment of the Easement must first be offered by Grantee to County and then, upon County's refusal, to City and then, upon City's refusal, to an organization which is qualified at the time of transfer as an eligible donee under Internal Revenue Code Section 170(h)(3) or its successor, or any regulations issued thereunder.

11. Costs and Liabilities. Grantor retains all responsibilities and shall bear all costs and liabilities of any kind related to the ownership, operation, and maintenance of the Easement Area, provided that the need or reason for such maintenance or any improvement is due to Grantor's use of the Easement Area or Grantor's breach of its obligations under this Deed. Grantor shall have no liability or obligation for any maintenance or improvement of the Easement Area, the need for which is not proximately caused by Grantor's usage of the Easement Area or by Grantor's breach of its obligations under this Deed. At all times while the Easement is in effect, Grantor and Grantee each agree at their respective sole cost and expense to procure and maintain adequate comprehensive general liability insurance for the Easement Area, to name the other as an additional insured under their respective insurance policies as to the interests of the additional insured, and to furnish to the other a current certificate of insurance for the required policy. Each such policy shall contain cross-liability endorsements and shall provide for not less than 30 days' prior written notice to all insured before cancellation or amendment. Grantor and Grantee each agree to indemnify, defend and hold harmless the other for any and all damages and liabilities proximately caused by the indemnifying party and incurred or suffered by the indemnified party, but limited to the amount that exceeds the amount of insurance proceeds, if any, received by the indemnified party.

12. Access.

a. No right of access by the general public to any portion of the Easement Area is conveyed by this Deed.

b. Grantor and Grantee shall cooperate to prevent any public access to any portion of the Easement Area that is not otherwise permitted by this Deed or that would interfere with the conservation values associated with the Easement. Grantee shall, however, develop an access management plan (the "Access Plan") in order to further the purposes of the Easement and provide opportunities for public education and research. The Access Plan shall provide for the following:

(i) access by groups only in the company of a trained guide who meets qualifications adopted by the Board of Directors of Grantee and who is knowledgeable of the rules and regulations described herein for Grantee's use of the Talega Reserve Area,

(ii) day use only, except as specifically permitted by the Access Plan,

(iii) the adoption of rules and regulations governing the nature, timing and extent of the access consistent with the provisions of this Deed, and

(iv) Grantor's review and written approval of the Access Plan shall be required, which approval may not be unreasonably withheld but may be conditioned or prohibited if it will interfere with the Grantor's use of the Easement Area pursuant to Grantor's reserved rights under Section 3.

c. Grantee may determine that public access shall be denied to all or portions of the Easement Area in order to protect the ecological values of such areas. In that event, cattle grazing shall also be precluded in such areas.

13. Equestrian Trail. The Equestrian Trail shall be constructed by a private entity approved by County. Any fence constructed in connection with the trail shall be maintained by County.

14. Baseline Documentation. Within twelve (12) months of the execution hereof, a compilation of baseline biological information known as the Easement Documentation Report (the "Report") shall be compiled. The Report shall include at a minimum (i) current aerial photographs and ground photographs depicting all improvements and all major floral communities of the Easement Area, and (ii) inventories of all floral, faunal and aquatic communities and features of said Easement Area. The Report shall be conducted at the expense of the Grantee and under the direction of a competent biologist familiar with the ecology of Southern California, to be designated by the Grantee. Failure to compile the information required herein shall not affect the enforceability or validity of any other provision of this Deed.

15. Monitoring. The Grantee shall conduct annual monitoring of the conservation values within the Easement Area. Such monitoring shall be done in accordance with a systematic and routine form or checklist designed to facilitate the identification of trends and changes of the conservation values over time. A copy of each monitoring report shall be given to the County and City.

16. Successors. The term "Grantor" wherever used herein, and any pronouns used in place thereof, shall mean and include the above-named Grantors, their heirs, successors, assigns, affiliates and designees. "Affiliates" shall mean any lineal descendant of Marguerite O'Neill or any entity in which any such lineal descendent owns an interest. The term "Grantee", whenever used herein, and any pronouns used in place thereof, shall mean and include the above-named Grantee and any successors and assigns. The covenants, terms, conditions, and restrictions of this Deed shall be binding upon, and inure to the benefit of Grantor and Grantee and shall continue as a servitude running in perpetuity with the Easement Area.

17. Severability. If any provision of this Easement or the application thereof to any person or circumstances is found to be invalid, the remainder of the provisions of this Deed and the application of such provisions to persons or circumstances other than those to which it is found to be invalid shall not be affected thereby.

18. Controlling Law. The interpretation and performance of this Deed shall be governed by the laws of the State of California.

19. Required Consent. By executing and delivering this Deed, SMC consents to the execution and delivery of this Deed by Arvida/JMB as required by the Holding Agreement.

TO HAVE AND TO HOLD unto Grantee, its successors, and assigns forever.

IN WITNESS WHEREOF, the Grantor has hereunto set its hand this 24th day of April, 1990.

GRANTOR

"The Moiso Living Trust"

Anthony R. Moiso

Anthony R. Moiso, and

Melinda R. Moiso

Melinda R. Moiso, as Trustees of the Moiso Living Trust under Declaration of Trust dated February 7, 1985

"Richard J. O'Neill Trust"

Anthony R. Moiso

Anthony R. Moiso, as Special Trustee, and

Richard J. O'Neill

Richard J. O'Neill, as Trustee, under the Declaration of Trust dated April 18, 1968 for the benefit of Richard J. O'Neill

"Alice O'Neill Avery Trust"

Anthony R. Moiso

Anthony R. Moiso, as Special Trustee, and

Richard J. O'Neill

Richard J. O'Neill, as Trustee, under Declaration of Trust dated April 18, 1968 for the benefit of Alice O'Neill Avery

"SMC"

Santa Margarita Company, a California corporation

By: Anthony R. Moiso

Anthony R. Moiso

Its: President

By: Thomas C. Blum

Thomas C. Blum

Its: Executive Vice President

"San Juan Partnership"

San Juan Partnership No. I, a
California limited partnership

By: Richard J. O'Neill
Richard J. O'Neill,
a general partner

By: Anthony R. Moiso
Anthony R. Moiso,
a general partner

"San Juan Company"

The San Juan Company, a
California limited partnership

By: Richard J. O'Neill
Richard J. O'Neill,
a general partner

By: Anthony R. Moiso
Anthony R. Moiso,
a general partner

"Arvida/JMB"

Arvida/JMB Partners, L.P.-II,
a Delaware limited partnership

By: ARVIDA/JMB MANAGERS-II, INC.,
an Illinois corporation
General Partner

By: John C. Yelverton
John C. Yelverton
Vice President

(INTENTIONALLY LEFT BLANK)

STATE OF CALIFORNIA)
) ss.
COUNTY OF ORANGE)

On _____, 1990, before me, the undersigned, a Notary Public in and for said County and State, personally appeared ANTHONY R. MOISO and MELINDA R. MOISO, known to me or proved to me on the basis of satisfactory evidence, to be the persons who executed the within instrument and known to me to be the Trustees of the Moiso Living Trust under Declaration of Trust dated February 7, 1985 and acknowledged to me that they subscribed their own names as the Trustees of said Trust.

WITNESS my hand and official seal.

OFFICIAL SEAL
Emmy Lou Jolly- Vann
NOTARY PUBLIC-CALIFORNIA
ORANGE COUNTY
MY COMM. EXP. JAN. 28, 1994

_____
Notary Public in and for said State

[SEAL]

STATE OF CALIFORNIA)
) ss.
COUNTY OF ORANGE)

On _____, 1990, before me, the undersigned, a Notary Public in and for said County and State, personally appeared RICHARD J. O'NEILL, personally known to me or proved to me on the basis of satisfactory evidence to be the person who executed the within instrument as Trustee on behalf of THE TRUST FOR THE BENEFIT OF RICHARD J. O'NEILL DATED APRIL 18, 1968, and acknowledged to me that he executed the within instrument in accordance with the trust instrument.

WITNESS my hand and official seal.

OFFICIAL SEAL
Emmy Lou Jolly- Vann
NOTARY PUBLIC-CALIFORNIA
ORANGE COUNTY
MY COMM. EXP. JAN. 28, 1994

Emmy Lou Jolly-Vann
Notary Public in and for said State

[SEAL]

STATE OF CALIFORNIA)
) ss.
COUNTY OF ORANGE)

On _____, 1990, before me, the undersigned, a Notary Public in and for said County and State, personally appeared ANTHONY R. MOISO, personally known to me or proved to me on the basis of satisfactory evidence to be the person who executed the within instrument as Special Trustee on behalf of THE TRUST FOR THE BENEFIT OF RICHARD J. O'NEILL DATED APRIL 18, 1968, and acknowledged to me that he executed the within instrument in accordance with the trust instrument.

WITNESS my hand and official seal.

OFFICIAL SEAL
Emmy Lou Jolly- Vann
NOTARY PUBLIC-CALIFORNIA
ORANGE COUNTY
MY COMM. EXP. JAN. 28, 1994

[Seal]

_____
Notary Public in and for said State

STATE OF CALIFORNIA)
) ss.
COUNTY OF _____)

On _____, 1990, before me, the undersigned, a Notary Public in and for said County and State, personally appeared RICHARD J. O'NEILL, personally known to me or proved to me on the basis of satisfactory evidence to be the person who executed the within instrument as Trustee on behalf of THE TRUST FOR THE BENEFIT OF ALICE O'NEILL AVERY DATED APRIL 18, 1968, and acknowledged to me that he executed the within instrument in accordance with the trust instrument.

WITNESS my hand and official seal.

OFFICIAL SEAL
Emmy Lou Jolly- Vann
NOTARY PUBLIC-CALIFORNIA
ORANGE COUNTY
MY COMM. EXP. JAN. 28, 1994

[SEAL]

_____
Notary Public in and for said State

OFFICIAL SEAL
Emmy Lou Jolly- Vann
NOTARY PUBLIC-CALIFORNIA
ORANGE COUNTY
MY COMM. EXP. JAN. 28, 1994

STATE OF CALIFORNIA)
) ss.
COUNTY OF ORANGE)

On _____, 1990, before me, the undersigned, a Notary Public in and for said County and State, personally appeared ANTHONY R. MOISO, personally known to me or proved to me on the basis of satisfactory evidence to be the person who executed the within instrument as Special Trustee on behalf of THE TRUST FOR THE BENEFIT OF ALICE O'NEILL AVERY DATED APRIL 18, 1968, and acknowledged to me that he executed the within instrument in accordance with the trust instrument.

WITNESS my hand and official seal.

OFFICIAL SEAL
Emmy Lou Jolly- Vann
NOTARY PUBLIC-CALIFORNIA
ORANGE COUNTY
MY COMM. EXP. JAN. 28, 1994

[SEAL]

_____
Notary Public in and for said State

STATE OF CALIFORNIA)
) ss.
COUNTY OF ORANGE)

On _____, 1990 before me, the undersigned, a Notary Public in and for said County of State, personally appeared _____ and _____ personally known to me or proved to me on the basis of satisfactory evidence to be the _____ and _____ respectively, of SANTA MARGARITA COMPANY, a California corporation, the corporation that executed the within instrument, known to me or proved to me on the basis of satisfactory evidence to be the persons who executed the within instrument on behalf of the corporation therein named, and acknowledged to me that said corporation executed the within instrument pursuant to its bylaws or a resolution of its board of directors.

WITNESS my hand and official seal.

OFFICIAL SEAL
Emmy Lou Jolly- Vann
NOTARY PUBLIC-CALIFORNIA
ORANGE COUNTY
MY COMM. EXP. JAN. 28, 1994

[SEAL]

_____
Notary Public in and for said State

STATE OF CALIFORNIA)
) ss.
COUNTY OF ORANGE)

On _____, 1990, before me, the undersigned, a Notary Public in and for said County and State, personally appeared RICHARD J. O'NEILL and ANTHONY R. MOISO, personally known to me or proved to me on the basis of satisfactory evidence, to be the persons who executed the within instrument as the sole General Partners of San Juan Partnership No. I, as established by the within instrument, and acknowledged that they have executed the within instrument as such General Partners.

WITNESS my hand and official seal.

OFFICIAL SEAL
Emmy Lou Jolly- Vann
NOTARY PUBLIC-CALIFORNIA
ORANGE COUNTY
MY COMM. EXP. JAN. 28, 1994

[SEAL]

_____
Notary Public in and for said State

STATE OF CALIFORNIA)
) ss.
COUNTY OF ORANGE)

On _____, 1990, before me, the undersigned, a Notary Public in and for said County and State, personally appeared RICHARD J. O'NEILL and ANTHONY R. MOISO, personally known to me or proved to me on the basis of satisfactory evidence, to be the persons who executed the within instrument as the sole General Partners of The San Juan Company, as established by the within instrument, and acknowledged that they have executed the within instrument as such General Partners.

WITNESS my hand and official seal.

OFFICIAL SEAL
Emmy Lou Jolly- Vann
NOTARY PUBLIC-CALIFORNIA
ORANGE COUNTY
MY COMM. EXP. JAN. 28, 1994

[SEAL]

Emmy Lou Jolly-Vann
Notary Public in and for said State

STATE OF CALIFORNIA)
) ss.
COUNTY OF ORANGE)

On _____, 1990, before me, the undersigned, a Notary Public in and for said County and State, personally appeared _____, personally known to me or proved to me on the basis of satisfactory evidence to be the person that executed this instrument as _____ on behalf of _____ therein named that executed the within instrument on behalf of Arvida/JMB Partners, L.P.-II, a Delaware limited partnership, and acknowledged to me that said corporation executed the within instrument as general partner of said partnership, and pursuant to its Bylaws or a resolution of its board of directors.

WITNESS my hand and official seal.

OFFICIAL SEAL
Emmy Lou Jolly- Vann
NOTARY PUBLIC-CALIFORNIA
ORANGE COUNTY
MY COMM. EXP. JAN. 28, 1994

[SEAL]

_____
Notary Public in and for said State

EXHIBIT A

90105(A)
03-01-90
Revised
03-15-90
04-02-90
05-17-90

LEGAL DESCRIPTION
TALEGA VALLEY CONSERVANCY AREA
(UNINCORPORATED TERRITORY OF THE COUNTY OF ORANGE)

That certain land situated in the Unincorporated Territory of the County of Orange, State of California, described in parcels as follows:

Parcel A: Parcel 5 of Certificate of Compliance No. CC83-3, recorded August 29, 1983 as Instrument No. 83-377561 of Official Records, in the office of the County Recorder of said County.

EXCEPTING THEREFROM the land described in that easement in favor of Talega Valley Partnership for Ingress, Egress, construction of a roadway and adjacent slopes and incidental purposes recorded April 16, 1987 as Instrument No. 87-208958 of Official Records, in the office of said County Recorder.

Parcel B: Parcel 2 of Certificate of Compliance No. CC87-06, recorded August 7, 1987 as Instrument No. 87-449971 of Official Records, in the office of the County Recorder of said County.

EXCEPTING THEREFROM the land described in that easement in favor of Talega Valley Partnership for Ingress, Egress, construction of a roadway and adjacent slopes and incidental purposes recorded September 2, 1988 as Instrument No. 88-444055 of Official Records, in the office of said County Recorder.

Parcel C: Parcel 3 of Certificate of Compliance No. CC87-06, recorded August 7, 1987 as Instrument No. 87-449971 of Official Records, in the office of the County Recorder of said County.

EXCEPTING THEREFROM the land described in that easement in favor of Talega Valley Partnership for Ingress, Egress, construction of a roadway and adjacent slopes and incidental purposes recorded April 1, 1987 as Instrument No. 87-178076 of Official Records, in the office of said County Recorder.

ALSO EXCEPTING THEREFROM that portion described as follows: Commencing at the most Northerly corner of said Parcel 3; thence South 52°20'18" East 948.34 feet along the Northeasterly line of said Parcel 3 to the TRUE POINT OF BEGINNING; thence continuing along said Northeasterly line and along the Easterly line of said Parcel 3, the following courses: South 52°20'18" East 487.66 feet to the beginning of a tangent curve, concave

Southwesterly having a radius of 4650.00 feet, Southeasterly 2726.27 feet along said curve through a central angle of 33°35'32", and South 1°59'42" West 816.13 feet; thence North 9°14'13" West 268.21 feet to the beginning of a tangent curve concave Westerly having a radius of 1190.00 feet; thence Northerly 363.97 feet along said curve through a central angle of 17°31'28" to the beginning of a reverse curve, concave Easterly having a radius of 1550.00 feet; thence Northerly 358.19 feet along said curve through a central angle of 13°14'26" to the beginning of a reverse curve, concave Westerly having a radius of 1450.00 feet; thence Northerly 433.88 feet along said curve through a central angle of 17°08'40" to the beginning of a reverse curve, concave Northeasterly having a radius of 1550.00 feet; thence Northwesterly 132.64 feet along said curve through a central angle of 4°54'11"; thence North 25°45'44" West 519.86 feet to the beginning of a tangent curve, concave Southwesterly having a radius of 1450.00 feet; thence Northwesterly 360.61 feet along said curve through a central angle of 14°14'57"; thence North 40°00'41" West 224.02 feet to the beginning of a tangent curve, concave Northeasterly having a radius of 1650.00 feet; thence Northwesterly 227.91 feet along said curve through a central angle of 7°54'50" to the beginning of a reverse curve, concave Southwesterly having a radius of 1350.00 feet; thence Northwesterly 379.85 feet along said curve through a central angle of 16°07'17"; thence North 48°13'08" West 634.22 feet to the true point of beginning.

ALSO EXCEPTING THEREFROM that portion described as follows: Beginning at the Northerly termius of that certain course described as "North 18°00'00" East 2856.38 feet" for a portion of said Easterly line of Parcel 3; thence South 17°59'42" West 707.14 feet along said Easterly line; thence North 16°43'04" West 479.12 feet to the beginning of a tangent curve, concave Easterly having a radius of 850.00 feet; thence Northerly 440.33 feet along said curve through a central angle of 29°40'53"; thence North 12°57'49" East 487.25 feet to the beginning of a tangent curve, concave Westerly having a radius of 1310.00 feet; thence Northerly 586.45 feet along said curve through a central angle of 25°38'59"; thence North 12°41'10" West 354.70 feet to the beginning of a tangent curve, concave Easterly having a radius of 550.00 feet; thence Northerly 386.78 feet along said curve through a central angle of 40°17'32"; thence North 27°36'22" East 828.15 feet to said Easterly line of Parcel 3; thence South 1°59'42" West 2735.11 feet along said Easterly line to the point of beginning.

ALSO EXCEPTING THEREFROM that portion described as follows: Beginning at the most Southerly corner of said Parcel 3; thence along the Southerly and Westerly lines of said Parcel 3, the following courses: North 69°30'18" West 694.75 feet and North 0°43'19" East 2666.90 feet to the Northwest corner of Section 24, Township 8 South, Range 7 West, San Bernardino Meridian

as shown on a map filed in Book 9, Pages 15 through 22 of Records of Surveys in the office of said County Recorder; thence South 89°15'50" East 653.72 feet along the Northerly line of said Section 24 to the West line of the East one-half of the West one-half of the West one-half of said Section 24: thence South 0°43'14" West 2901.77 feet along said last mentioned West line to the point of beginning.

ALSO EXCEPTING THEREFROM that portion described as follows: Beginning at the Southerly terminus of that certain course described as "South 0°43'37" West 2666.90 feet" for a portion of the Westerly line of said Parcel 3; thence North 0°43'19" East 104.32 feet along said Westerly line; thence South 51°30'41" East 23.32 feet; thence South 73°46'05" East 659.36 feet to said Easterly line of Parcel 3; thence along said Easterly line and along the Southerly line of said Parcel 3, the following courses: South 0°43'14" West 148.75 feet and North 69°30'18" West 694.75 feet to the point of beginning.

Parcel D: Parcel 4 of Certificate of Compliance No. CC87-06, recorded August 7, 1987 as Instrument No. 87-449971 of Official Records, in the office of the County Recorder of said County.

EXCEPTING THEREFROM that portion described as follows: Beginning at the most Southerly corner of said Parcel 4; thence North 0°43'19" East 104.32 feet along the Easterly line of said Parcel 4; thence North 51°30'41" West 939.03 feet; thence North 69°20'43" West 444.81 feet; thence North 55°14'00" West 503.15 feet; thence North 39°03'50" East 364.34 feet; thence North 8°58'33" East 646.17 feet; thence North 2°33'02" West 630.26 feet to the Northerly line of said Parcel 4; thence along said Northerly line and along the Westerly and Southwesterly lines of said Parcel 4, the following courses: North 89°15'51" West 65.66 feet, South 0°59'42" West 506.04 feet, South 8°29'42" West 720.00 feet, South 38°44'42" West 425.00 feet, South 57°25'18" East 1540.00 feet, South 40°35'18" East 294.77 feet, and South 69°30'18" East 232.93 feet to the point of beginning.

Parcel E: That portion of Parcel 3 of Certificate of Compliance No. CC87-06 in Unincorporated Territory of the County of Orange, State of California, recorded August 7, 1987 as Instrument No. 87-449971 of Official Records, in the office of the County Recorder of said County, described as follows:

Beginning at the most Southerly corner of said Parcel 3; thence along the Southerly and Westerly lines of said Parcel 3, the following courses: North 69°30'18" West 694.75 feet and North 0°43'19" East 2666.90 feet to the Northwest corner of Section 24, Township 8 South, Range 7 West, San Bernardino Meridian as shown on a map filed in Book 9, Pages 15 through 22 of Records of Surveys in

the office of said County Recorder; thence South 89°15'50" East 653.72 feet along the Northerly line of said Section 24 to the West line of the East one-half of the West one-half of the West one-half of said Section 24; thence South 0°43'14" West 2901.77 feet along said last mentioned West line to the point of beginning.

EXCEPTING therefrom that portion described as follows: Beginning at the Southerly terminus of that certain course described as "South 0°43'37" West 2666.90 feet" for a portion of the Westerly line of said Parcel 3; thence North 0°43'19" East 104.32 feet along said Westerly line; thence South 51°30'41" East 23.32 feet; thence South 73°46'05" East 659.36 feet to said Easterly line of Parcel 3; thence along said Easterly line and along the Southerly line of said Parcel 3, the following courses: South 0°43'14" West 148.75 feet and North 69°30'18" West 694.75 feet to the point of beginning.

Contains an area of 997.268 acres, more or less.

Subject to covenants, conditions, reservations, restrictions, rights of way and easements, if any, of record.

JAMES F. GILLEN, LS 5557

LICENSED LAND SURVEYOR
JAMES F. GILLEN
Exp. 9-30-93
No. 5557
STATE OF CALIFORNIA

EXHIBIT A (Continued)

90105(A)
03-01-90
Revised
04-02-90
05-15-90

LEGAL DESCRIPTION
TALEGA VALLEY CONSERVANCY AREA
(CITY OF SAN CLEMENTE)

That portion of the Rancho Mission Viejo or La Paz, in the City of San Clemente, County of Orange, State of California, as shown on a map thereof recorded in Book 1, Pages 63 and 64, of Patents, in the office of the County Recorder of Los Angeles County, California, lying within Section 14, Township 8 South, Range 7 West, as shown on a map recorded in Book 9, Pages 15 through 22, of Records of Survey, in the office of the County Recorder of said Orange County, described as follows:

Beginning at the Southeast corner of said Section 14; thence North 89°15'50" West 1360.24 feet along the Southerly line of said Section 14; thence North 0°59'42" East 1518.96 feet; thence North 21°00'18" West 975.00 feet; thence North 1°34'42" East 375.00 feet; thence North 8°40'18" West 545.00 feet; thence North 49°39'42" East 285.00 feet; thence North 33°09'42" East 370.00 feet; thence North 0°09'42" East 235.00 feet; thence North 37°53'18" West 457.71 feet to the beginning of a non-tangent curve, concave Westerly having a radius of 1450.00 feet, a radial line to said curve bears South 63°49'13" East; thence Northerly 687.97 feet along said curve through a central angle of 27°11'05"; thence North 1°00'18" West 182.54 feet to the Northerly line of said Section 14; thence along said Northerly line and along the Easterly line of said Section 14, the following courses: South 89°15'50" East 1537.18 feet and South 0°43'19" West 5278.83 feet to the point of beginning.

EXCEPTING therefrom that portion described as follows:

A strip of land, 350.00 feet in width, the Westerly line of said strip being described as follows:

Commencing at the Northeast corner of said Section 14; thence North 89°15'50" West 1537.18 feet along said Northerly line of Section 14 to the TRUE POINT OF BEGINNING; thence South 1°00'18" East 182.54 feet to the beginning of a tangent curve concave Westerly having a radius of 1450.00 feet; thence Southerly 687.97 feet along said curve through a central angle of 27°11'05" to Point "A".

EXHIBIT A (Continued)

LEGAL DESCRIPTION-CONTINUED
TALEGA VALLEY CONSERVANCY AREA
(CITY OF SAN CLEMENTE)
PAGE TWO

90105(A)
03-01-90
Revised
04-02-90
05-15-90

The Easterly line of said strip to be shortened to terminate Northerly in said Northerly line of Section 14 and prolonged to terminate Southerly in a line which bears South 37°53'18" East and passes through said Point "A".

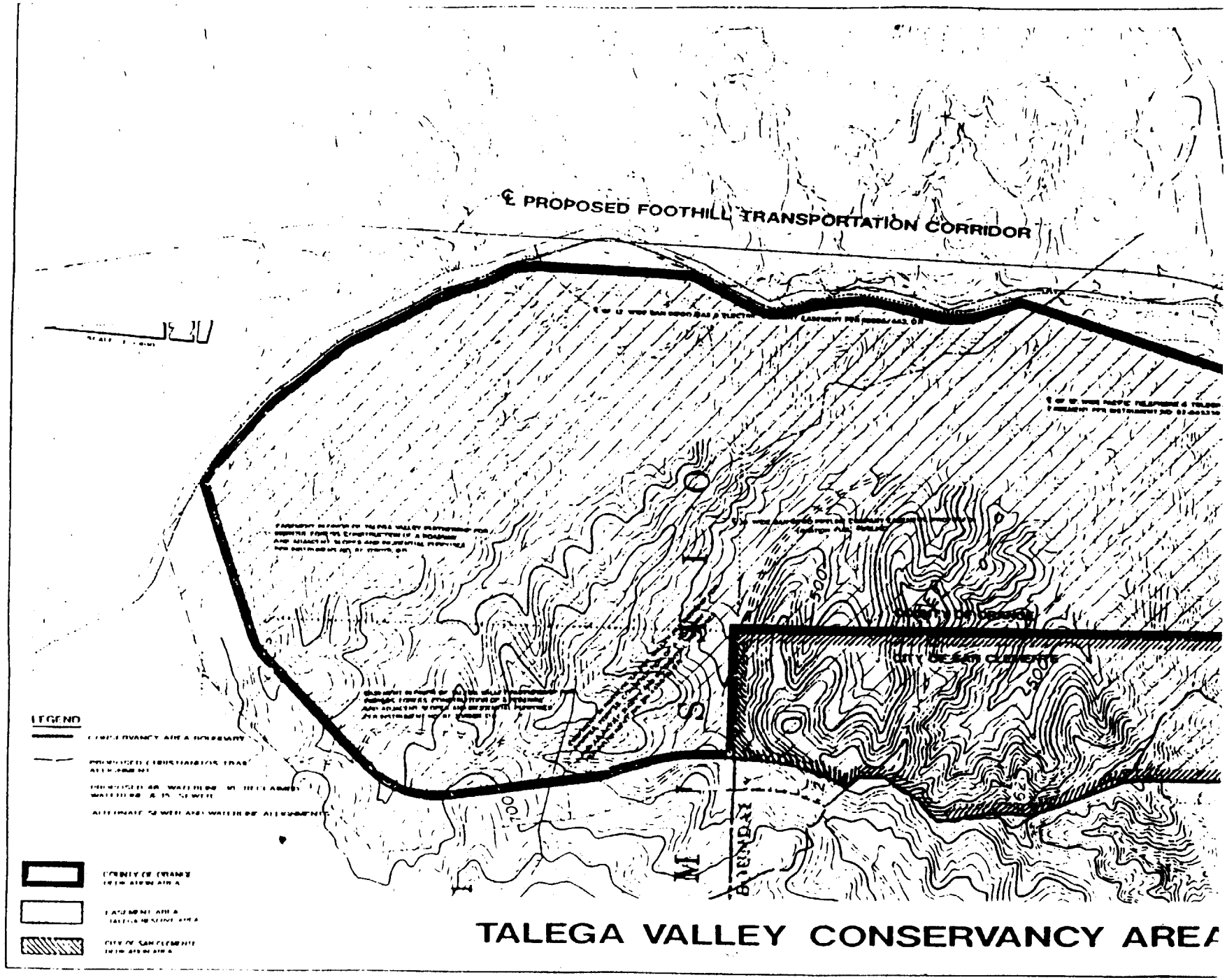
Contains an area of 175.709 acres, more or less.

Subject to covenants, conditions, reservations, restrictions, rights of way and easements, if any, of record.

JAMES F. GILLEN, LS 5557

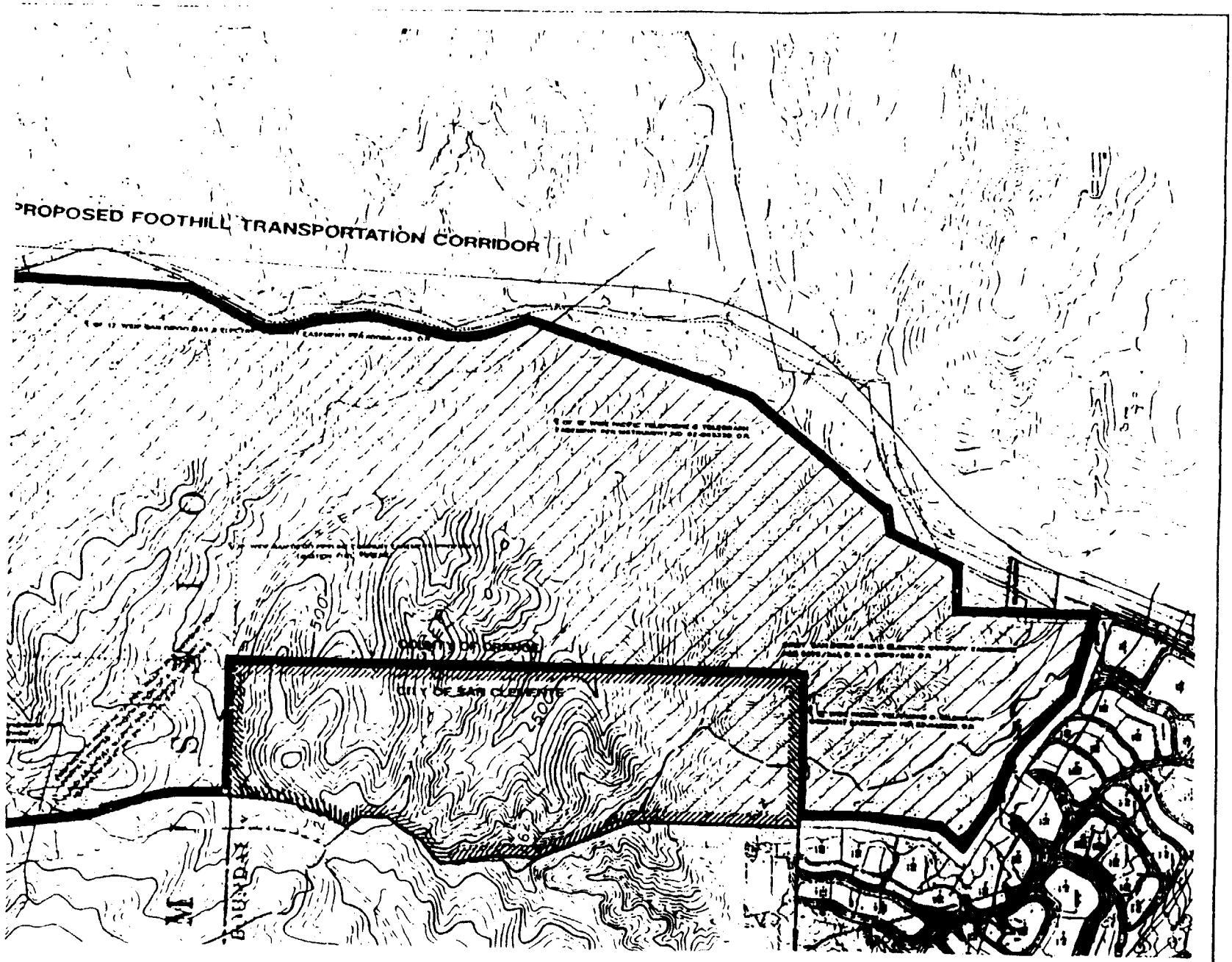
LICENSED LAND SURVEYOR
JAMES F. GILLEN
Exp. ——
No. 5557
STATE OF CALIFORNIA

EXHIBIT B



TALEGA VALLEY CONSERVANCY AREA

EXHIBIT B (Continued)



LEGA VALLEY CONSERVANCY AREA

STATEMENT OF DOCUMENTARY TRANSFER TAX DUE

[illegible]

(Name of one grantor)

and

[illegible]

(Name of one grantee)

The undersigned declares that the documentary transfer tax is $ [illegible] and is

- ☐ computed on the full value of the interest or property conveyed, or is
- ☐ computed on the full value less the value of liens or encumbrances remaining thereon at the time of sale.

The land, tenements or realty is located in

- ☒ an unincorporated area in the county, or as to Parcels A → E
- ☒ the city of [illegible]

Roger Reimer declarants agent

(Signature of declarant or signature of declarants agent)

RECORDING REQUESTED BY
FIRST AMERICAN TITLE INS. CO.

CONFORMED COPY

RECORDED AT THE REQUEST OF
AND RETURN TO:

COUNTY OF ORANGE
GSA REAL ESTATE DIVISION
14 Civic Center Plaza
P.O. Box 4106
Santa Ana, CA 92702

RECORDED IN OFFICIAL RECORDS
OF ORANGE COUNTY, CALIFORNIA
4:00
PM MAY 29 1990
Lee A. Branch Recorder

EXEMPT RECORDING REQUESTED
PER GOV'T CODE 6103

EXEMPT
C14

90-286036

(Space above this line for recorder's use only)

RECORDING REQUESTED BY
FIRST AMERICAN TITLE INS. CO.

RECORDED IN OFFICIAL RECORDS
OF ORANGE COUNTY, CALIFORNIA
4:00
PM MAY 29 1990
Lee A. Branch Recorder

Unincorporated Area of
Orange County

AP No. 125-162-1[illegible]

Project No. [illegible]

Project [illegible]

Parcel No. [illegible]

IRREVOCABLE OFFER OF DEDICATION

THIS IRREVOCABLE OFFER OF DEDICATION ("Offer") is made as of the 24th day of April, 1990, by Anthony R. Moiso and Melinda R. Moiso, as Trustees of the Moiso Living Trust under Declaration of Trust dated February 7, 1985, Anthony R. Moiso as Special Trustee and Richard J. O'Neill as Trustee under Declaration of Trust dated April 18, 1968 for the benefit of Richard J. O'Neill, Anthony R. Moiso as Special Trustee and Richard J. O'Neill as Trustee under Declaration of Trust for the benefit of Alice O'Neill Avery, Santa Margarita Company, a California corporation, San Juan Partnership No. I, a California limited partnership, and the San Juan Company, a California limited partnership (collectively "Offeror") on behalf of Arvida/JMB Partners, L.P.-II, a Delaware limited partnership ("Arvida/JMB"), for good and valuable consideration received from Arvida/JMB, to the COUNTY OF ORANGE, a political subdivision of the State of California (the "County").

04-23-90 10001-00199
F:\DOC\102\90040033.AGR

RECORDED AT THE REQUEST OF
AND RETURN TO:

COUNTY OF ORANGE
GSA REAL ESTATE DIVISION
14 Civic Center Plaza
P.O. Box 4106
Santa Ana, CA 92702

EXEMPT RECORDING REQUESTED
PER GOV'T CODE 6103

(Space above this line for recorder's use only)

Unincorporated Area of
Orange County

AP No. 125-162-[illegible]

Project No. [illegible]

Project [illegible]

Parcel No. [illegible]

IRREVOCABLE OFFER OF DEDICATION

THIS IRREVOCABLE OFFER OF DEDICATION ("Offer") is made as of the 24th day of April, 1990, by Anthony R. Moiso and Melinda R. Moiso, as Trustees of the Moiso Living Trust under Declaration of Trust dated February 7, 1985, Anthony R. Moiso as Special Trustee and Richard J. O'Neill as Trustee under Declaration of Trust dated April 18, 1968 for the benefit of Richard J. O'Neill, Anthony R. Moiso as Special Trustee and Richard J. O'Neill as Trustee under Declaration of Trust for the benefit of Alice O'Neill Avery, Santa Margarita Company, a California corporation, San Juan Partnership No. I, a California limited partnership, and the San Juan Company, a California limited partnership (collectively "Offeror") on behalf of Arvida/JMB Partners, L.P.-II, a Delaware limited partnership ("Arvida/JMB"), for good and valuable consideration received from Arvida/JMB, to the COUNTY OF ORANGE, a political subdivision of the State of California (the "County").

RECITALS

A. The entities which collectively comprise Offeror are the owners of fee title to portions of that certain real property located within a portion of Rancho Mission Viejo (as hereinafter defined) which is commonly referred to as "Talega Valley." Talega Valley is generally delineated on Exhibit A attached hereto. Rancho Mission Viejo consists of approximately forty thousand (40,000) acres located primarily in the unincorporated area of the County of Orange, California. A planned community containing residential, commercial, industrial, recreational, open-space and other uses (the "Rolling Hills Planned Community") has been approved by the County for a portion of Talega Valley (the "County Portion"). The remaining portion of Talega Valley lies within the City of San Clemente and has been approved for development by the City.

B. On June 9, 1983, the County Board of Supervisors, pursuant to Resolution No. 83-804, approved and adopted, subject to certain conditions, Amendment No. 83-1 to the County General Plan Land Use Element. Amendment No. 83-1 designated the County Portion for residential, employment and open space uses. On May 4, 1988, the County Board of Supervisors, pursuant to Resolution No. 88-620, approved and adopted, subject to certain conditions, Zone Change ("ZC") 86-31P and Feature Plan ("FP") 88-1P which permit development, use and operation of the Rolling Hills Planned Community. On September 13, 1989, County approved and adopted ZC 89-06 which, among other things, amended some of the conditions of approval to ZC 86-31P.

C. The approval and adoption of the Rolling Hills Planned Community is conditioned, among other things, upon Offeror establishing a private, non-profit land conservancy (the "Conservancy") and conveying to the Conservancy a conservation easement (the "Conservation Easement") over a portion of Talega Valley known as the "Reserve Area" and generally depicted on Exhibit A attached hereto as "EASEMENT AREA (Talega Reserve Area)". The portions of the Reserve Area offered for dedication by this Offer are referred to herein as the "Dedication Area". The Conservation Easement will encompass approximately 1181 acres. The approval and adoption of the Rolling Hills Planned Community is also conditioned upon Offeror making this Offer which may be accepted by the County as set forth in Section 1.4. The Dedication Area is more particularly described on Exhibit B hereto and shown on Exhibit A hereto as "County Dedication Area".

D. Offeror and Offeree recognize that a transportation corridor (the "Transportation Corridor") is being planned and may be located in the proximity of the Dedication

Area and have determined that the Transportation Corridor will not be inconsistent with the preservation of ecological values within the Dedication Area.

E. This Offer has been reviewed and approved by the County as satisfying pertinent portions of Condition No. 16 of the ZC 86-31P Conditions of Approval as revised by ZC 89-06 (the "Condition"). The County has consented to the recordation of this Offer and the parties agree to be bound by the terms, conditions and covenants contained herein.

F. The plan of Offeror and Offeror's successors-in-interest for the development of Rancho Mission Viejo and Rolling Hills Planned Community is a fully integrated plan, each element of which, as provided for and permitted by the County General Plan is functionally, financially and physically interrelated and interdependent. In order to develop any part of the Rolling Hills Planned Community as a balanced planned community, Offeror must be able to have provided to the Rolling Hills Planned Community necessary and appropriate services and facilities, including, without limitation, streets, roads and highways, libraries, parks, transportation systems, drainage discharges and facilities, flood control facilities, fire stations, public utilities, open space areas and recreational areas and facilities, and sources of local employment through development of commercial and industrial uses, all in accordance with the County General Plan.

NOW, THEREFORE, in consideration of the promises hereinabove contained, Offeror and the County hereby agree as follows:

ARTICLE 1.
Offer of Dedication

Section 1.1 Offer. Pursuant to the Condition and subject to the exclusions and reservations hereinafter described, Offeror hereby offers to dedicate to the County the Dedication Area, in fee, on the terms and conditions and in the manner set forth herein, for ecological preservation purposes.

Section 1.2 Irrevocability of Offer. This Offer may not be revoked, modified or amended by Offeror without the prior written consent of the County.

Section 1.3 Term of Offer. This Offer of Dedication shall be perpetual and shall have no expiration date.

Section 1.4 Acceptance of Offer.

(a) Acceptance of this Offer may be effected by a resolution of the Board of Supervisors of the County. County may accept this Offer only if the Conservancy (x) has not been established by September 1, 1990, or (y) has been established but ceases to function and either of the following events has occurred:

(i) the United States Department of Transportation has approved the Transportation Corridor, or any and every portion or aspect of the Transportation Corridor that requires such approval; or

(ii) ten (10) years have elapsed since the date of recordation of this Offer;

(b) For purposes of this Offer, "ceases to function" shall mean:

(i) termination of the Conservancy's corporate existence by any of the following methods:

(A) voluntary dissolution evidenced by the filing of a certificate of dissolution pursuant to California Corporations Code Section 6615;

(B) voluntary dissolution evidenced by a superior court order declaring the Conservancy wound-up and dissolved pursuant to Corporations Code Section 6617;

(C) involuntary dissolution evidenced by a superior court order declaring the Conservancy wound-up and dissolved pursuant to Corporations Code Section 6518; or

(ii) The existence of any of the following conditions which is not cured within sixty (60) days following service upon each of the Conservancy directors of written notice (given in the manner set forth in Section 3.5 hereof at each director's last known address) from the County of Orange that such a condition exists and that the County of Orange intends to accept this Offer if such condition is not remedied:

(A) Insolvency;

(B) Repeated failure of the Board to meet following a call made in accordance with the bylaws of the Conservancy; or

(C) Failure of the Conservancy to use reasonable efforts to identify, preserve and protect in perpetuity the open space and significant, relatively natural, ecological features and values of the Dedication Area.

(c) Upon acceptance of this Offer by the County, the County shall mail or deliver a copy of the resolution of acceptance to the then owner(s) of the Dedication Area at the address(es) shown on the latest secured assessment roll.

(d) Notwithstanding any applicable statute of limitations, the then owners of the Dedication Area may object in writing to acceptance of this Offer by the County only during one hundred eighty (180) days following written notice from the County referring to this instrument and this subsection and stating that County is invoking the time limit set forth in this subsection. Any such written notice shall be given in the manner set forth in Section 3.5 hereof to each then owner at such owner's last known address. If such written notice is given by County and the then owners do not object in writing within such period, the then owners shall have waived any further right to challenge the acceptance by the County of the Dedication Area.

Section 1.5 Title to the Dedication Area.

(a) Offeror covenants that the Dedication Area is and shall remain during the term of this Offer free and clear of all liens, encumbrances, assessments, easements, leases (recorded and unrecorded), taxes and restrictions except:

(i) Any installment of general and special County and City taxes that is not entirely earned at the time title is transferred to or physical possession of the Dedication Area is taken by the County, whichever first occurs, and all taxes subsequent thereto. Offeror shall remain liable for payment of any earned taxes, pursuant to the provisions of Sections 5084 and 5086 of the California Revenue and Taxation Code, as amended. Offeror shall pay any earned delinquent taxes together with penalties and interest thereon and any delinquent or earned, nondelinquent assessments or bonds prior to recordation of this Offer;

(ii) Items 1 through 13 and Items 15 through 17 which are set forth as exceptions to title on the Preliminary Title Report No. OR-1549751, dated March 9, 1990, issued by First American Title Insurance Company;

(iii) Any other items consented to by the County's Manager of the GSA Real Estate Division (or designee) or arising out of any action taken by the County; and

(iv) The exclusions, reservations, covenants, conditions and restrictions herein contained.

(b) Offeror shall cause to be issued to the County a CLTA standard owner's policy of title insurance dated the date of recordation of this Offer in the amount of One Million Dollars ($1,000,000) insuring title in the County subject to the exceptions set forth in Section 1.5(a).

Section 1.6 Reservation of Easements and Other Rights. Offeror hereby reserves in perpetuity the following interests in real property within the Dedication Area together with the right to grant and transfer the same:

(a) An easement for above-ground and below-ground electrical transmission facilities and for maintenance of and access to such facilities.

(b) An easement for aviation fuel pipeline purposes generally as shown on Exhibit A.

(c) All minerals, coal, oil, gas, petroleum and other hydrocarbon substances in and under the Dedication Area, it being expressly understood and agreed that Offeror, its successors and assigns shall retain the exclusive title and right to remove said substances, together with the sole right to negotiate and conclude leases and agreements with respect to all such substances under the Dedication Area and to use those portions of the Dedication Area which underlie a plane parallel to and 500 feet below the present surface of the Dedication Area for the purposes of prospecting for, developing and/or extracting such substances from the Dedication Area by means of wells drilled into or through such portions of the Dedication Area from drill sites located on other property; it being further expressly understood and agreed that Offeror, its successors and assigns shall have no right to enter upon the surface of the Dedication Area or to use the Dedication Area or any portion thereof above the level of the aforesaid 500 foot subterranean plane.

Section 1.7 Approval of Proposed Easements.

(a) Offeror and the County recognize that while Offeror requires the use of certain portions of the Dedication Area for the purposes set forth in Section 1.6, Offeror and the County desire that such facilities be located and constructed in a manner which will reduce any potential adverse impact upon the natural resources of the Dedication Area. Therefore, Offeror agrees that it shall submit the proposed conveyance of the facilities referenced in Section 1.6(a) and (b) to the County's

Director, Environmental Management Agency ("EMA") or such other person designated by the County Board of Supervisors for review and approval, which approval shall not be unreasonably withheld or delayed.

(b) Offeror shall attempt to consolidate and designate easement locations in order to follow existing roadways and bridges and proposed roadways and bridges as shown on the then existing Master Plan of Arterial Highways.

(c) In the event Offeror desires to convey an easement or right referenced in Section 1.6, the following procedures shall govern such proposed conveyance:

(i) Offeror shall submit to the EMA Director a written request for approval of the proposed easement. Such request shall include a copy of the proposed conveyance document in final form and a map showing the location of the proposed easement. In conveying such easements or rights, Offeror shall be entitled to use the standard form conveyance document normally used by the respective agency, utility or association. The conveyance document shall include a signature line for the EMA Director to indicate his approval.

(ii) Within forty-five (45) days after receipt of a request for approval of a proposed easement, the EMA Director shall either execute and return the conveyance document, or return the document unexecuted with a reasonably detailed explanation of the reason for denial. If the County fails to notify Offeror of its acceptance or denial within such forty-five (45) day period, the County shall be deemed to have approved the conveyance.

(iii) If the EMA Director disapproves of the location of a proposed easement, the EMA Director shall cooperate with Offeror in the selection of another location for such easement which (1) shall not significantly increase the cost thereof, (2) is consistent with sound engineering practices and (3) serves substantially the same needs as the easement originally proposed by Offeror.

(d) Upon the request of Offeror or any title company, County shall execute and deliver to Offeror or the title company, as the case may be, within ninety (90) days after such request, a document in form reasonably acceptable to Offeror or the title company, as the case may be, confirming that Offeror has reserved the interests set forth in Section 1.6 together with the right to grant and transfer the same.

Section 1.8 Reservation of Easements and Property Rights. The easements referenced in Section 1.6 shall be appurtenant to the real property known as Rancho Mission Viejo and owned by the lineal descendants of Marguerite O'Neill, their affiliated companies and entities including, without limitation, Rancho Santa Margarita Joint Venture, Santa Margarita Company, San Juan Company and San Juan Partnership Nos. I through VII, inclusive, and are intended to run with the land. After the conveyance by Offeror of an easement referenced in Section 1.6, Offeror shall provide the County with a conformed copy of the recorded conveyance instrument.

ARTICLE II
USE RESTRICTIONS

Section 2.1 Permitted Uses.

(a) At any time prior to acceptance of this Offer, without consideration therefor, Offeror shall have the right (consistent with the provisions of the Deed of Conservation Easement recorded concurrently herewith) to (i) conduct ranching activities on the Dedication Area; (ii) use agricultural and construction equipment to repair and construct waterlines, roads, fences and agriculturally-related buildings, structures and facilities on the Dedication Area; and (iii) to allow the construction and maintenance of a hiking and equestrian trail across the southern portion of the Dedication Area.

(b) The County acknowledges that the Dedication Area is adjacent to other land owned by Offeror and its affiliates, which land is used for grazing cattle and farming operations. After acceptance of this Offer, the County shall use its best efforts to control the growth and spread of artichoke thistle in order to protect such adjacent lands.

(c) Offeror shall not use the Dedication Area in a manner not permitted by the County's applicable zoning regulation or in a manner which will be incompatible with the County's ultimately-adopted Open-Space Plan.

(d) If the County accepts this Offer and if the County also acquires the conservation easement created by the Deed of Conservation Easement recorded concurrently herewith (the "Deed"), County's use of the Dedication Area shall be subject to the restrictions set forth in Section 4 of the Deed, each of which are incorporated herein by this reference and each of which is hereby made a covenant running with the land. A copy of Section 4 of the Deed is attached hereto as Exhibit C and incorporated herein by this reference. It is the intention of

Grantor and County that this paragraph shall limit County's use of the Dedication Area even if a court of competent jurisdiction determines that County's acquisition of the easement created by the Deed and County's acquisition of the fee pursuant to this Offer effects a merger of title.

ARTICLE III
MISCELLANEOUS

Section 3.1 Binding Effect. Except as otherwise provided herein, all terms, conditions, restrictions, exclusions and reservations of this Offer, and the acquisition of the Dedication Area by acceptance thereof, shall be binding upon and inure to the benefit of the County and Offeror, and their respective successors and assigns. It is the intent of Offeror that the covenants, conditions and restrictions set forth herein shall run with the land.

Section 3.2 Severability. Each of the provisions of this Offer shall be deemed independent and severable, and the invalidity or partial invalidity of any provision or portion hereof shall not affect the validity or enforceability of any other provision.

Section 3.3 Counterparts. This Offer may be executed in any number of counterparts, each of which shall be an original but all of which shall constitute one and the same instrument.

Section 3.4 Indemnification. Offeror hereby agrees to indemnify, defend and hold the County harmless from and against any liabilities, claims, demands, losses, damages, costs and expenses (including, without limitation, attorneys' fees) arising out of or relating to (i) the location, development, operation or use of the easements reserved by Offeror and identified in Section 1.6 and (ii) Offeror's permitted use of the Dedication Area as described in Section 2.1.

Section 3.5 Notices. All notices required or permitted by this Offer shall be in writing and may be delivered in person to either party or may be sent by registered or certified mail, with postage prepaid, return receipt requested or delivered by Express Mail of the U.S. Postal Service or Federal Express or any other courier service guaranteeing overnight delivery, charges prepaid, or may be transmitted by facsimile transmission and addressed as follows:

If to Offeror at:

Santa Margarita Company
30211 Avenida de las Banderas
Rancho Santa Margarita, CA 92688
Attention: Thomas C. Blum/Richard Broming

With a copy to:

Pettis, Tester, Kruse & Krinsky
18881 Von Karman Avenue, Suite 1600
Irvine, CA 92715
Attention: Bruce Tester

If to County at:

County of Orange
GSA/Real Estate Division
P.O. Box 4106
Santa Ana, CA 92702

With a Copy to:

County of Orange
Environmental Management Agency
P.O. Box 4048
Santa Ana, CA 92702
Attention: Director

Any such notice sent by registered or certified mail, return receipt requested, shall be deemed to have been duly given and received seventy-two (72) hours after the same is so addressed and mailed in Orange County with postage prepaid. Notices delivered by overnight service shall be deemed to have been given twenty-four (24) hours after delivery of the same, charges prepaid, to the U.S. Postal Service or private courier. If any notice is transmitted by facsimile transmission or similar means, the same shall be deemed served or delivered upon confirmation of transmission thereof. Any notice or other document sent by any other manner shall be effective only upon actual receipt thereof. Any party may change its address for purposes of this Section by giving notice to the other party as herein provided. Unless notified in writing otherwise by any of the Offerors, Santa Margarita Company is designated as the recipient of any notice on behalf of the Offerors.

Section 3.6 Exhibits. All exhibits attached hereto and referred to herein are incorporated in this Agreement as though fully set forth herein.

IN WITNESS WHEREOF, Offeror has duly executed this Offer of Dedication as of the 24th day of April, 1990.

Anthony R. Moiso, and

Melinda R. Moiso, as Trustees of the Moiso Living Trust under Declaration of Trust dated February 7, 1985

Anthony R. Moiso, as Special Trustee, and

Richard J. O'Neill, as Trustee, under the Declaration of Trust dated April 18, 1968 for the benefit of Richard J. O'Neill

Anthony R. Moiso, as Special Trustee, and

Richard J. O'Neill, as Trustee, under Declaration of Trust dated April 18, 1968 for the benefit of Alice O'Neill Avery

Santa Margarita Company, a
California corporation

By: _____
Anthony R. Moiso

Its: President

By: _____
Thomas C. Blum

Its: Executive Vice President

San Juan Partnership No. I, a
California limited partnership

By: _____
Richard J. O'Neill,
a general partner

By: _____
Anthony R. Moiso,
a general partner

The San Juan Company, a
California limited partnership

By: _____
Richard J. O'Neill,
a general partner

By: _____
Anthony R. Moiso,
a general partner

CERTIFICATE OF ACCEPTANCE

This is to certify that the within document is hereby accepted for purposes of recordation only, under authority of a Resolution adopted by the Board of Supervisors of Orange County on 90-[illegible], 1990. This acceptance is not to be construed in any way, shape, form or manner as an acceptance of the Offer embodied in the subject document.

COUNTY OF ORANGE

Dated: _____

By: _____
LINDA D. RUTH
Clerk of Board of Supervisors
County of Orange, California

Approved as to form by County Counsel on _____ By: _____	Recommended for approval Environmental Management Agency By: Robert E. Hamilton
Description Compared to EMA-approved description dated 4-26-90 By: _____	Recommended for approval GSA Real Estate Division By: _____

04-23-90 10001-00199
F:\DOC\102\90040033.AGR

STATE OF CALIFORNIA)
) ss.
COUNTY OF ORANGE)

On _____, 1990, before me, the undersigned, a Notary Public in and for said County and State, personally appeared ANTHONY R. MOISO and MELINDA R. MOISO, known to me or proved to me on the basis of satisfactory evidence, to be the persons who executed the within instrument and known to me to be the Trustees of the Moiso Living Trust under Declaration of Trust dated February 7, 1985 and acknowledged to me that they subscribed their own names as the Trustees of said Trust.

WITNESS my hand and official seal.

OFFICIAL SEAL
Emmy Lou Jolly- Vann
NOTARY PUBLIC-CALIFORNIA
ORANGE COUNTY
MY COMM. EXP. JAN. 28, 1994

_____
Notary Public in and for said State

[SEAL]

STATE OF CALIFORNIA)
) ss.
COUNTY OF ORANGE)

On _____, 1990, before me, the undersigned, a Notary Public in and for said County and State, personally appeared RICHARD J. O'NEILL, personally known to me or proved to me on the basis of satisfactory evidence to be the person who executed the within instrument as Trustee on behalf of THE TRUST FOR THE BENEFIT OF RICHARD J. O'NEILL DATED APRIL 18, 1968, and acknowledged to me that he executed the within instrument in accordance with the trust instrument.

WITNESS my hand and official seal.

OFFICIAL SEAL
Emmy Lou Jolly- Vann
NOTARY PUBLIC-CALIFORNIA
ORANGE COUNTY
MY COMM. EXP. JAN. 28, 1994

_____
Notary Public in and for said State

[SEAL]

STATE OF CALIFORNIA)
) ss.
COUNTY OF ORANGE)

On _____, 1990, before me, the undersigned, a Notary Public in and for said County and State, personally appeared ANTHONY R. MOISO, personally known to me or proved to me on the basis of satisfactory evidence to be the person who executed the within instrument as Special Trustee on behalf of THE TRUST FOR THE BENEFIT OF RICHARD J. O'NEILL DATED APRIL 18, 1968, and acknowledged to me that he executed the within instrument in accordance with the trust instrument.

WITNESS my hand and official seal.

OFFICIAL SEAL
Emmy Lou Jolly- Vann
NOTARY PUBLIC-CALIFORNIA
ORANGE COUNTY
MY COMM. EXP. JAN. 28, 1994

_____
Notary Public in and for said State

[Seal]

STATE OF CALIFORNIA)
) ss.
COUNTY OF _____)

On _____, 1990, before me, the undersigned, a Notary Public in and for said County and State, personally appeared RICHARD J. O'NEILL, personally known to me or proved to me on the basis of satisfactory evidence to be the person who executed the within instrument as Trustee on behalf of THE TRUST FOR THE BENEFIT OF ALICE O'NEILL AVERY DATED APRIL 18, 1968, and acknowledged to me that he executed the within instrument in accordance with the trust instrument.

WITNESS my hand and official seal.

OFFICIAL SEAL
Emmy Lou Jolly- Vann
NOTARY PUBLIC-CALIFORNIA
ORANGE COUNTY
MY COMM. EXP. JAN. 28, 1994

Emmy Lou Jolly-Vann
Notary Public in and for said State

[SEAL]

STATE OF CALIFORNIA)
) ss.
COUNTY OF ORANGE)

On _____, 1990, before me, the undersigned, a Notary Public in and for said County and State, personally appeared ANTHONY R. MOISO, personally known to me or proved to me on the basis of satisfactory evidence to be the person who executed the within instrument as Special Trustee on behalf of THE TRUST FOR THE BENEFIT OF ALICE O'NEILL AVERY DATED APRIL 18, 1968, and acknowledged to me that he executed the within instrument in accordance with the trust instrument.

WITNESS my hand and official seal.

OFFICIAL SEAL
Emmy Lou Jolly- Vann
NOTARY PUBLIC-CALIFORNIA
ORANGE COUNTY
MY COMM. EXP. JAN. 28, 1994

[SEAL]

_____
Notary Public in and for said State

STATE OF CALIFORNIA)
) ss.
COUNTY OF ORANGE)

On _____, 1990 before me, the undersigned, a Notary Public in and for said County of State, personally appeared _____ and _____ personally known to me or proved to me on the basis of satisfactory evidence to be the _____ and _____ respectively, of SANTA MARGARITA COMPANY, a California corporation, the corporation that executed the within instrument, known to me or proved to me on the basis of satisfactory evidence to be the persons who executed the within instrument on behalf of the corporation therein named, and acknowledged to me that said corporation executed the within instrument pursuant to its bylaws or a resolution of its board of directors.

WITNESS my hand and official seal.

OFFICIAL SEAL
Emmy Lou Jolly- Vann
NOTARY PUBLIC-CALIFORNIA
ORANGE COUNTY
MY COMM. EXP. JAN. 28, 1994

[SEAL]

_____
Notary Public in and for said State

STATE OF CALIFORNIA)
) ss.
COUNTY OF ORANGE)

On _____, 1990, before me, the undersigned, a Notary Public in and for said County and State, personally appeared RICHARD J. O'NEILL and ANTHONY R. MOISO, personally known to me or proved to me on the basis of satisfactory evidence, to be the persons who executed the within instrument as the sole General Partners of San Juan Partnership No. I, as established by the within instrument, and acknowledged that they have executed the within instrument as such General Partners.

WITNESS my hand and official seal.

OFFICIAL SEAL
Emmy Lou Jolly- Vann
NOTARY PUBLIC-CALIFORNIA
ORANGE COUNTY
MY COMM. EXP. JAN. 28, 1994

[SEAL]

_____
Notary Public in and for said State

STATE OF CALIFORNIA)
) ss.
COUNTY OF ORANGE)

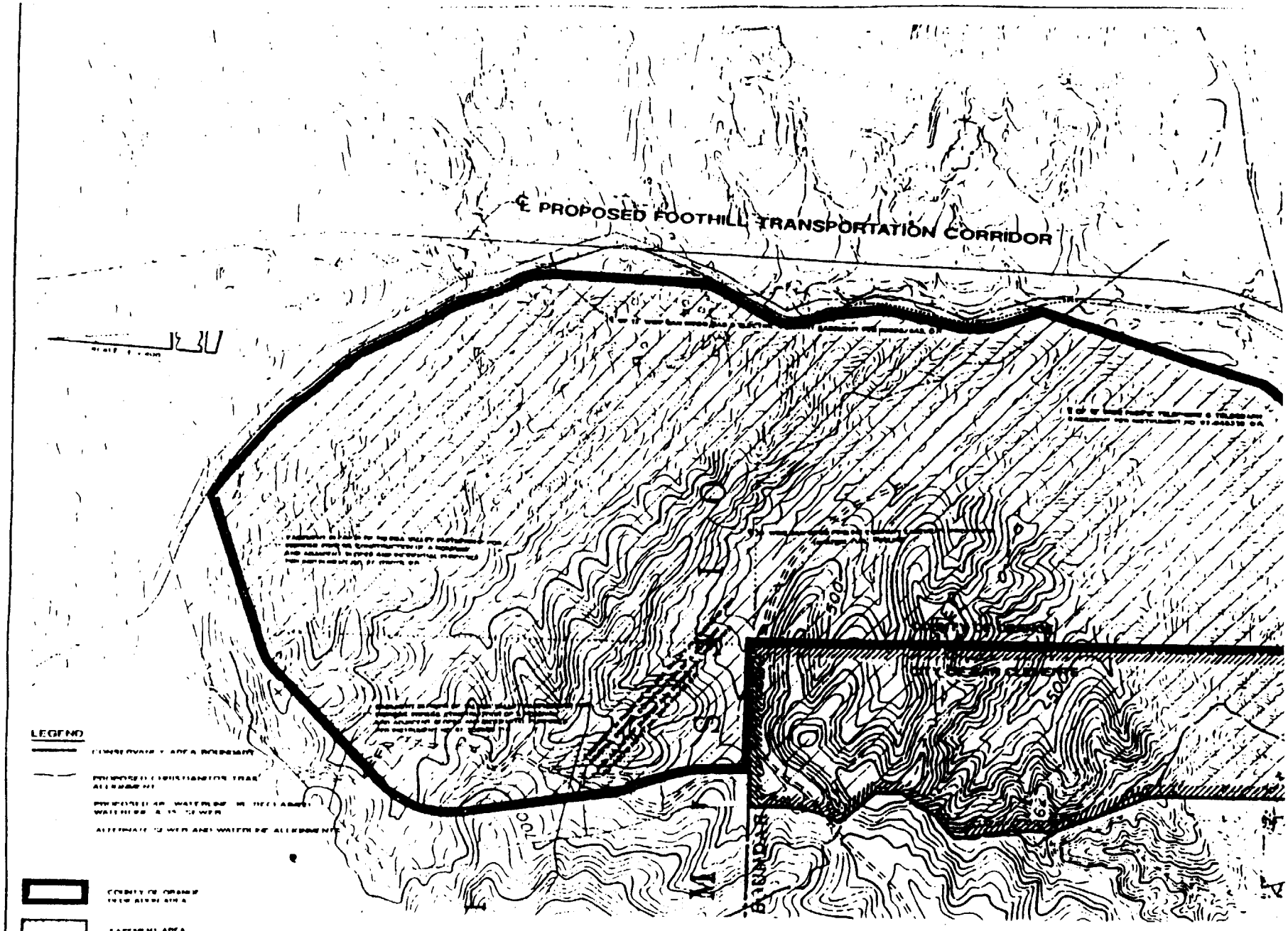
On _____, 1990, before me, the undersigned, a Notary Public in and for said County and State, personally appeared RICHARD J. O'NEILL and ANTHONY R. MOISO, personally known to me or proved to me on the basis of satisfactory evidence, to be the persons who executed the within instrument as the sole General Partners of The San Juan Company, as established by the within instrument, and acknowledged that they have executed the within instrument as such General Partners.

WITNESS my hand and official seal.

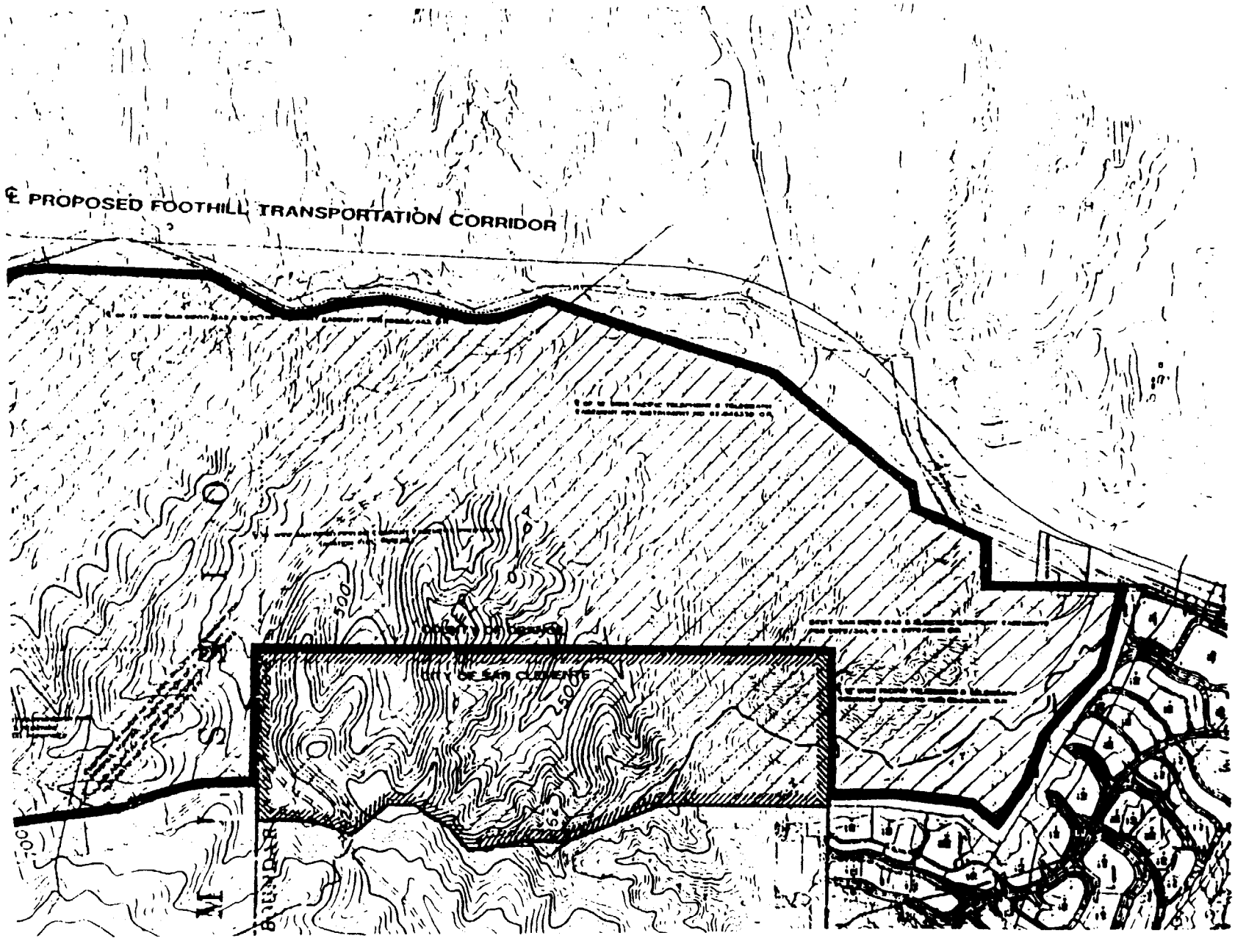
OFFICIAL SEAL
Emmy Lou Jolly- Vann
NOTARY PUBLIC-CALIFORNIA
ORANGE COUNTY
MY COMM. EXP. JAN. 28, 1994

[SEAL]

_____
Notary Public in and for said State



TALEGA VALLEY CONSERVANCY AREA



ALEGA VALLEY CONSERVANCY AREA

EXHIBIT B

CONSULTING CIVIL ENGINEERS AND LAND SURVEYORS
1962 - 1987 Twenty-Five Years of Engineering Excellence

90105(A)
03-01-90
Revised
03-15-90
04-02-90

LEGAL DESCRIPTION
TALEGA VALLEY CONSERVANCY AREA
(UNINCORPORATED TERRITORY OF THE COUNTY OF ORANGE)

That certain land situated in the Unincorporated Territory of the County of Orange, State of California, described in parcels as follows:

Parcel A: Parcel 5 of Certificate of Compliance No. CC 83-3, recorded August 29, 1983 as Instrument No. 83-377561 of Official Records, in the office of the County Recorder of said County.

EXCEPTING THEREFROM the land described in that easement in favor of Talega Valley Partnership for Ingress, Egress, construction of a roadway and adjacent slopes and incidental purposes recorded April 16, 1987 as Instrument No. 87-208958 of Official Records, in the office of said County Recorder.

Parcel B: Parcel 2 of Certificate of Compliance No. 87-06, recorded August 7, 1987 as Instrument No. 87-449971 of Official Records, in the office of the County Recorder of said County.

EXCEPTING THEREFROM the land described in that easement in favor of Talega Valley Partnership for Ingress, Egress, construction of a roadway and adjacent slopes and incidental purposes recorded September 2, 1988 as Instrument No. 88-444055 of Official Records, in the office of said County Recorder.

Parcel C: Parcel 3 of Certificate of Compliance No. 87-06, recorded August 7, 1987 as Instrument No. 87-449971 of Official Records, in the office of the County Recorder of said County.

EXCEPTING THEREFROM the land described in that easement in favor of Talega Valley Partnership for Ingress, Egress, construction of a roadway and adjacent slopes and incidental purposes recorded April 1, 1987 as Instrument No. 87-178076 of Official Records, in the office of said County Recorder.

ALSO EXCEPTING THEREFROM that portion described as follows: Commencing at the most Northerly corner of said Parcel 3; thence South 52°20'18" East 948.34 feet along the Northeasterly line of said Parcel 3 to the TRUE POINT OF BEGINNING; thence continuing along said Northeasterly line and along the Easterly line of said Parcel 3, the following courses: South 52°20'18" East 487.66 feet to the beginning of a tangent curve, concave

Corporate Office • 17782 Sky Park Blvd. • Irvine, California 92714 • 714/261-2222 • FAX# 474-9120
Inland Empire Office • 1101 S. Milliken Ave., Ste. G • Ontario, California 91761 • 714/988-7880 • FAX# 988-5299
San Diego County Office • Carlsbad, California 92008 • 619/438-4330

Southwesterly having a radius of 4650.00 feet, Southeasterly 2726.27 feet along said curve through a central angle of 33°35'32", and South 1°59'42" West 816.13 feet; thence North 9°14'13" West 268.21 feet to the beginning of a tangent curve concave Westerly having a radius of 1190.00 feet; thence Northerly 363.97 feet along said curve through a central angle of 17°31'28" to the beginning of a reverse curve, concave Easterly having a radius of 1550.00 feet; thence Northerly 358.19 feet along said curve through a central angle of 13°14'26" to the beginning of a reverse curve, concave Westerly having a radius of 1450.00 feet; thence Northerly 433.88 feet along said curve through a central angle of 17°08'40" to the beginning of a reverse curve, concave Northeasterly having a radius of 1550.00 feet; thence Northwesterly 132.64 feet along said curve through a central angle of 4°54'11"; thence North 25°45'44" West 519.86 feet to the beginning of a tangent curve, concave Southwesterly having a radius of 1450.00 feet; thence Northwesterly 360.61 feet along said curve through a central angle of 14°14'57"; thence North 40°00'41" West 224.02 feet to the beginning of a tangent curve, concave Northeasterly having a radius of 1650.00 feet; thence Northwesterly 227.91 feet along said curve through a central angle of 7°54'50" to the beginning of a reverse curve, concave Southwesterly having a radius of 1350.00 feet; thence Northwesterly 379.85 feet along said curve through a central angle of 16°07'17"; thence North 48°13'08" West 634.22 feet to the TRUE POINT OF BEGINNING.

ALSO EXCEPTING THEREFROM that portion described as follows: Beginning at the Northerly termius of that certain course described as "North 18°00'00" East 2856.38 feet" for a portion of said Easterly line of Parcel 3; thence South 17°59'42" West 707.14 feet along said Easterly line; thence North 16°43'04" West 479.12 feet to the beginning of a tangent curve, concave Easterly having a radius of 850.00 feet; thence Northerly 440.33 feet along said curve through a central angle of 29°40'53"; thence North 12°57'49" East 487.25 feet to the beginning of a tangent curve, concave Westerly having a radius of 1310.00 feet; thence Northerly 586.45 feet along said curve through a central angle of 25°38'59"; thence North 12°41'10" West 354.70 feet to the beginning of a tangent curve, concave Easterly having a radius of 550.00 feet; thence Northerly 386.78 feet along said curve through a central angle of 40°17'32"; thence North 27°36'22" East 828.15 feet to said Easterly line of Parcel 3; thence South 1°59'42" West 2735.11 feet along said Easterly line to the point of beginning.

ALSO EXCEPTING THEREFROM that portion described as follows: Beginning at the Southerly terminus of that certain course described as "South 0°43'37" West 2666.90 feet" for a portion of the Westerly line of said Parcel 3; thence North 0°43'19" East 104.32 feet along said Westerly line; thence South 51°30'41" East 23.32 feet; thence South 73°46'05" East 659.36 feet to said Easterly line of Parcel 3; thence along said Easterly line and along the Southerly line of said Parcel 3, the following courses: South 0°43'14" West 148.75 feet and North 69°30'18" West 694.75 feet to the point of beginning.

Parcel D: Parcel 4 of Certificate of Compliance No. 87-06, recorded August 7, 1987 as Instrument No. 87-449971 of Official Records, in the office of the County Recorder of said County.

EXCEPTING THEREFROM that portion described as follows: Beginning at the most Southerly corner of said Parcel 4; thence North 0°43'19" East 104.32 feet along the Easterly line of said Parcel 4; thence North 51°30'41" West 939.03 feet; thence North 69°20'43" West 444.81 feet; thence North 55°14'00" West 503.15 feet; thence North 39°03'50" East 364.34 feet; thence North 8°58'33" East 646.17 feet; thence North 2°33'02" West 630.26 feet to the Northerly line of said Parcel 4; thence along said Northerly line and along the Westerly and Southwesterly lines of said Parcel 4, the following courses: North 89°15'51" West 65.66 feet, South 0°59'42" West 506.04 feet, South 8°29'42" West 720.00 feet, South 38°44'42" West 425.00 feet, South 57°25'18" East 1540.00 feet, South 40°35'18" East 294.77 feet, and South 69°30'18" East 232.93 feet to the point of beginning.

Contains an area of 997.268 acres, more or less.

Subject to covenants, conditions, reservations, restrictions, rights of way and easements, if any, of record.

Thomas E. Verloop
THOMAS E. VERLOOP, LS 5348

LICENSED LAND SURVEYOR
THOMAS E. VERLOOP
Exp. 12-31-91
No. 5348
STATE OF CALIFORNIA

EXHIBIT C

Restrictions as Set Forth in Section 4 of
the Deed of Conservation Easement Recorded
Concurrently Herewith

The following uses and practices on the Easement Area are inconsistent with the purposes of the Easement and shall be prohibited unless otherwise permitted in the exercise of Grantor's reserved rights:

a. The damage or impairment of natural ecological values or the destruction of other significant conservation interests in the violation of the Easement, except as otherwise provided by this Deed.

b. The planting of commercial agricultural crops or the conversion of native vegetation to new or exotic species.

c. The introduction of non-native plant or animal species except cattle.

d. Hunting or trapping.

e. Use of the Easement Area for the purpose of recreational, residential, commercial, retail or industrial development except as otherwise specifically permitted herein (e.g. the riding and hiking trail referred to in Paragraph 3(f) hereof).

f. The construction or placement of any mobilehomes, trailers, signs, billboards or other advertising material or any other structures except as otherwise provided herein.

g. The use of motor vehicles, except as incidental to and as needed for the purposes permitted by this Deed.

h. The dumping of ashes, trash, garbage or other unsightly, offensive or toxic material.

i. The removal, destruction or cutting of trees or plants, except for artichoke thistle and other trees or plants agreed to by Grantor and Grantee or as otherwise permitted by this Deed.

j. The storage or use of biocides and agricultural chemicals except as may be necessary to protect the native vegetation which is of conservation value and threatened by the invasion of exotic material from outside the Easement Area.

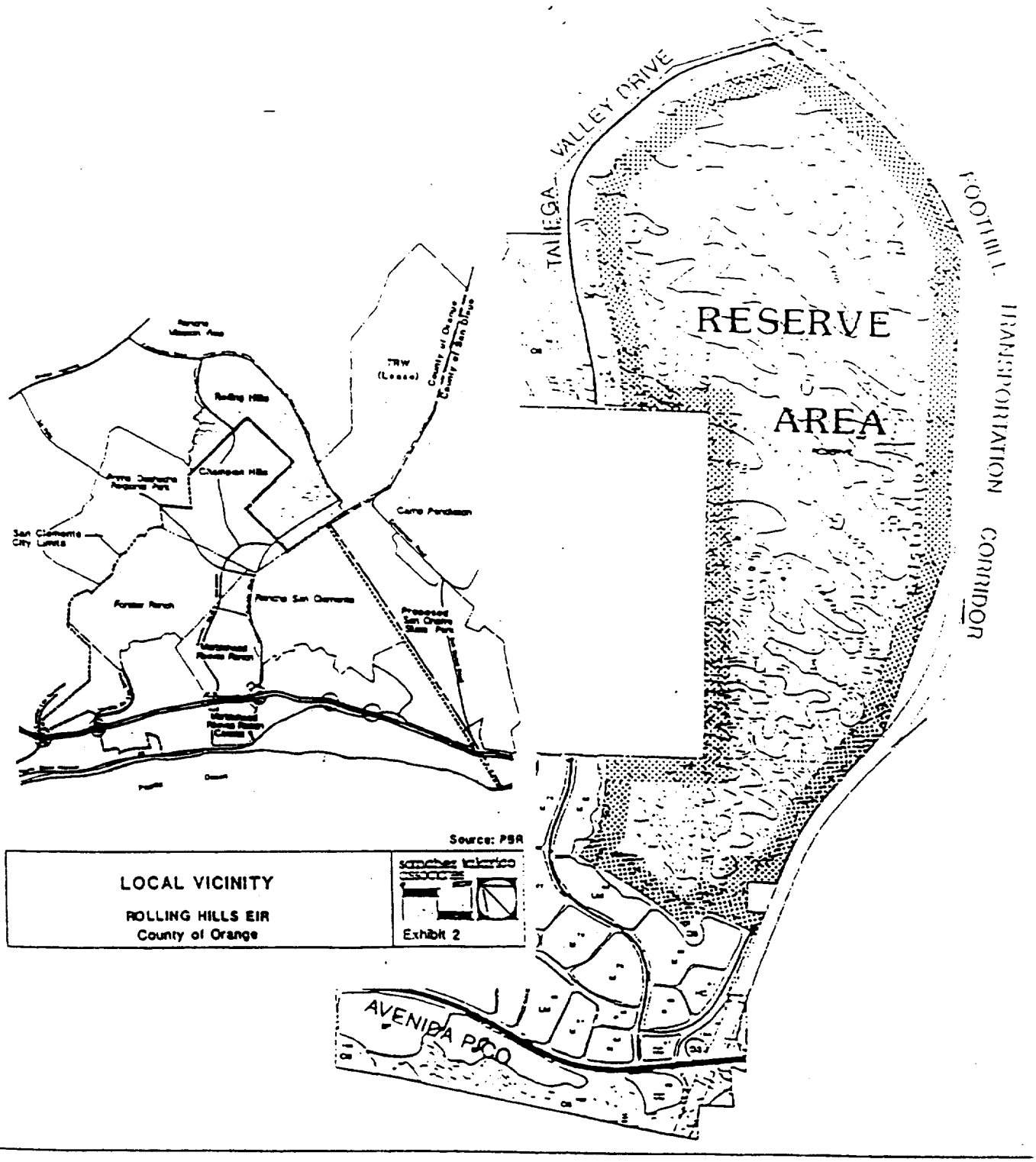
k. The changing of the topography through the placing of soil, dredging soils, landfill or other material.

l. Filling, excavating, dredging, mining, drilling or removal of topsoil, sand, gravel, rock, minerals or other materials.

m. The alteration or manipulation of existing patterns of water drainage or of water quality.

n. Plowing, drilling seed, or any other farming activity which would disturb the soil surface.

EXHIBIT A
RESERVE AREA LOCATION MAP



Source:

PROJECT LAND USE PLAN

ROLLING HILLS EIR
County of Orange

sanchez talarico associates
no scale
Exhibit A

ROLLING HILLS P.C. ZONE CHANGE NO. 89-06

CONDITION NO. 16

16. Reserve Area/Ecological Conservancy

Prior to the recordation of any final map, except maps for financing purposes, the landowner shall cause the formation of a Conservancy and shall cause to be conveyed to such a Conservancy a conservation easement pursuant to California Civil Code Section 815 et seq. over the Reserve Area generally shown as Planning Area 107 on Exhibit A attached hereto and made a part hereof. The text of the grant of conservation easement, the articles of incorporation and the bylaws of the Conservancy shall be subject to advance approval by the Board of Supervisors. The articles of incorporation, the bylaws, or both, as appropriate, shall provide for County representation on the Conservancy Board of Directors, representing at least one-third of Conservancy Directors voting rights. The conservation easement shall be granted in perpetuity, shall require that the property be preserved and maintained in a natural state, and shall provide for such easement to vest in the County of Orange or its designee if the Conservancy ceases to function for any reason. The easement shall be free of, or senior to, all monetary encumbrances, leases, fees, assessments and delinquent taxes except those approved by the Board of Supervisors.

In addition to the above conservation easement, prior to recordation of any final map, the landowner shall make an irrevocable continuing offer of dedication to the County of Orange or its designee of the Reserve Area generally shown as Planning Area 107 on Exhibit A attached hereto. Said offer shall be for ecological preservation purposes and shall be in a form approved by the Board of Supervisors suitable for recording fee title. Said offer shall be free of, or senior to, all monetary and all other encumbrances, liens, leases, fees, assessments, and unpaid taxes. Easements over the property, if any, (recorded and unrecorded) shall be in a form approved by the Board of Supervisors. Said offer shall be in a form that can be accepted for transfer of fee title by the County or its designee.

Said offer of dedication in fee may be accepted by the County only if the Conservancy has been established but has ceased to function. The meaning of the phrase: "ceases to function" shall be defined in the Offer of Dedication. Additionally, said phrase shall be defined in the Articles of Incorporation of the Conservancy in the same way; if required by the Board of Supervisors in its approval of the Articles of Incorporation.

"Conservancy" means a private, non-profit entity approved by the Board of Supervisors at a public hearing established for the purpose of managing and conserving the property in order to maintain and enhance its present character and quality.

RECORDED AT THE REQUEST OF
AND RETURN TO:

City of San Clemente
100 Avenida Presidio
San Clemente, CA 92672

ATTN: CITY CLERK

RECORDING REQUESTED BY
FIRST AMERICAN TITLE INS. CO.

RECORDED IN OFFICIAL RECORDS
OF ORANGE COUNTY, CALIFORNIA

4:00
PM MAY 29 1990

Lee A. Branch Recorder

EXEMPT
C14

90-286035

RECORDING REQUESTED BY
FIRST AMERICAN TITLE INS. CO.

RECORDED IN OFFICIAL RECORDS
OF ORANGE COUNTY, CALIFORNIA

4:00
PM MAY 29 1990

Lee A. Branch Recorder

(Space above this line for recorder's use only)

Exempt recording requested
per Gov. Code Sec. 6103.
City Clerk

Incorporated Area of the
City of San Clemente

AP No. _____

Project No. _____

Project _____

Parcel No. _____

IRREVOCABLE OFFER OF DEDICATION

THIS IRREVOCABLE OFFER OF DEDICATION ("Offer") is made as of the 22nd day of May, 1990, by Arvida/JMB Partners, L.P.-II, a Delaware limited partnership ("Offeror"), for good and valuable consideration the receipt of which is hereby acknowledged, to the City of San Clemente, a municipal corporation ("City").

RECITALS

A. Offeror owns fee title to portions of that certain real property located within a portion of Rancho Mission Viejo (as hereinafter defined) which is commonly referred to as "Talega Valley." Talega Valley is generally delineated on Exhibit A attached hereto. Rancho Mission Viejo consists of approximately forty thousand (40,000) acres located primarily in the unincorporated area of the County of Orange, California. A planned community containing residential, commercial, industrial, recreational, open-space and other uses (the "Rolling Hills Planned Community") has been approved by the County of Orange

RECORDED AT THE REQUEST OF
AND RETURN TO:

City of San Clemente
100 Avenida Presidio
San Clemente, CA 92672

ATTN: CITY CLERK

(Space above this line for recorder's use only)

Exempt recording requested
per Gov. Code Sec. 6103
City Clerk

Incorporated Area of the
City of San Clemente

AP No. _____

Project No. _____

Project _____

Parcel No. _____

IRREVOCABLE OFFER OF DEDICATION

THIS IRREVOCABLE OFFER OF DEDICATION ("Offer") is made as of the 22nd day of May, 1990, by Arvida/JMB Partners, L.P.-II, a Delaware limited partnership ("Offeror"), for good and valuable consideration the receipt of which is hereby acknowledged, to the City of San Clemente, a municipal corporation ("City").

RECITALS

A. Offeror owns fee title to portions of that certain real property located within a portion of Rancho Mission Viejo (as hereinafter defined) which is commonly referred to as "Talega Valley." Talega Valley is generally delineated on Exhibit A attached hereto. Rancho Mission Viejo consists of approximately forty thousand (40,000) acres located primarily in the unincorporated area of the County of Orange, California. A planned community containing residential, commercial, industrial, recreational, open-space and other uses (the "Rolling Hills Planned Community") has been approved by the County of Orange

("County") for a portion of Talega Valley (the "County Portion"). The remaining portion of Talega Valley lies within the City of San Clemente (the "City Portion") and has been approved for development by the City.

B. On June 9, 1983, the County Board of Supervisors, pursuant to Resolution No. 83-804, approved and adopted, subject to certain conditions, Amendment No. 83-1 to the County General Plan Land Use Element. Amendment No. 83-1 designated the County Portion for residential, employment and open space uses. On May 4, 1988, the County Board of Supervisors, pursuant to Resolution No. 88-620, approved and adopted, subject to certain conditions, Zone Change ("ZC") 86-31P and Feature Plan ("FP") 88-1P which permit development, use and operation of the Rolling Hills Planned Community. On September 13, 1989, County approved and adopted ZC 89-06 which, among other things, amended some of the conditions of approval to ZC 86-31P.

C. On August 10, 1988, City, pursuant to Resolution No. 88-64, approved the Talega Valley Specific Plan (84-02) designating the City Portion for residential, employment and open space uses. On November 15, 1989, the City Council, pursuant to Resolution No. 89-129, approved Specific Plan Amendment No. 89-109, amending certain conditions of approval to the Talega Valley Specific Plan.

D. The approval and adoption of the Talega Valley Specific Plan is conditioned, among other things, upon Offeror establishing a private, non-profit land conservancy (the "Conservancy") and conveying to the Conservancy a conservation easement (the "Conservation Easement") over a portion of Talega Valley known as the "Reserve Area" and generally depicted on Exhibit A attached hereto. The portions of the Reserve Area offered for dedication by this Offer are referred to herein as the "Dedication Area". The Conservation Easement will encompass approximately 1181 acres. The approval and adoption of the Talega Valley Specific Plan is also conditioned upon Offeror making this Offer which may be accepted by the City as set forth in Section 1.4. The Dedication Area is depicted on Exhibit "A" and more particularly described on Exhibit B hereto.

E. Offeror and Offeree recognize that a transportation corridor (the "Transportation Corridor") is being planned and may be located in the proximity of the Dedication Area and have determined that the Transportation Corridor will not be inconsistent with the preservation of ecological values within the Dedication Area.

F. This Offer has been reviewed and approved by the City as satisfying pertinent portions of Condition No. 12 of the

Talega Valley Specific Plan Conditions of Approval as revised by Specific Plan Amendment No. 89-109 (the "Condition"). The City has consented to the recordation of this Offer and the parties agree to be bound by the terms, conditions and covenants contained herein.

G. Offeror holds title to the Dedication Area pursuant to a "Holding Agreement" recorded May 10, 1989 as Instrument No. 89-248116 (the "Holding Agreement") entered into between Santa Margarita Company, a California corporation ("SMC"), and Offeror's predecessors-in-interest, Arvida Talega Limited Partnership. The Holding Agreement provides that Offeror holds the Dedication Area as agent for the benefit of SMC and that Offeror shall have no power or authority to deal with the Dedication Area without the explicit written consent of SMC. SMC desires to consent to the execution and delivery of this Offer by offeror.

NOW, THEREFORE, in consideration of the promises hereinabove contained, Offeror and the City hereby agree as follows:

ARTICLE 1.
Offer of Dedication

Section 1.1 Offer. Pursuant to the Condition and subject to the exclusions and reservations hereinafter described, Offeror hereby offers to dedicate to City the Dedication Area, in fee, on the terms and conditions and in the manner set forth herein, for ecological preservation purposes.

Section 1.2 Irrevocability of Offer. This Offer may not be revoked, modified or amended by Offeror during the term hereof without the prior written consent of City.

Section 1.3 Term of Offer. This Offer shall be perpetual and shall have no expiration date.

Section 1.4 Acceptance of Offer.

(a) Acceptance of this Offer may be effected by a resolution of the City Council of City. City may accept this Offer only if the Conservancy (x) has not been established by September 1, 1990, or (y) has been established but ceases to function and either of the following events has occurred:

(i) the United States Department of Transportation has approved the Transportation Corridor, or any

and every portion or aspect of the Transportation Corridor that requires such approval; or

(ii) ten (10) years have elapsed since the date of recordation of this Offer;

(b) For purposes of this Offer, "ceases to function" shall mean:

(i) termination of the Conservancy's corporate existence by any of the following methods:

(A) voluntary dissolution evidenced by the filing of a certificate of dissolution pursuant to California Corporations Code Section 6615;

(B) voluntary dissolution evidenced by a final and non-appealable judgment or similar court order declaring the Conservancy wound-up and dissolved pursuant to Corporations Code Section 6617; or

(C) involuntary dissolution evidenced by a final and non-appealable judgment or similar court order declaring the Conservancy wound-up and dissolved pursuant to Corporations Code Section 6518; or

(ii) The existence of any of the following conditions which is not cured within sixty (60) days following service upon the Conservancy of written notice (given in the manner set forth in Section 3.5 hereof) from City that such a condition exists and that City intends to accept this Offer if such condition is not remedied:

(A) Insolvency;

(B) Repeated failure of the Board to meet following a call made in accordance with the bylaws of the Conservancy; or

(C) The City Council reasonably determines that the Conservancy has failed to use reasonable efforts to identify, preserve and protect in perpetuity the open space and significant, relatively natural, ecological features and values of the Dedication Area.

(c) Upon acceptance of this Offer by City, City shall mail or deliver a copy of the resolution of acceptance to the then owner(s) of the Dedication Area at the address(es) shown on the latest secured assessment roll. Notwithstanding any applicable statute of limitations, the then owners of the

Dedication Area may object in writing to acceptance of this Offer by City only during one hundred eighty (180) days following written notice from City referring to this instrument and this subsection and stating that City is invoking the time limit set forth in this subsection. Any such written notice shall be given in the manner set forth in Section 3.5 hereof to each then owner at such owner's last known address. If such written notice is given by City and the then owners do not object in writing within such period, the then owners shall be conclusively deemed to have waived any further right to challenge the acceptance by City of the Dedication Area.

Section 1.5 Title to Dedication Area.

(a) Offeror covenants that the Dedication Area is and shall remain during the term of this Offer free and clear of all liens, encumbrances, assessments, easements, leases (recorded and unrecorded), taxes and restrictions except:

(i) Any installment of general and special County and City taxes that is not entirely earned at the time title is transferred to or physical possession of the Dedication Area is taken by City, whichever first occurs, and all taxes subsequent thereto. Offeror shall remain liable for payment of any earned taxes, pursuant to the provisions of Sections 5084 and 5086 of the California Revenue and Taxation Code, as amended. Offeror shall pay any earned delinquent taxes together with penalties and interest thereon and any delinquent or earned, nondelinquent assessments or bonds prior to recordation of this Offer;

(ii) Any other items consented to by the City Manager or arising out of any action taken by City; and

(iii) The exclusions, reservations, covenants, conditions and restrictions herein contained.

(b) Offeror shall cause to be issued to City a CLTA standard owner's policy of title insurance dated the date of recordation of this Offer in the amount of Five Hundred Thousand Dollars ($500,000.00) insuring title in City subject to the exceptions set forth in Section 1.5(a).

Section 1.6 Reservation of Easements and Other Rights. Offeror hereby reserves in perpetuity for, holds title to and on behalf of SMC and shall grant to SMC, pursuant to the Holding Agreement, the following interests in real property within the Dedication Area together with the right to grant and transfer the same to SMC:

(a) All minerals, coal, oil, gas, petroleum and other hydrocarbon substances in and under the Dedication Area, it being expressly understood and agreed that Offeror, its successors and assigns shall retain the exclusive title and right to remove said substances, together with the sole right to negotiate and conclude leases and agreements with respect to all such substances under the Dedication Area and to use those portions of the Dedication Area which underlie a plane parallel to and 500 feet below the present surface of the Dedication Area for the purposes of prospecting for, developing and/or extracting such substances from the Dedication Area by means of wells drilled into or through such portions of the Dedication Area from drill sites located on other property; it being further expressly understood and agreed that Offeror, its successors and assigns shall have no right to enter upon the surface of the Dedication Area or to use the Dedication Area or any portion thereof above the level of the aforesaid 500 foot subterranean plane.

ARTICLE II
USE RESTRICTIONS

Section 2.1 Permitted Uses.

(a) At any time prior to acceptance of this Offer, without consideration therefor, SMC shall have the right (consistent with the provisions of the Deed of Conservation Easement recorded concurrently herewith) to (i) conduct ranching activities on the Dedication Area; (ii) use agricultural and construction equipment to repair and construct waterlines, roads, fences and agriculturally-related buildings, structures and facilities on the Dedication Area; and (iii) allow the construction and maintenance of a hiking and equestrian trail across the southern portion of the Dedication Area.

(b) City acknowledges that the Dedication Area is adjacent to other land owned by SMC and its affiliates, which land is used for grazing cattle and farming operations. In order to protect such adjacent lands, SMC and its employees and agents shall have the right to enter upon the Dedication Area for purposes of spraying, removing or otherwise controlling the growth and spread of artichoke thistle.

(c) Offeror shall not use the Dedication Area in a manner not permitted by City's applicable zoning regulation. Prior to acceptance of this Offer, Offeror shall use reasonable efforts to provide adequate security for the Dedication Area to prevent members of the public from trespassing onto the Dedication Area.

(d) If City accepts this Offer and if City also acquires the conservation easement created by the Deed of Conservation Easement recorded concurrently herein ("the Deed"), City's use of the Dedication Area shall be subject to the restrictions set forth in Section 4 of the Deed, each of which are incorporated herein by this reference and each of which is hereby made a covenant running with the land. A copy of Section 4 of the Deed is attached hereto as Exhibit "C" and incorporated herein by this reference. It is the intention of Offeror and City that this paragraph shall limit City's use of the Dedication Area even if a court of competent jurisdiction determines that City's acquisition of the easement created by the Deed and City's acquisition of the Fee pursuant to this Offer effects a merger of title.

ARTICLE III
MISCELLANEOUS

Section 3.1 Binding Effect. Except as otherwise provided herein, all terms, conditions, restrictions, exclusions and reservations of this Offer, and the acquisition of the Dedication Area by acceptance thereof, shall be binding upon and inure to the benefit of City and Offeror, and their respective successors and assigns. It is the intent of Offeror that the covenants, conditions and restrictions set forth herein shall run with the land.

Section 3.2 Severability. Each of the provisions of this Offer shall be deemed independent and severable, and the invalidity or partial invalidity of any provision or portion hereof shall not affect the validity or enforceability of any other provision.

Section 3.3 Counterparts. This Offer may be executed in any number of counterparts, each of which shall be an original but all of which shall constitute one and the same instrument.

Section 3.4 Indemnification. Offeror hereby agrees to indemnify, defend and hold City harmless from and against any liabilities, claims, demands, losses, damages, costs and expenses (including, without limitation, attorneys' fees) arising out of or relating to (i) the location, development, operation or use of the easements reserved by Offeror and identified in Section 1.6 and (ii) Offeror's permitted use of the Dedication Area as described in Section 2.1.

Section 3.5 Notices. All notices required or permitted by this Offer shall be in writing and may be delivered in person to either party or may be sent by registered or

certified mail, with postage prepaid, return receipt requested or delivered by Express Mail of the U.S. Postal Service or Federal Express or any other courier service guaranteeing overnight delivery, charges prepaid, or may be transmitted by facsimile transmission and addressed as follows:

If to Offeror at:

Santa Margarita Company
30211 Avenida de las Banderas
Rancho Santa Margarita, CA 92688
Attention: Thomas C. Blum/Richard Broming

With a copy to:

Pettis, Tester, Kruse & Krinsky
18881 Von Karman Avenue, Suite 1600
Irvine, CA 92715
Attention: Bruce Tester

If to City at:

City of San Clemente
100 Avenida Presidio
San Clemente, CA 92672
Attention: City Manager

Any such notice sent by registered or certified mail, return receipt requested, shall be deemed to have been duly given and received seventy-two (72) hours after the same is so addressed and mailed in Orange County with postage prepaid. Notices delivered by overnight service shall be deemed to have been given twenty-four (24) hours after delivery of the same, charges prepaid, to the U.S. Postal Service or private courier. If any notice is transmitted by facsimile transmission or similar means, the same shall be deemed served or delivered upon confirmation of transmission thereof. Any notice or other document sent by any other manner shall be effective only upon actual receipt thereof. Any party may change its address for purposes of this Section by giving notice to the other party as herein provided. Unless notified in writing otherwise by any of the Offerors, SMC is designated as the recipient of any notice on behalf of the Offeror.

Section 3.6 Exhibits. All exhibits attached hereto and referred to herein are incorporated in this Offer as though fully set forth herein.

Section 3.7 Required Consent. By executing and delivering this Offer, SMC consents to the execution and delivery

of this Offer by Offeror as required by the Holding Agreement. Notwithstanding any other provision of this Offer, SMC's consent to the execution and delivery of this offer shall in no way alter, amend or extinguish any of the rights or obligations of Offeror regarding the Dedication Area as set forth in the Holding Agreement.

Section 3.8 SMC Rights. All parties hereto expressly acknowledge that this Offer is being executed and delivered by Offeror on behalf of SMC. All rights of any nature whatsoever retained by Offeror hereunder are for the benefit of SMC as fully as if SMC were the Offeror hereunder.

IN WITNESS WHEREOF, Offeror has duly executed this Offer of Dedication as of the 22nd day of May, 1990.

"Offeror"

Arvida/JMB Partners, L.P.-II,
a Delaware limited partnership

By: Arvida/JMB Managers-II, Inc., an Illinois corporation, General Partner

By: _____
John C. Yelverton,
Vice President

"SMC"

Santa Margarita Company, a California corporation

By: _____
Thomas C. Blum,
Executive Vice President

STATE OF CALIFORNIA)
) ss.
COUNTY OF ORANGE)

On _____, 1990, before me, the undersigned, a Notary Public in and for said County and State, personally appeared John C. Yelverton, personally known to me or proved to me on the basis of satisfactory evidence to be the person that executed this instrument as Vice President on behalf of Arvida/JMB Managers-II, Inc., an Illinois Corporation, General Partner, therein named that executed the within instrument on behalf of Arvida/JMB Partners, L.P.-II, a Delaware limited partnership, and acknowledged to me that said corporation executed the within instrument as general partner of said partnership, and pursuant to its Bylaws or a resolution of its board of directors.

WITNESS my hand and official seal.

_____
Notary Public in and for said State

[SEAL]

STATE OF CALIFORNIA)
) ss.
COUNTY OF ORANGE)

On May 22, 1990 before me, the undersigned, a Notary Public in and for said County of State, personally appeared Thomas C. Blum, personally known to me or proved to me on the basis of satisfactory evidence to be the Executive Vice President of SANTA MARGARITA COMPANY, a California corporation, the corporation that executed the within instrument, known to me or proved to me on the basis of satisfactory evidence to be the person who executed the within instrument on behalf of the corporation therein named, and acknowledged to me that said corporation executed the within instrument pursuant to its bylaws or a resolution of its board of directors.

WITNESS my hand and official seal.

Carole A Watson

Notary Public in and for said State

[SEAL]

OFFICIAL SEAL
CAROLE A WATSON
NOTARY PUBLIC - CALIFORNIA
ORANGE COUNTY
My comm. expires FEB 18, 1992

CERTIFICATE OF ACCEPTANCE

This is to certify that, by order of the City Council of the City of San Clemente on May 23, 1990, the City of San Clemente hereby approves the form and content of the Irrevocable Offer of Dedication, dated May 23, 1990, from Arvida/JMB Partners, L.P.-II, a Delaware limited partnership, to the City of San Clemente, a political corporation, and consents to the recordation of it in the official Records of the County of Orange.

CITY OF SAN CLEMENTE

By: Candace Haggard
Mayor

Approved as to Form:

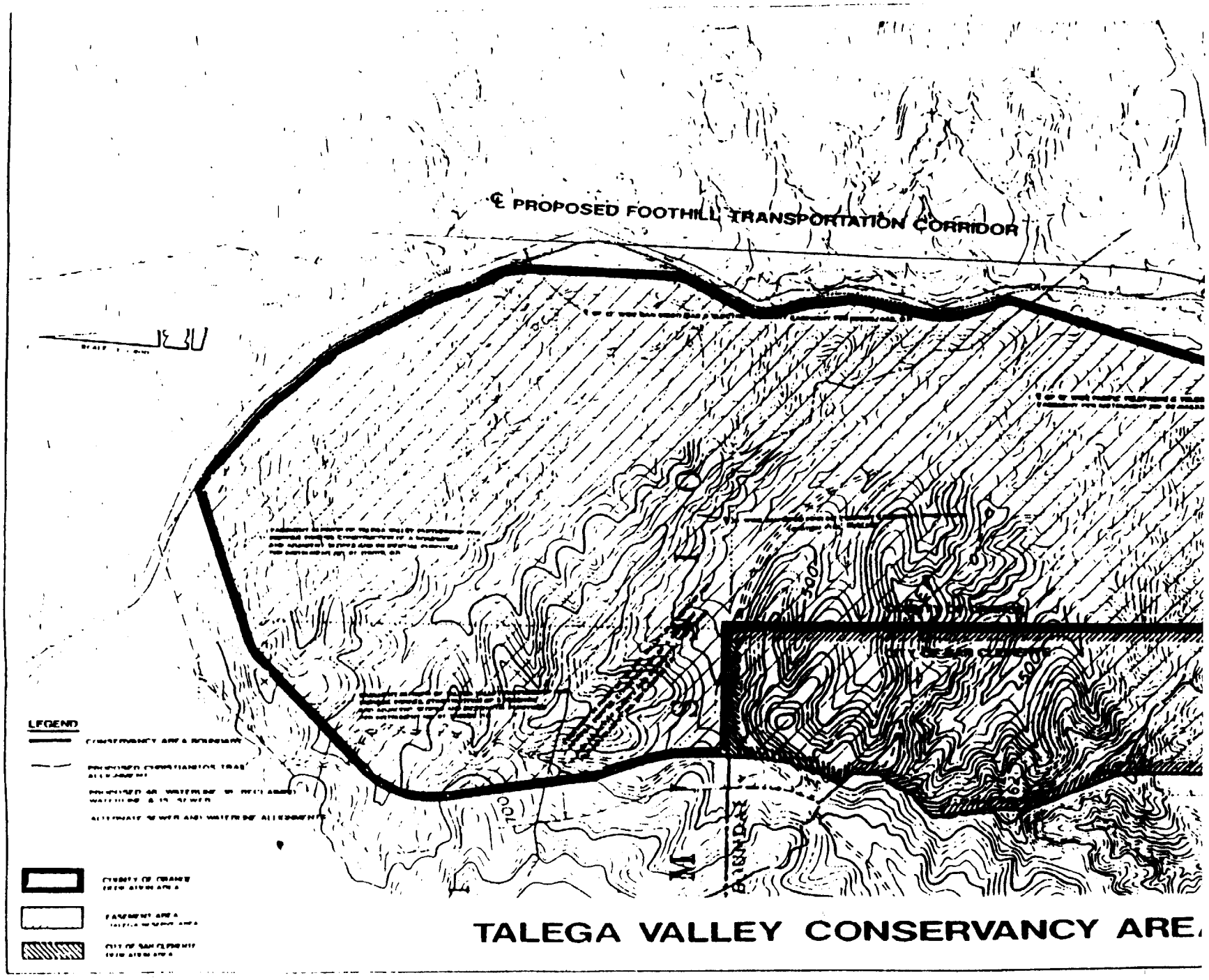
/s/ Jeff Goldfarb
Assistant City Attorney

STATE OF CALIFORNIA)
COUNTY OF ORANGE) SS.
CITY OF SAN CLEMENTE)

On this 25th day of May, in the year 1990, before me, the undersigned, the City Clerk of the City of San Clemente, personally appeared Candace Haggard, known to me to be the Mayor of the City of San Clemente and known to me to be the person who executed the within instrument on behalf of the City of San Clemente, and acknowledged to me that such public corporation executed the same.

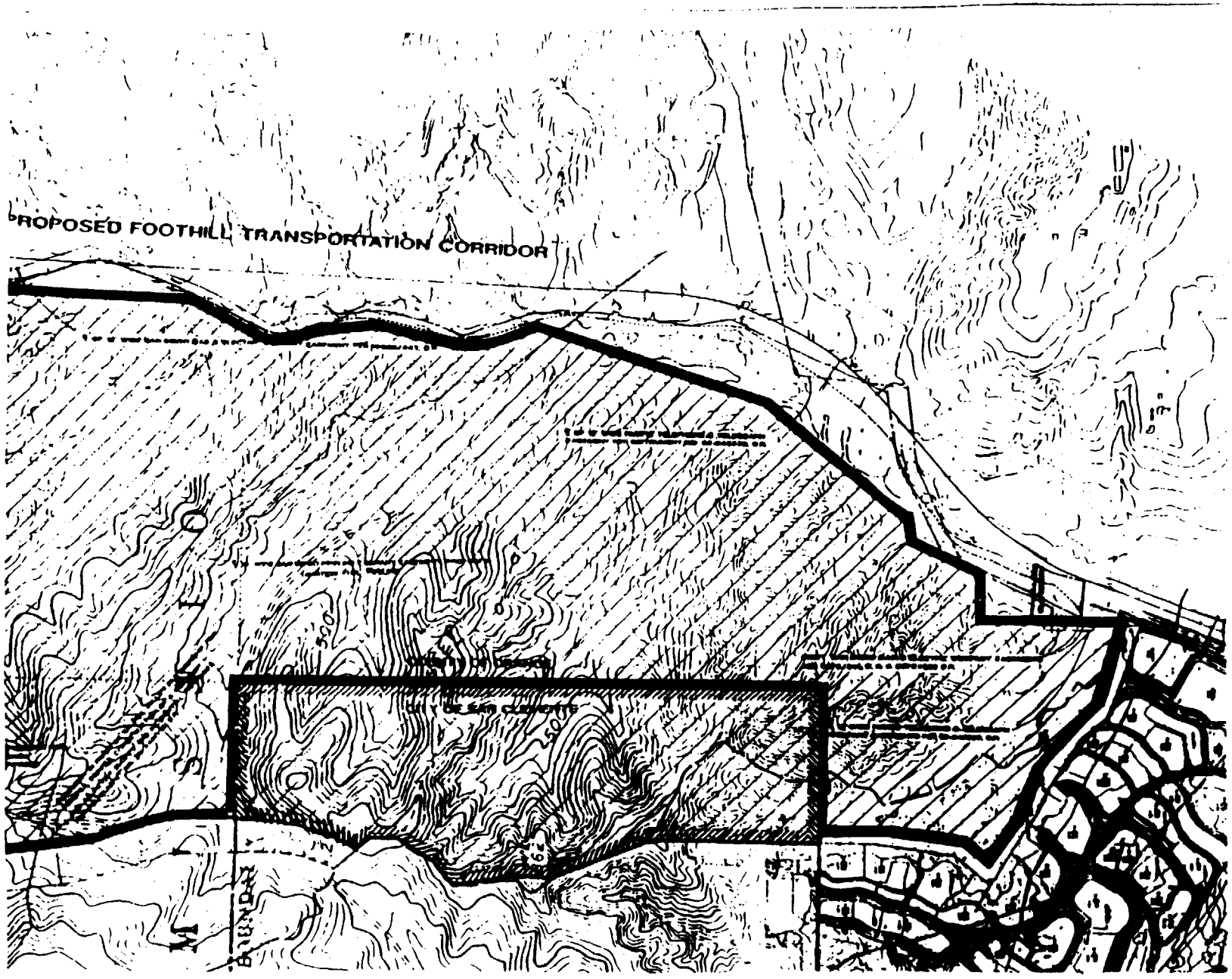
Myrna Erway
CITY CLERK of the City of
San Clemente

EXHIBIT A



TALEGA VALLEY CONSERVANCY ARE

EXHIBIT A (Continued)



LEGA VALLEY CONSERVANCY AREA

CONSULTING CIVIL ENGINEERS AND LAND SURVEYORS

90105(A)
03-01-90
Revised
04-02-90
05-15-90

LEGAL DESCRIPTION
TALEGA VALLEY CONSERVANCY AREA
(CITY OF SAN CLEMENTE)

That portion of the Rancho Mission Viejo or La Paz, in the City of San Clemente, County of Orange, State of California, as shown on a map thereof recorded in Book 1, Pages 63 and 64, of Patents, in the office of the County Recorder of Los Angeles County, California, lying within Section 14, Township 8 South, Range 7 West, as shown on a map recorded in Book 9, Pages 15 through 22, of Records of Survey, in the office of the County Recorder of said Orange County, described as follows:

Beginning at the Southeast corner of said Section 14; thence North 89°15'50" West 1360.24 feet along the Southerly line of said Section 14; thence North 0°59'42" East 1518.96 feet; thence North 21°00'18" West 975.00 feet; thence North 1°34'42" East 375.00 feet; thence North 8°40'18" West 545.00 feet; thence North 49°39'42" East 285.00 feet; thence North 33°09'42" East 370.00 feet; thence North 0°09'42" East 235.00 feet; thence North 37°53'18" West 457.71 feet to the beginning of a non-tangent curve, concave Westerly having a radius of 1450.00 feet, a radial line to said curve bears South 63°49'13" East; thence Northerly 687.97 feet along said curve through a central angle of 27°11'05"; thence North 1°00'18" West 182.54 feet to the Northerly line of said Section 14; thence along said Northerly line and along the Easterly line of said Section 14, the following courses: South 89°15'50" East 1537.18 feet and South 0°43'19" West 5278.83 feet to the point of beginning.

EXCEPTING therefrom that portion described as follows:

A strip of land, 350.00 feet in width, the Westerly line of said strip being described as follows:

Commencing at the Northeast corner of said Section 14; thence North 89°15'50" West 1537.18 feet along said Northerly line of Section 14 to the TRUE POINT OF BEGINNING; thence South 1°00'18" East 182.54 feet to the beginning of a tangent curve concave Westerly having a radius of 1450.00 feet; thence Southerly 687.97 feet along said curve through a central angle of 27°11'05" to Point "A".

Corporate Office • 17782 Sky Park Blvd. • Irvine, California 92714 • 714/261-2222 • FAX# 474-9120
Inland Empire Office • 1101 S. Milliken Ave., Ste. G • Ontario, California 91761 • 714/988-7880 • FAX# 988-5299
San Diego County Office • Carlsbad, California 92008 • 619/438-4332

90105(A)
03-01-90
Revised
04-02-90
05-15-90

The Easterly line of said strip to be shortened to terminate Northerly in said Northerly line of Section 14 and prolonged to terminate Southerly in a line which bears South 37°53'18" East and passes through said Point "A".

Contains an area of 175.709 acres, more or less.

Subject to covenants, conditions, reservations, restrictions, rights of way and easements, if any, of record.

JAMES F. GILLEN, LS 5557

LICENSED LAND SURVEYOR
JAMES F. GILLEN
Exp. ——
No. 5557
STATE OF CALIFORNIA

EXHIBIT C

Restrictions as Set Forth in Section 4 of the Deed of Conservation Easement Recorded Concurrently Herewith

The following uses and practices on the Easement Area are inconsistent with the purposes of the Easement and shall be prohibited unless otherwise permitted in the exercise of Grantor's reserved rights:

a. The damage or impairment of natural ecological values or the destruction of other significant conservation interests in the violation of the Easement, except as otherwise provided by this Deed.

b. The planting of commercial agricultural crops or the conversion of native vegetation to new or exotic species.

c. The introduction of non-native plant or animal species except cattle.

d. Hunting or trapping.

e. Use of the Easement Area for the purpose of recreational, residential, commercial, retail or industrial development except as otherwise specifically permitted herein (e.g. the riding and hiking trail referred to in Paragraph 3(f) hereof).

f. The construction or placement of any mobilehomes, trailers, signs, billboards or other advertising material or any other structures except as otherwise provided herein.

g. The use of motor vehicles, except as incidental to and as needed for the purposes permitted by this Deed.

h. The dumping of ashes, trash, garbage or other unsightly, offensive or toxic material.

i. The removal, destruction or cutting of trees or plants, except for artichoke thistle and other trees or plants agreed to by Grantor and Grantee or as otherwise permitted by this Deed.

j. The storage or use of biocides and agricultural chemicals except as may be necessary to protect the native vegetation which is of conservation value and threatened by the invasion of exotic material from outside the Easement Area.

k. The changing of the topography through the placing of soil, dredging soils, landfill or other material.

l. Filling, excavating, dredging, mining, drilling or removal of topsoil, sand, gravel, rock, minerals or other materials.

m. The alteration or manipulation of existing patterns of water drainage or of water quality.

n. Plowing, drilling seed, or any other farming activity which would disturb the soil surface.

SUPPORTING TECHNICAL DOCUMENTS

Part One

1. South Coast Air Quality Management District, Improvement of Specific Emission Factors (BACM Project No. 1), Final Report (March 29, 1996).
2. Beier, P. 1993. Determining minimum habitat areas and habitat corridors for cougars. Conservation Biology 7:94-108.
3. Bittner, D. 2001. Letter to Dan Silver regarding golden eagle activity in Orange County, June 6, 2001. 2pp.
4. Bloom, PH. 1994. The biology and current status of the Long-eared Owl in coastal southern California. Bull. So. Calif. Acad. Sci. 93(1).
5. Clevenger, A.P., and N. Waltho. 1999. Factors influencing the effectiveness of wildlife underpasses in Banff National Park, Alberta, Canada. Conservation Biology 14:47-56.
6. Clevenger, A.P., B. Chruszcz, and K. Gunson. 2001. Drainage culverts as habitat linkages and factors affecting passage by mammals. J. Applied Ecology 38:1340-1349.
7. Forman, R.T.T., and R.D. Deblinger. 2000. The ecological road-effect zone of a Massachusetts (U.S.A) suburban highway. Conservation Biology 14:36-46.
8. Horn, M., M. Carlin, T.L. Eagan, M. Erickson, C. Jones, W. Loeffler, and G. Nishiyama. 1993. A regional landscape approach to maintaining biodiversity: Protected areas in Orange County and environs. Pages 69-83 in J.E. Keeley, Ed. Interface between ecology and land development in California. Southern California Academy of Sciences, Los Angeles, CA.
9. Jones, J.A., F.J. Swanson, B.C. Wemple, and K.U. Snyder. 2000. Effects of roads on hydrology, geomorphology, and disturbance patches in stream networks. Conservation Biology 14:76-85.
10. Ng, S.J., J.W. Dole, R.M. Sauvajot, S.P.D. Riley, and T.J. Valone. 2004. Use of highway undercrossings by wildlife in southern California. Biological Conservation 115:499-507.
11. Spencer, W.D. In Press. Recovery research for the endangered Pacific pocket mouse: An overview of collaborative studies. Symposium Proceedings. Planning for Biodiversity: Bringing Research and Management Together. U.S. Geological Survey, Biological Resources Division, and U.S. Forest Service. USDA Forest Service Gen. Tech. Rep. PSW-GTR-xxx.
12. Spencer, W.D.; Schaefer, C.; Dodd, S.; Montgomery, S.J. 2000a. Pacific pocket mouse studies program Phase I report: Task 1, translocation feasibility, and Task 3, dispersal characteristics. Unpublished report prepared for Foothill/Eastern Transportation Corridor Agencies and U.S. Fish and Wildlife Service. January 2000.

Part Two

13. Spencer, W.D.; Schaefer, C.; Dodd, S.; Montgomery, S.J.; Holland, H. 2000b. Pacific pocket mouse studies program Phase II report. Task 5, translocation receiver site study, Task 6, laboratory surrogate study, and Task 7, field surrogate study. Unpublished report prepared for Foothill/Eastern Transportation Corridor Agencies and U.S. Fish and Wildlife Service. May 2000.

14. Spencer, W.D.; Schaefer, C.; Dodd, S.; Montgomery, S.J.; Holland, H. 2001. Pacific pocket mouse studies program Phase III report. Task 5, translocation receiver site study, Task 6, laboratory surrogate study, Task 7, field surrogate study, and other associated studies. Unpublished report prepared for Foothill/Eastern Transportation Corridor Agencies and U.S. Fish and Wildlife Service. February 2001.

15. Spencer, W.D., M.D. White, and J.A. Stallcup. 2001. On the global and regional ecological significance of southern Orange County: conservation priorities for a biodiversity hotspot. Unpublished Report. Prepared for Endangered Habitats League. 44pp.

16. Brylski, Phillip, Loren Hays, and Jon Avery. 1998. Recovery plan for the Pacific Pocket Mouse. Published by the U.S. Fish & Wildlife Service. September 1998

REC'D AUG 06 2004

SUPPORTING TECHNICAL DOCUMENTS

(Part 1 of 2)

Volume 3

Supporting Technical Documents to Comment Letter
Prepared by Shute, Mihaly & Weinberger LLP for
the South Orange County Transportation
Infrastructure Improvement Project

Pacific Pocket Mouse Studies Program

Phase II Report:

Task 5- Translocation Receiver Site Study
Task 6- Laboratory Surrogate Study
Task 7- Field Surrogate Study

Prepared for:

Foothill/Eastern Transportation Corridor Agency

And

U.S. Fish and Wildlife Service

Prepared by:

Principal Investigator
Wayne Spencer, Ph.D.
Conservation Biology Institute

Project Manager
Christina Schaefer
KEA Environmental

KEA ENVIRONMENTAL, INC

Contributing Researchers
Shana Dodd
Stephen J. Montgomery
Charles Holland

Final
Pacific Pocket Mouse Studies Program

Phase II Report:
Task 5 – Translocation Receiver Site Study
Task 6 – Laboratory Surrogate Study
Task 7 – Field Surrogate Study

Prepared For:

Foothill/Eastern Transportation Corridor Agency
and
U.S. Fish and Wildlife Service

Prepared By:

Principal Investigator
Wayne D. Spencer, Ph.D.
Conservation Biology Institute

Project Manager
Christina Schaefer
KEA Environmental

Contributing Researchers
Shana Dodd
Stephen J. Montgomery
Charles Holland

May 2000

TABLE OF CONTENTS

Section **Page**

ABSTRACT v

ACKNOWLEDGEMENTS ix

INTRODUCTION 1

TASK 5 – TRANSLOCATION RECEIVER SITE STUDY 3
- Methods 3
- Results and Discussion 7
- Conclusions and Recommendations 15

TASK 6 – LABORATORY SURROGATE STUDY 17
- Methods 17
- Results and Discussion 20
- Conclusions and Recommendations 23

TASK 7 – FIELD SURROGATE STUDY 25
- Methods 25
- Results and Discussion 30
- Conclusions and Recommendations 36

RECOMMENDED PHASE III STUDIES 39

REFERENCES CITED 43

TABLE OF CONTENTS

APPENDICES

A Responses to Comments by Scientific Peer Reviewers, Pacific Pocket Mouse Studies Program, Phase II Report

B Soil Types in Orange and San Diego Counties, Ranked for Potential to Support Pacific Pocket Mice

C Data Sheet for Initial Habitat Quality Reconnaissance at Potential PPM Translocation Receiver Sites

D Analysis of Genetic Diversity in the Pacific Pocket Mouse (*Perognathus longimembris pacificus*): a Proposal from Dr. James Patton

E Summary data on *Perognathus longimembris bangsi* captures on the Snow Creek Study Grids, 1999

F Measurements on *Perognathus longimembris longimembris* individuals used in laboratory marking experiment, 1999

LIST OF FIGURES

Figure		Page
1	Habitat Potential to Support Translocated Pacific Pocket Mouse Populations and Areas Recommended for Field Evaluation, Camp Pendleton and Orange County	8
2	Habitat Potential to Support Translocated Pacific Pocket Mouse Populations and Areas Recommended for Field Evaluation, San Diego County	9
3	Example of Orthophoto Field Map, Point Loma	13
4	Body Weight Changes in *Perognathus longimembris longimembris* After Application of Various Marking Techniques	20
5	Location of Snow Creek Study Grids	27
6	Captures of New *Perognathus longimembris bangsi* Individuals, Recaptured Individuals, Total Individuals, and Cumulative Individuals on the Two Snow Creek Study Grids	35

LIST OF TABLES

Table		Page
1	Potential of Soils to Support PPM Based on Soil Surface Horizon Texture	5
2	Potential of Coastal Vegetation Communities to Support PPM	6
3	Determination of Overall Habitat Potential to Support PPM Based on Soils and Vegetation	6
4	Acreage of Potential PPM Habitat in Orange and San Diego Counties	10
5	Summary of *P. l. bangsi* Capture Data During the First and Second Trap Sessions	31
6	Summary of Activity Data Means for the Two Snow Creek Study Grids	33
7	Spearman Rank Correlations for Activity Measures on the Two Snow Creek Study Grids	34

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ABSTRACT

During Phase II (1999) of the Pacific pocket mouse (PPM; *Perognathus longimembris pacificus*) study program, the study team focused on several tasks identified during Phase I as high priority for steering recovery of the species: (1) a systematic search for possible translocation receiver sites, (2) a controlled laboratory investigation of alternative marking techniques using an unlisted surrogate subspecies, *P. l. longimembris*, and (3) a field surrogate study using the unlisted *P. l. bangsi* to test marking and other study techniques before applying them to the endangered PPM. These studies were also designed to gain basic biological information on *P. longimembris*. The team continued coordinating with research tasks being performed by others, including population genetics studies and ongoing monitoring studies and habitat management experiments at extant PPM sites.

A simple GIS habitat evaluation model was developed using existing digital soils and vegetation maps to identify, at a coarse scale, sites worthy of further evaluation as PPM translocation receiver sites. The study area included an 8-km strip along the Pacific coast for the length of Orange and San Diego counties. Field reconnaissance has begun in areas identified as potentially suitable PPM habitat by the GIS model. A rapid field evaluation procedure has been derived and will be used during the winter of 1999-2000 to identify 5 to 10 sites worthy of more intensive, quantitative evaluation as potential translocation receiver sites.

Four individual marking techniques were tested on *P. l. longimembris* in the laboratory: color-coded surgical sutures; custom-designed, miniature ear tags; subcutaneous PIT tags; and toe clipping. All marking groups maintained or slightly increased body weight during the trials, and most individuals remained healthy and active in comparison with control (unmarked) individuals. However, the techniques varied in cost, ease of application, mark retention, and at least short-term effects on health and behavior. Surgical sutures were ruled out as a useful marking technique due to difficulties in applying and reading the marks, obvious discomfort to the animals, and an unacceptably high rate of loss of the marks due to individuals scratching at the sutures. Ear tags were also ruled out due to inflammation and tearing of the ears and an unacceptable tag loss rate. PIT tags inserted using hypodermic syringes are endorsed for further evaluation, although concerns remain about their long-term health effects. Toe clipping appears to be the easiest, most reliable, and least harmful of the techniques, and is endorsed for further study and for use on PPM.

Two 0.5-ha study grids were established in *P. l. bangsi* habitat near Snow Creek, in the Coachella Valley, California. One grid used a 7-m inter-trap spacing (10 x 10 grid = 100 total trap stations) and the other a 5-m inter-trap spacing (14 x 14 grid = 196 trap stations). The grids were trapped with two traps per station for eight nights in July through August and for two nights in September 1999. All captured *P. l. bangsi* were toe clipped, and subsamples were also fitted either with ear tags or PIT tags. Results suggest that the closer trap spacing may be more effective in sampling the resident population (although differences were not statistically significant), and the 14 x 14-station grid is endorsed for continued use in this surrogate study and possibly for use on PPM. The denser trap grid captured more individual *P. l. bangsi* in fewer nights than the other grid. The denser grid also captured equal numbers of males (22) and females (22), whereas the other grid captured a predominance of males (24) over females (9). On the less dense grid, recaptures of marked individuals occurred more frequently at only a single trap station than on the denser grid, where individuals seemed to encounter more trap stations within their nightly travels.

Ear tags do not appear to be an acceptable marking technique based on the field results due to problems with ear inflammation, tearing, and tag loss. Toe clipping is recommended as a safe and reliable field marking method for the PPM. PIT tags are also endorsed for continued testing on surrogates to investigate their long-term health effects before tagging PPM.

Based on results of these Phase II studies, the team recommends the following studies for Phase III (year 2000):

- Continued field reconnaissance and ranking of those areas identified by the GIS model as high and moderate potential for PPM introductions. The model should also be refined based on recent results of USFWS soils analyses at the Oscar One site. The 5 to 10 sites receiving the highest field rankings should then be subjected to more intensive and quantitative evaluations during summer 2000 and compared with extant and historic PPM sites to determine their probability of success as receiver sites. These studies should quantitatively assess and compare vegetation composition and structure, soil suitability, resident rodent community, and abundance of likely PPM predators and competitors on these sites to identify characteristics favoring or disfavoring PPM introductions. Discussions with land-use authorities should also commence regarding the potential for translocations and associated management issues.

- Continued testing of the health effects of PIT tags using the laboratory population of *P. l. longimembris*. The sample of PIT-tagged individuals should be increased, and the health and

activity of these individuals should be tracked through the year 2000. The team should also investigate use of this laboratory population to test captive breeding methods for PPM, perhaps in partnership with the Center for Reproduction of Endangered Species (CRES) or other groups experienced with captive breeding programs.

- Continued trapping of the Snow Creek study grids using 5-m trap spacing during at least three seasons (pre-breeding, peak-breeding, and post-breeding). This study should be used to further test our study techniques and to improve our abilities to age individuals and track reproductive condition, population demography, and other aspects of species biology. The team should also begin experimenting at the study grids with such translocation tools as enclosures or artificial burrow systems to evaluate their application to a PPM translocation program.

- Continued coordination with other PPM studies, such as (1) ongoing population monitoring and experimental habitat manipulations at extant PPM sites, and (2) population genetics studies by Dr. James Patton and others on *P. longimembris*. We also endorse broadening the genetics study to include use of both mitochondrial DNA and nuclear microsatellite DNA. Data from these studies should be integrated into decisions concerning PPM recovery, including the design of a translocation program and possibly a captive breeding program.

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ACKNOWLEDGEMENTS

Laura Coley Eisenberg continued to provide excellent leadership and the financial support of the Transportation Corridor Agencies (TCA). Comments and email discussions with the scientific peer committee (James Patton, William Longland, Howard Shellhammer, Nicholas Holler, Michael Wooten, Karen Messer, and Richard Reading) were invaluable in guiding these studies. Jay Diffendofer has been added to the peer review committee. Jay is an expert in conservation biology with a strong background in the population biology of mammals and statistical design for population studies. In recent months, Jay has provided helpful advice on statistical methods for trapping design and translocation protocol. Robert Graham provided his expertise in soil science and assisted in the ranking of soils for the habitat evaluation model. Wendy Barto performed all GIS work included in the report, with direction from Pat Atchison. GIS data were used with the permission of the San Diego Association of Governments and County of Orange, with special thanks to Gary Meideros. Kris Beaver cared for the laboratory population of *Perognathus longimembris longimembris* and made careful, thorough measurements and observations of the animals for the duration of the study. Dr. Anthony Michael, a veterinarian, volunteered his expertise, time, and materials to assist with the laboratory marking experiment. Mark Pavelka and Loren Hays of the U.S. Fish and Wildlife Service provided sage advice and lively discussion throughout the study. Mark shared his unmatched experience with PPM, and Loren his unmatched experience with recovery planning in southern California. John Gustafson of the California Department of Fish and Game also provided wise input to the planning of this project, and expedited permit amendments for the marking and handling of sensitive mammals. Scott Fleury assisted with statistical analyses, and Jerre Stallcup reviewed sections of the report. William Berry and Deborah Bieber provided coordination with Marine Corps Base Camp Pendleton.

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INTRODUCTION

Phase I of the Pacific pocket mouse (PPM; *Perognathus longimembris pacificus*) studies program concluded with a recommendation by the recovery research team for several new or refocused study tasks. The studies were recommended to better answer those questions most critical to implementation of the PPM recovery program. This Phase II report summarizes results to date on these tasks.

Specifically, the Phase I report recommended 5 study tasks:

1. A systematic review of potential translocation receiver sites based on habitat suitability, land ownership, and planned land uses.

2. An intensive, multiyear study of a nonlisted subspecies of *P. longimembris* to test field techniques before using them on PPM, to gain basic biological information on the species, and to test potential translocation methods.

3. An intensive multiyear study of PPM, informed by results of the foregoing surrogate study and designed to obtain essential population demographic, natural history, and other data on PPM.

4. A population genetics study to establish baseline measures of genetic diversity within and between extant and historic PPM populations.

5. Continued monitoring of extant PPM populations with some modifications to the techniques intended to maximize value of the data obtained.

Based on these recommendations, the Transportation Corridor Agencies (TCA) agreed to fund the first two studies during 1999, along with a related study of marking techniques using a laboratory population of a nonlisted subspecies of little pocket mouse (*P. l. longimembris*). These three study tasks are the primary focus of this Phase II report. Hereafter, they are referred to as Task 5 – Translocation Receiver Site Study, Task 6 – Laboratory Surrogate Study, and Task 7 – Field Surrogate Study.

In addition, the study team has continued coordinating with other researchers on related research tasks, including those recommended in the Phase I report. Although this report does not focus

on efforts not included in our work scope, we continue coordinating with the research tasks listed below and report on their progress where appropriate.

1. Dr. James Patton and students at UC Berkeley have initiated the population genetics study using Section 6 funding from the U.S. Fish and Wildlife Service (USFWS) and California Department of Fish and Game (CDFG).

2. Fieldwork for the translocation receiver site study is also being performed using Section 6 funding, primarily by Shana Dodd and Steve Montgomery. These efforts are closely coordinated with the results of the Task 5 efforts funded by the TCA and are, therefore, summarized in this document.

3. Shana Dodd and Steve Montgomery are also implementing experimental habitat thinning at the Dana Point Headlands site to improve PPM habitat conditions with the intent to increase population size. This effort, using Section 6 funding, included pre-thinning trapping of experimental and control plots during 1999. Select grid cells will be hand thinned of individual shrubs this winter, with follow-up trapping during spring/summer 2000. Similar habitat management efforts are being discussed for the San Mateo North and South sites on Marine Corps Base Camp Pendleton.

4. Finally, population monitoring has continued on the extant PPM populations by various parties under various funding arrangements. Some of the recommended modifications to the monitoring program are being implemented, such as collection of genetics samples for analysis by Dr. Patton.

TASK 5 – TRANSLOCATION RECEIVER SITE STUDY

During Phase I the study team concluded that PPM recovery would likely require an active reintroduction or translocation program, but that it was unclear whether sufficient suitable habitat remained to institute such a program. We therefore recommended a systematic review to identify areas that might serve as translocation receiver sites, and to rank such sites based on habitat, degree of protection, and other pertinent factors. During this Phase II period, the study team used existing digital data to identify, at a coarse scale, areas within coastal Orange and San Diego Counties that had suitable soils and vegetation to support PPM, and began rating these sites in the field for other suitability criteria. Please note that these results are preliminary and subject to change with new information.

METHODS

We developed a simple habitat evaluation model based on existing geographic information system (GIS) data layers and applied it to coastal Orange and San Diego Counties. Los Angeles County, which also historically supported PPM, is not included because very few native coastal habitat areas remain. Furthermore, most of the remnant undeveloped areas in Los Angeles County (e.g., portions of LAX Airport and the Palos Verdes Peninsula) have been well surveyed for PPM and are generally considered unsuitable to support the species due to inappropriate soils, habitat degradation, abundant exotic species (including nonnative rodents), and other factors (W. Spencer, personal observations; P. Behrends, S. Montgomery, and M. Pavelka, personal communications; Ogden and Dames and Moore 1999). Although it is possible that remnant habitats in Los Angeles County harbor an extant PPM population, they are not considered suitable for a possible PPM reintroduction to Los Angeles County at this time.

The purpose of the GIS habitat model was to eliminate from consideration areas of Orange and San Diego Counties that are clearly unsuitable for PPM reintroduction, and to identify areas deserving further evaluation. Hence, the model was designed to be conservative, erring on the side of overestimating rather than underestimating potential habitat value for PPM. This conservative approach recognizes that available digital information for soils and vegetation is coarse in scale relative to PPM habitat selection and may have inaccuracies. This conservative approach also helps avoid prematurely ruling out potential receiver sites before they can be more accurately evaluated in the field.

The model ranks PPM habitat suitability based on three criteria: distance from the Pacific coast, soil type (and phase), and vegetation community type, as described here:

Distance from coast – Sites within 8 km of the Pacific coast (measured from the main shoreline or the eastern shore of larger bays) were considered potentially suitable, and areas beyond 8 km unsuitable. Nearly all historic observations of PPM are within about 4 km of the coast, with a few as far as 6 km. Although the proximate reasons for this coastal association are unclear, biologists familiar with the species generally agree that some physical, climatic, or other coastal influence restricts the species distribution (Ference 1996). The inland limits of the study area were set at 8 km to conservatively include all areas that might meet the species requirements.

Soils – All soil types mapped within 8 km of the coast (USDA 1973, 1978) were ranked as having high, low, or no potential to support PPM (Appendix B). The ranking was based primarily on surface horizon texture (the soil "phase") modified as appropriate by depth of the surface horizon (A horizon), potential inclusions of other soil types or phases within mapped polygons, and soil-type modifiers (e.g., percent gravel or cobble). Dr. Wayne Spencer and Mark Pavelka developed the rankings in collaboration with Dr. Robert Graham, Professor of Soil Mineralogy and Pedology at U.C. Riverside. Dr. Graham's expertise was essential to ensure that our rankings did not oversimplify soil classification, that those physical factors most likely to affect burrowing or foraging abilities of little pocket mice were adequately addressed, and that we did not overlook other important considerations, such as the potential for high quality soil substrates to exist as "inclusions" within mapped soil polygons otherwise ranked as unsuitable.

Biologists familiar with PPM and related species generally agree that the texture and depth of surface soils are critical to habitat value for the species (Ference 1996). PPM are closely associated with fine sandy loams or loamy sands that are deep enough (probably at least 30 cm) and friable enough to allow burrowing. Heavier soils (high in clay content) preclude burrowing and are considered unsuitable. Intermediate textures (loams and silt loams) may have some habitat value, especially if they occur in association with more suitable sandy loams. Consequently, soil surface texture ratings were initially based on the classic soil textural triangle as summarized in Table 1.

These initial rankings based on soil surface texture were next modified as appropriate based on other attributes of a soil type, as listed in the detailed soil type descriptions (USDA 1973, USDA 1978). For example, a sandy loam might be decremented from high value to low value if its surface horizon is shallow (e.g., averages less than 10 inches deep) and overlays a rock or clay hardpan layer. Likewise, sandy loams with a high or very high gravel content, or that may be

Table 1
Potential of Soils to Support PPM Based on Soil Surface Horizon Texture

Texture of Surface Soil Horizon	Potential to Support PPM
Sands, loamy sands, and sandy loams (roughly, soils with <20% clay content and >50% sand)	High
Loams, silt loams, silts (roughly, soils with <50% sand content and >73% silt)	Low
Sandy clay loams, clay loams, silty clay loams, to clays (roughly, >20% clay content for sandier soils and >27% clay for siltier soils)	None

seasonally saturated with water, were decremented to low value. Conversely, a loam or silt loam soil might be elevated to high value if it contains inclusions of deep sandy loams. Soils that are clearly unsuitable for PPM, such as vertisols (saturated by water) were ranked as having no potential (see Appendix B for a complete listing of soil type ranks used in the model).

[Note: At the time this report was being finalized, the soil rankings were being modified based on recent results of detailed soils analyses and PPM microhabitat selection by the USFWS at the Oscar One site. The refined results will be incorporated into the Phase III report.]

Vegetation – The regional vegetation community digital maps developed for the southern California Natural Community Conservation Planning (NCCP) program (SANDAG and Ogden, 1997, for San Diego County; Orange County Planning and Development Services, 1993, for Orange County) were used to rank potential PPM habitat based on vegetation. PPM are generally thought to be associated with open coastal scrub habitats or grasslands and probably cannot persist in denser chaparral habitats, woodlands, forests, or moist habitats (e.g., riparian scrubs and other wetland communities). However, the mapping scale for the regional vegetation database is coarse relative to PPM habitat requirements, and vegetation communities are dynamic. Extensive areas mapped as chaparral, for example, may include open areas or patches of grasslands or coastal sage scrub that could be suitable for PPM. Similarly, fire or habitat management actions can convert dense or otherwise unsuitable habitat to more open or suitable conditions. Consequently, we did not wish the model to prematurely rule out natural vegetation communities that could possibly support PPM now, or that could support PPM in the future under active habitat management. Erring again on the side of conservatism, vegetation communities were therefore ranked for PPM value as summarized in Table 2.

Table 2
Potential of Coastal Vegetation Communities to Support PPM

Vegetation Community	Potential to Support PPM
Coastal scrubs (includes Diegan coastal sage scrub, coastal bluff scrub, maritime succulent scrub, alluvial fan scrub) and southern foredunes	High
Grassland (includes native perennial, nonnative annual grasslands, and ruderal areas)	High
Other natural habitats (including all chaparral woodlands, forests, marshes, and riparian vegetation communities)	Low
Agriculture, developed, disturbed, rock, open water	None

Model Structure – The above rankings were combined in a simple GIS overlay model to determine the overall habitat potential at all locations within the study area, as summarized in Table 3.

Table 3
Determination of Overall Habitat Potential to Support PPM Based on Soils and Vegetation

Soil Suitability	Vegetation Suitability	Potential to Support PPM
High	High	High
High	Low	Moderate
High	None	None
Low	High or Low	Low
None	High or Low	None

The logic behind this structure is as follows: Soils are considered the primary limiting factor for PPM habitat quality, at least in areas still supporting natural vegetation within 8 km of the coast. So long as the soils are highly suitable to support PPM, less suitable vegetation (e.g., chaparral) may reduce PPM habitat potential somewhat, but vegetation management (e.g., burning or thinning) might be used to increase habitat quality. Therefore, the presence of low quality vegetation on high quality soils only reduces the overall habitat potential to moderate. However, if the soils are low quality for PPM, the vegetation community type or vegetation management will probably have little effect on PPM habitat potential, and the overall rating reflects the soil potential (low). If either soils or vegetation are inappropriate (e.g., clay soils or agricultural fields), the site has no PPM potential.

The results of the model predictions were compared with the known extant PPM population sites and with the historic distribution of the PPM and found to be highly concordant (although no formal statistical tests were made). The primary purpose of the model is not to predict absolute probabilities of PPM occurrence or the need to perform surveys for PPM. Rather, the model is used solely to identify large blocks of natural habitat with the right combinations of soils and vegetation to warrant further investigation for their potential to accommodate translocated PPM populations.

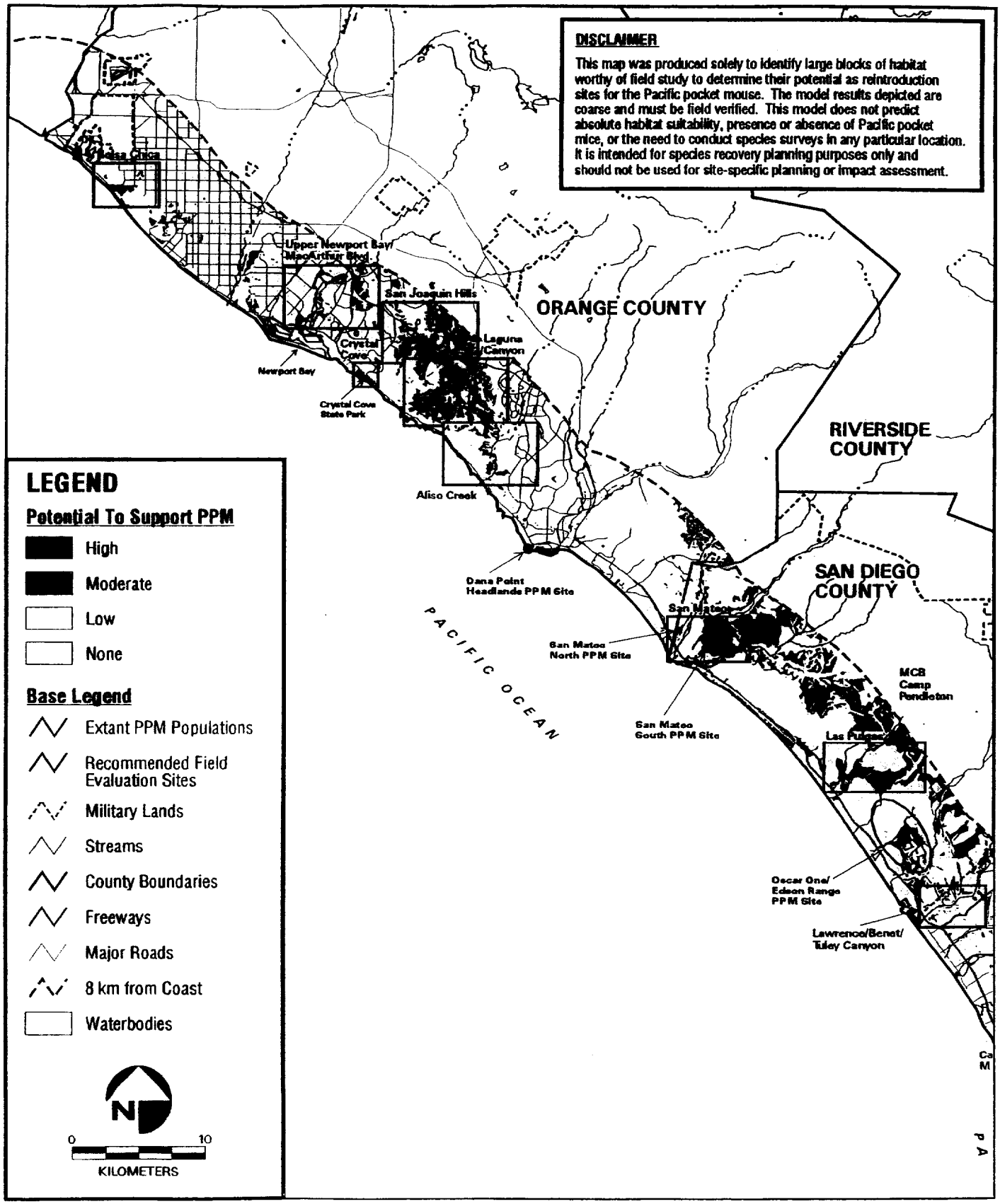
Relatively large (minimum about 50 acres) blocks of high and moderate value habitat were then identified on resultant maps for further study. Some of these blocks that are known by the study team to be biologically unsuitable based on previous field work, or that are otherwise unsuitable due to land-use restrictions or decisions, were omitted from further consideration. Clusters of other suitable habitat areas were outlined as field evaluation sites and for creation of field maps.

RESULTS AND DISCUSSION

Results of the habitat potential model are shown in Figures 1 and 2 and Table 4. These results surely overestimate the total acreage having potential to support PPM due to the conservative approach that was used in defining habitat potential. More refined results based on recent microhabitat analyses will be reported during Phase III.

The largest remaining blocks of contiguous natural habitat with potential to support PPM are found on Marine Corps Base Camp Pendleton in San Diego County and in the San Joaquin Hills/Laguna Canyon area of Orange County. Other notable but smaller areas of high quality habitat are concentrated at or near the following locations (listed from north to south): Bolsa Chica Ecological Reserve, Upper Newport Bay, Crystal Cove State Park, Aliso Creek, Lawrence Canyon/Benet Canyon/Tuley Canyon (in northern Oceanside, adjacent to Camp Pendleton), portions of northern and central Carlsbad (e.g., Calavera Heights, Dawson/Los Monos Reserve, and Macario Canyon), the Fieldstone/La Costa area, Del Mar Mesa, Torrey Pines State Park and extension, Point Loma, the U.S. Naval Radio Station in Coronado, and Tijuana River Valley.

Outside of these areas, potential habitat is highly fragmented due to development and agriculture. Nevertheless, the maps also illustrate that some of the extant PPM sites have persisted on very small, isolated habitat fragments (extant populations are illustrated in blue on the figures). This result reemphasizes that, although reintroductions would best be directed towards larger, more intact habitat blocks, we should not prematurely discount blocks as small as 25 or 50 acres as potentially useful to the recovery of the species.



OGDEN

Habitat Potential to Support Translocated Pacific Pocket Mouse Populations and Areas Recommended for Field Evaluation Camp Pendleton/Orange County

FIGURE 1

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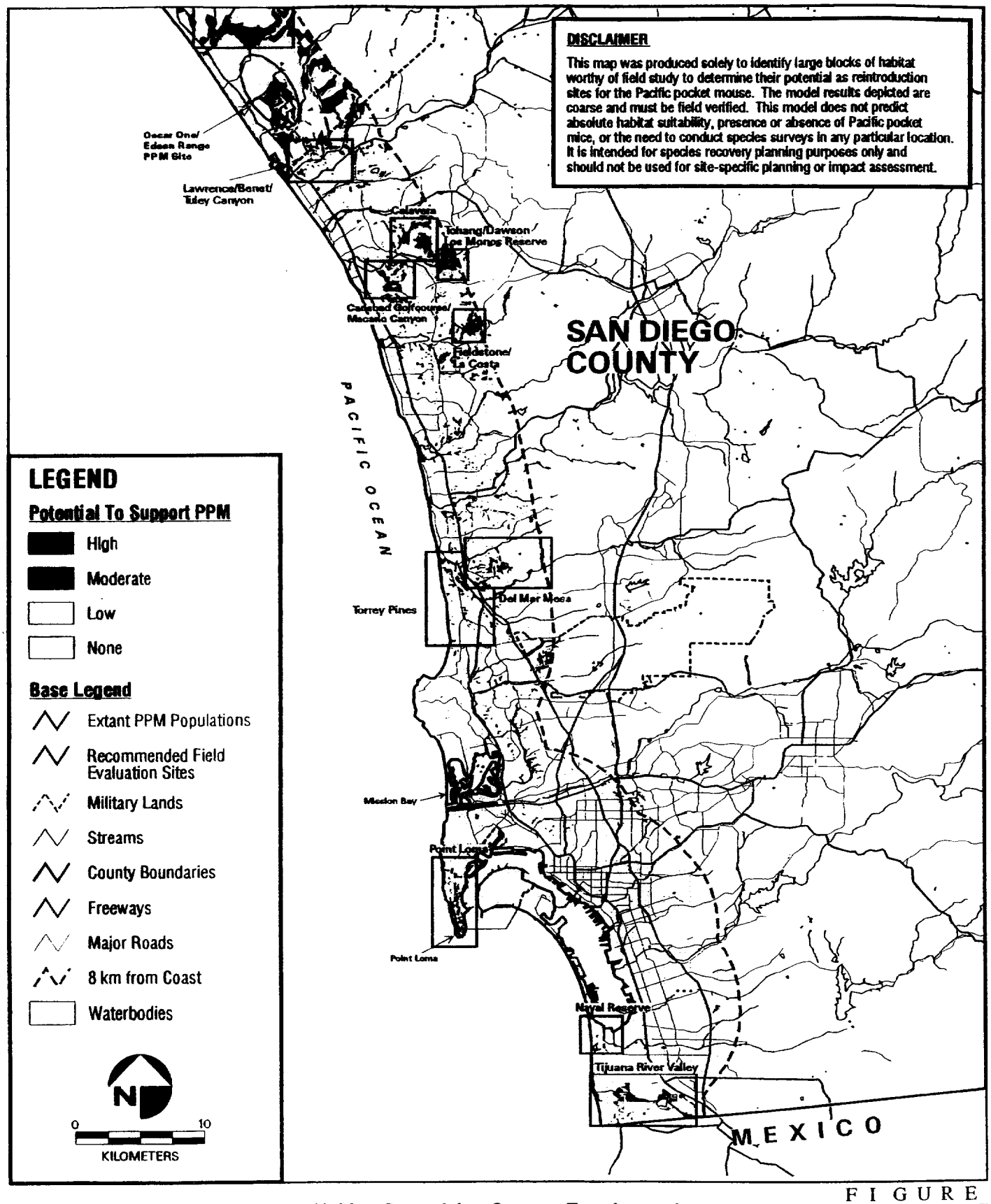

OGDEN

Habitat Potential to Support Translocated Pacific Pocket Mouse Populations and Areas Recommended for Field Evaluation San Diego County

FIGURE 2

/gis1/tcappm/plots/figures/ppmfiab811.aml

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Table 4
Acreage of Potential PPM Habitat in Orange and San Diego Counties

Habitat Potential	Orange County	San Diego County	Total
High	11,044	26,561	37,605
Moderate	4,117	6,579	10,696
Low	7,166	28,947	36,112
None	100,844	186,147	286,991
Total Study Area	**123,170**	**248,234**	**371,404**

Recommended field evaluation sites are outlined as green rectangles on Figures 1 and 2. Determination of which sites are worthy of field evaluation was guided in part by the personal experience of study team members and other species experts in many of these areas. The boxes primarily enclose larger or more contiguous blocks of high and moderate value habitat. In selecting these translocation study sites, we attempted to identify areas representing the full north-south extent of the study area and hence the range of conditions within the historic distribution of the species. In some portions of this geographic range (e.g., on Camp Pendleton), extensive high quality habitat blocks stretch from near the coast to more inland areas. Where such options were available, we prioritized those portions of high quality habitat closest to the coast for further evaluation. However, in other reaches of the study area (e.g., near the northern and southern extremes of the historic range) such options for prioritizing study sites don't exist. Consequently, in these areas we included some more inland sites, as well as some more fragmented or lower quality sites, as deserving further evaluation. We also omitted from immediate consideration some areas that were ranked high by the GIS model, but that we know from previous field studies may not be worthy of further consideration for biological or land-use reasons.

The following areas were specifically considered and deemed unworthy of consideration for further evaluation based on existing information:

- *Huntington Beach/Costa Mesa* – Scattered areas predicted to be high quality by the GIS model in Huntington Beach and Costa Mesa (particularly in the oil fields and along the Santa Ana River) were considered too fragmented, disturbed, overrun with exotic species, and subject to development pressures to be considered candidates for PPM translocations and habitat management.

- *Camp Pendleton Between San Onofre and Los Pulgas* – Marine Corps Base Camp Pendleton has been extensively surveyed for PPM habitat and populations (Ogden 1997; Montgomery, Dodd, and Pavelka pers. comm.). Areas predicted to be high value by the GIS model between San Onofre and Las Pulgas Creek are generally unsuitable, based on field surveys. Although sandy soils occur along the coastal mesa, soils and vegetation have been severely altered by construction of Interstate 5, former agricultural tilling, intense military training, park facilities, and other factors. Vegetation in these areas is largely dominated by fennel (*Foeniculum vulgare*) and other exotic species, and is considered unsuitable for PPM. Soil compaction and erosion gullies are also common in the area. Sandy soils on the inland slopes of the coastal hills are also considered unlikely to support PPM for similar reasons, and because PPM seems restricted to coastal-facing slopes. Because lesser-disturbed, coastal slopes in the region seem more promising as possible translocation receiver sites, these inland areas were omitted from further consideration.

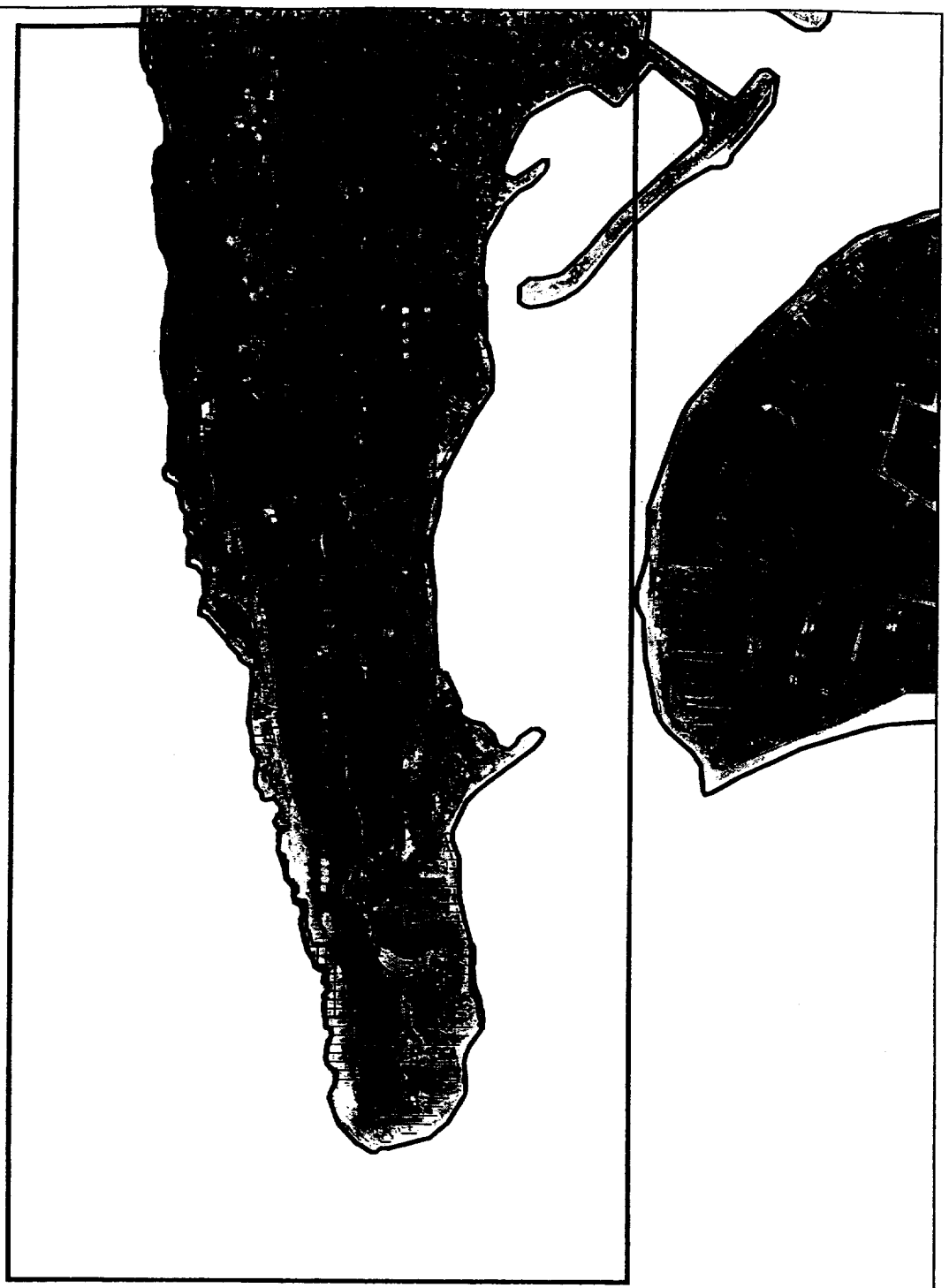
- *Canyons of Urbanized San Diego County* – Numerous small canyons predicted to have PPM habitat potential by the GIS model are scattered throughout coastal San Diego County (e.g., Rose Canyon, Tecolote Canyon, Green Valley, and slopes above Batiquitos Lagoon). However, these canyon habitats are generally highly disturbed, overrun by exotic species, subject to intense recreational activity, and fragmented by urban development. Many of the areas predicted to have the right combination of soils and vegetation to support PPM are very small and isolated, and most are on slopes considered by PPM experts to be too steep to support the species (topography was not included as a model factor). [Note: One canyon in Encinitas initially considered too small for PPM translocation is being reevaluated during Phase III due to occurrence of highly suitable soils on gentle slopes in the canyon floor, and due to the status of the property as a mitigation bank (the Manchester Mitigation Bank, managed by the Center for Natural Lands Management)].

Field maps have been prepared for each of the green boxes in Figures 1 and 2, using 1994-95 digital orthophoto imagery as the base map. Figure 3 shows a large-scale sample of the field maps, which are produced at finer scale for field use. Fieldwork is prioritizing those land areas already in biological open space, or that have been identified as probable wildlife preserve areas by regional conservation planning efforts. Initial field reconnaissance has begun at some of the translocation study sites to develop a rapid field evaluation procedure to further screen and prioritize these sites, as described below.

Initial Reconnaissance Efforts – Several of the priority areas in San Diego County have been visited by team members Shana Dodd and Steve Montgomery during summer 1999: Point Loma, Torrey Pines State Park and extension, and Del Mar Mesa. These visits provided a preliminary assessment of habitat quality at these locations and helped to verify the GIS model. As predicted, the model was conservative in that it tended to rank more areas as moderate to high value than the biologists did during their field visits. However, the model also ranked as low some areas ranked high by the field biologists. This is due to the digital soils maps either mismapping soil types or being too coarse in scale to delineate some areas of fine sandy loams or loamy sands. Overall, the biologists felt that the model provided good general guidance to the most promising locations, but that it missed important details that can only be confirmed during field visits. A brief summary of the assessment for the three sites visited to date follows:

- *Point Loma* – The team has visited the lands within Cabrillo National Monument and the Point Loma Ecological Reserve, except those portions managed by the U.S. Navy. Overall, the ridge-tops and gentler slopes of the peninsula were rated in the field as having moderate to high PPM habitat value, which is generally consistent with the GIS model results. Other areas ranked high by the model were ranked low by the biologists due to steep slopes or other factors not included in model parameters. Areas of loosely packed sandy loam soils are well distributed on the peninsula. However, much of the vegetation is dense chaparral and sage scrub with small, scattered openings that appear suitable for PPM. Vegetation management (i.e., thinning the denser areas of sage scrub) may improve and increase the amount of high-quality PPM habitat prior to an introduction attempt. Also, invasive exotic plant species, especially ice plant (*Carpobrotus* spp.) would need to be controlled. The peninsula is largely conserved as open space and managed for biological values by the National Park Service and U.S. Navy (Ogden 1994). The peninsula supports an abundance of other rare species, with localized concentrations of narrow endemic plant species. Habitat management for the benefit of PPM would need to avoid adverse effects on these rare and endangered plants in compliance with the Point Loma Natural Resource Management Plan (Ogden 1994).

- *Torrey Pines* – The team surveyed Torrey Pines State Reserve, Torrey Pines State Reserve Extension, and undeveloped lands surrounding the Reserve. Within this large area, PPM habitat ratings by the field biologists were patchy, ranging from medium-low to high. Although the GIS model predicts much of the area to be low quality, field surveys revealed scattered areas that appear to be very high quality, with loosely packed sandy loam soils and open vegetation occurring on small patches, as well as some larger areas (up to about 10 acres or more). Vegetation ranges from relatively open to dense chaparral and sage scrub.



LEGEND

- High and Moderate PPM Model Results
- Open Space/ Preserve Planning Areas
- Waterbodies
- County Boundary
- Streams
- Freeways/Major Roads
- Field Reconnaissance Area

MAP NOTES

1994-95 Orthophoto Base, 6 Foot Resolution

Map Coordinates: Stateplane NAD83 Feet

N

0 900

METERS

OGDEN

Example of Orthophoto Field Map
Point Loma

FIGURE

3

/gis1/ocappm/plots/figures/orthomap811.aml

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Several areas within the Reserve, especially near the Parry's Grove, Guy Flemming, and Extension trails, seem highly suitable for a PPM introduction attempt, especially if some vegetation management (especially thinning) were done. The land is already managed for its biological resources by the State of California Department of Parks and Recreation. The reserve supports a number of rare plants and animals, which must be considered in recommending habitat management actions to benefit PPM.

- *Del Mar Mesa* – Most areas visited in Del Mar Mesa were rated in the field as moderate PPM habitat value. Although a few areas appear highly suitable, they are very small and patchy. In general, the mesa may be too highly fragmented by recent development to be seriously considered for PPM translocations. The soils range from sandy loams to clays and compacted areas. Vegetation consists mostly of dense chaparral with few areas of sage scrub. Historically, the area probably had higher PPM value, as evidenced by small sandy patches along dirt roads among the developed areas and as predicted by the GIS model. However, most of the undeveloped land occurs on steep canyon slopes, which were rated as low by the field biologists. This site may be eliminated from further consideration as a translocation receiver site once all sites have been rated.

The field visits were also used to refine an approach and data sheet that allows rapid assessment of potential receiver sites to determine which sites deserve more detailed, quantitative evaluations in the future. An example of the reconnaissance data sheet that evolved from these efforts is provided in Appendix C.

CONCLUSIONS AND RECOMMENDATIONS

At least based on the results of the coarse and conservative GIS model, sufficient acreage of potential habitat exists to warrant pursuing a translocation program for PPM. Initial reconnaissance of several promising sites in San Diego county suggests that some areas may be suitable to support introduced PPM populations, although further study is clearly needed. Discussions with land use authorities should be initiated on these lands as soon as possible regarding the potential for PPM translocations and any associated management considerations.

Phase III efforts should focus on ranking all recommended field evaluation sites as potential translocation receiver sites based on continued qualitative field assessments by the study team and based on land ownership, land use, and land management considerations. Candidate areas for translocation receiver sites will be identified as those areas that are sufficiently large, with suitable PPM habitat characteristics, and having compatible land use and land management

plans, to allow for reintroduction. These areas will be field checked by experienced PPM biologists, and ranked qualitatively as possible reintroduction sites (e.g., high, medium or low priority for further evaluation). Field evaluations will also identify potential constraints to successful PPM population establishment, such as an abundance of house cats or Argentine ants. Those five to ten sites considered of highest potential based on this initial reconnaissance should then be quantitatively studied in the field using vegetation transects, refined soils assessments (and perhaps soil mapping), and trapping studies. Trapping studies should characterize the mammal communities existing on the sites, relative to extant PPM sites, and identify potential problems (e.g., high densities of potential competitors or predators). The focus of these quantitative studies should be to rank these sites in priority to serve as translocation receiver sites. This effort should also compare measures recorded at these sites with extant and historic PPM locations to evaluate where similarities and differences may help predict the probability of success for a translocation attempt. For example, known PPM population areas tend to be low in overall rodent diversity, with mammalogists often noting that, where found, PPM tend to be the most frequently captured species in trapping studies (Spencer, Dodd, Montgomery, Pavelka unpublished data). Furthermore, extant PPM sites have been characterized as having an abundance of certain herbaceous species (e.g., *Croton californica*; Pavelka pers. comm.). Such patterns should be statistically analyzed in hopes of finding better indicators of PPM habitat quality.

TASK 6 – LABORATORY SURROGATE STUDY

Performing an intensive field study of PPM life history, natural history, or dispersal, or tracking success of a translocation attempt will require an individual marking technique that is reliable, relatively long-term (three to four years), and safe. Our Phase I literature review and limited pilot studies suggested that most traditional mammal marking techniques (e.g., commercial ear tags or fingerling tags, freeze marking, tattooing) would not work on the tiny and endangered PPM. We therefore recommended testing several promising marking techniques on a surrogate subspecies to determine which technique would be most reliable and least harmful to PPM. In this study, we tested four marking methods on a nonlisted subspecies of *P. longimembris* under laboratory conditions. (1) subcutaneous PIT tags, (2) toe clipping, (3) tiny, custom-designed ear tags, and (4) color-coded surgical sutures.

METHODS

P. l. longimembris was chosen as a logical surrogate for PPM due to close taxonomic and body size relations and its lack of sensitivity status. Twenty-eight *P. l. longimembris* were collected by Shana Dodd using Sherman live traps in the Mojave Desert near Yucca Valley, San Bernardino County, California, on June 8-10, 1999. One animal died of unknown causes within days of capture, but the other 27 remain alive and healthy as of November 1999. The animals are housed individually in 19 by 21 by 32-cm plastic "critter cages," in a room with a skylight (for natural day/night cycles) and air filter. Temperature in the room fluctuated between about 15 and 25°C, similar to outside conditions. Natural sandy loam soil was collected at the Snow Creek study site (see Task 7) and filled to a depth of four to six cm. Six-inch cardboard tubes, capped at one end, were provided ad libatum to serve as shelter. The animals are fed mixed birdseed, occasional greens, and ad-lib water.

The animals were initially weighed (and sorted into two weight classes: <8.5 g and ≥8.5 g), sexed, and visually assessed in the hand for health problems or physical abnormalities. They were then assigned to one of the four marking techniques or to a control group. Assignment was by random draw, except that "redraws" were made where necessary to minimize chance biases in assignment of sex and weight classes (to avoid, for example, one marking group being all small animals or all one sex). After marking, animals were returned to their original (previously coded) cages, such that the different marking groups were randomly distributed within the room (i.e., no systematic bias in group position relative to light, heat, etc., in the environment).

Marking was done on July 13, 1999, with assistance and oversight by a veterinarian (Dr. Anthony Michael). The techniques and some initial observations at the time of their application are described here:

Ear Tags – Six animals were marked in one ear with custom-designed aluminum ear tags bearing three-digit numbers etched into their surface. The tags were manufactured by Vaga Industries (El Monte, California) using photochemical machining. They are similar in shape to standard fingerling tags, but smaller and lighter (weight unknown, but << 0.1 g). Before folding, the tags are 9.5 mm long and 1.5 mm wide. Once folded they measure 4.0 mm long in front and 5.0 mm in back, which provides a tight fit across the ear of a little pocket mouse. The tags are applied with a small surgical forceps. A small point on one end of the tag punctures the ear from the lateral side and passes through a hole in the other end of the tag on the medial side, after which it is folded flat against the medial tag surface. Tagging requires finesse, good eyesight, and some practice to obtain a good fit. Once properly fitted, the tags are tight to the ear (both latero-medially and longitudinally); however, most tags still caused some "ear droop" due to the extreme thinness and elasticity of this species' ear cartilage. Some tags would "pivot" around the puncture wound after application. The mice seemed to tolerate tagging well, with some scratching at the tag and initial head shaking, but no other obvious or persistent behavioral or posture changes. Little or no bleeding occurred. Tags can be applied in about one to four minutes by a practiced biologist.

Toe Clips – Six animals were marked with a two-digit toe clip code (one digit on a front paw and one on a rear paw) using the standard mammalogical method (Baumgartner 1940, Melchior and Iwen 1965). Toes were clipped distal to the ultimate toe joint, only far enough back to remove the nail and the quick (the cells producing nail growth), using either a baby nail clipper or surgical scissors. This method was quick (less than one minute per mark) and was easiest of any for a biologist to perform in hand. Some animals lost a drop or two of blood, and others no visible drops. No obvious behavioral or postural changes were observed in the animals who resumed natural behaviors immediately upon release back into their cages.

Monofilament Sutures – We attempted this technique on six animals, but immediately removed (without replacing) the sutures from one animal due to skin tearing and tension of the suture on the skin. Two sutures (size 3-0 monofilament nylon surgical sutures, one black, one blue) were stitched through the loose skin on the nape of the neck, tied with a triple surgeon's knot, and cut to leave 1.0 to 1.5 cm of loose thread projecting from the knot. The technique was difficult, required practice and precision, required two biologists (one to hold the animal), and caused severe trauma, squealing, and struggling in the subject. It was difficult to avoid bunching of the

skin and hair within the knots, which appeared irritating to the animals. This technique also took the most time of any we attempted, requiring 10-15 minutes per mark in our trials (although with practice this could be greatly shortened). The resultant mark was somewhat difficult to observe clearly, and it was slightly difficult to detect the color difference except under bright light.

PIT Tags – Only three animals were PIT-tagged, due to initial concerns regarding the size of the tags and trauma to the animals. Tags were inserted subcutaneously between the scapulae. Two tags were injected using a 12-gauge hypodermic syringe; and one tag was inserted by hand via a surgical incision across the nape after shaving a patch of hair. Although some practice is required with the hypodermic technique to get the proper depth of needle insertion, it was relatively quick (about 1 to 3 minutes) and easy for a single biologist to perform. Holding the animal by the nape between thumb and forefinger (standard mammal grip) conveniently lifts the skin so that the hypodermic can be inserted posteriorly along the dorsal midline while feeling the plunger between the thumb and forefinger. Puncturing the skin is easy with a fresh (sharp) syringe, and it does not require shaving hair. However, care must be taken to minimize pushing hair into the puncture with the syringe. Once the syringe is inserted, care must be taken not to push it too far (thus exiting the skin through a second puncture) or not far enough (thus allowing the PIT tag to squeeze back out the entry hole). Little or no bleeding was observed from the puncture wounds, which scabbed over quickly. This technique is recommended over the surgical incision method.

The surgical incision did not work well. It took two people to perform (one to hold the animal), caused severe trauma and struggling in the animal, and resulted in a fairly large wound due to continued tearing of the skin from the initial incision. At the recommendation of the veterinarian, we did not close the wound with sutures or surgical glue, but closed it by hand only to allow natural healing. Little bleeding was observed.

All three PIT-tagged animals showed varying signs of trauma immediately after tagging, including lethargic and stiff body movements, repeated body shaking or twitching, scratching at the insertion point, and vigorous dust bathing when released to the cage.

Controls – Five animals served as unmarked controls. They were removed from cages, weighed, and examined according to the same schedule as the marked animals.

After application of marks, the test and control groups were regularly weighed and examined for adverse health effects or behaviors. The examination schedule was every other day for the first

two weeks, then weekly for 10 more weeks. Currently, the animals are being monitored monthly.

RESULTS AND DISCUSSION

Of the various marking techniques tested, toe clipping seems clearly the least harmful, and possibly the most reliable for uniquely identifying animals over their life span. The suture technique and ear tags experienced high rates of tag loss and other complications and are not recommended for further testing. PIT tags had minor complications, seem promising overall as a useful technique, and are recommended for further testing.

Figure 4 graphs changes in mean body weight for the various marked groups and the control animals over the study period. Body weights in all groups fluctuated moderately throughout the period, but with an overall increase by the end of the study. A dip in body weight occurred in

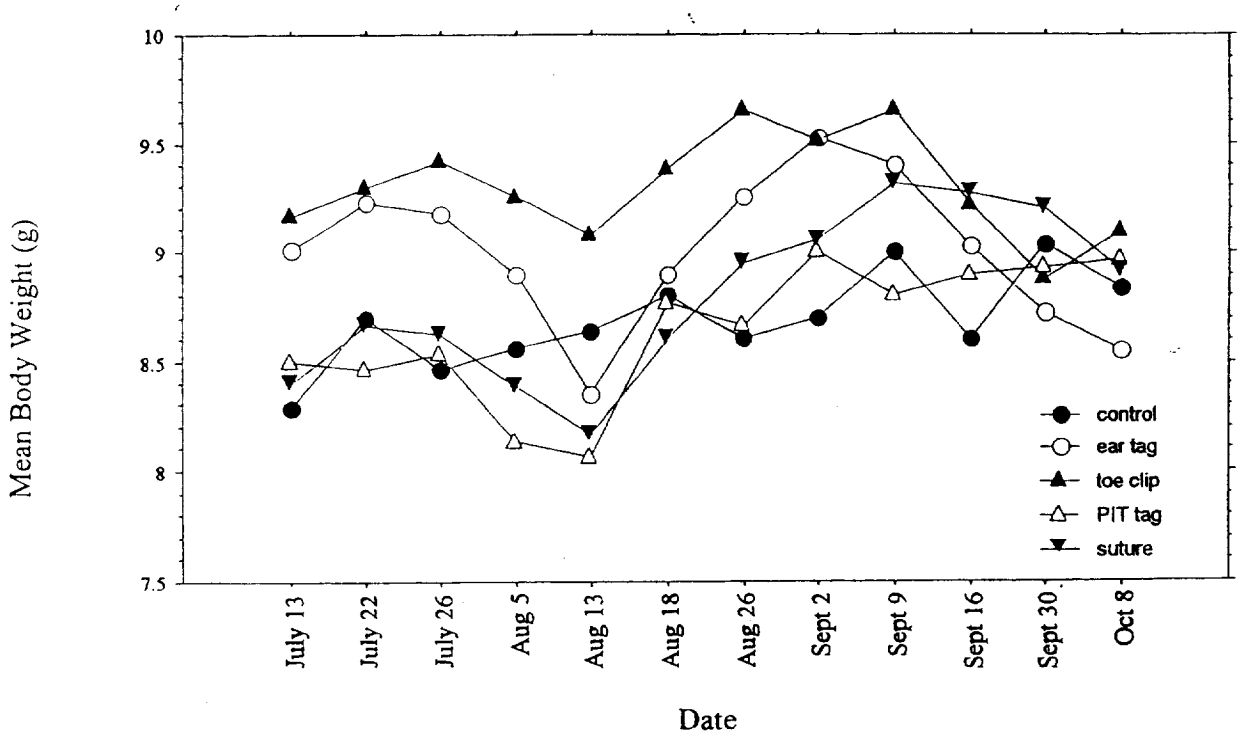

Figure 4. Body Weight Changes in *Perognathus longimembris longimembris* After Application of Various Marking Techniques

nearly all animals during mid August. This timing corresponded with the switch in the maintenance and monitoring schedule from a two-day interval to a seven-day interval, and may reflect inadequate food during that first weekly provisioning. No animals died during the trials, and all animals that lost weight regained it once the provisioning schedule was adjusted.

A repeated measures ANOVA showed no significant effect of marking technique on body weight over time (DF = 4; $F = 0.665$; $P = 0.623$). The test has low statistical power (0.179) due to the small sample sizes, and a non-parametric test may be more appropriate for this comparison. Nevertheless, it is clear that there was no detectable effect of marking technique on body weight changes. This can be seen in Figure 4, which shows that all groups tended to converge in body weight on a mean of about 8.95 g. As a group, the study population increased in weight slightly, but not significantly, from July 13 to October 8 (paired *t*-test, $P = 0.174$). However, females as a group did increase significantly in weight, from a mean of 8.68 to 9.33, regardless of marking technique ($P = 0.021$). In contrast, males did not change body weights during this period (mean 8.63 g on July 13 and 8.69 g on October 8; $P = 0.861$).

Although all marking groups maintained or increased weight after marking and appear in relatively good health (due probably to the easy living conditions in captivity), marking methods differed in mark retention and in observable health and behavioral effects, as described below.

Controls – All control animals remained healthy and active throughout the study period. They were alert, well groomed, and relaxed during handling. Although their weights fluctuated somewhat from week to week, overall the animals maintained and slightly increased their weight, again females more than males.

Ear Tags – Within the first week, four of the six ear-tagged mice developed inflammation in the tagged ear (bright pink discoloration of the whole ear and/or swelling). The inflammation lasted for up to 42 days or until loss of the tag. Animals experiencing these symptoms all had tightly fitted ear tags; the two animals with more loosely fitted tags did not develop such problems, although their tags privoted freely around the insertion point, gradually increasing the size of the hole. Continued scratching at the ear tag resulted in enlargement of the puncture hole in several mice, and in some cases tearing of the ear. The weight of the tag caused the ears to droop in all mice, some more than others. In one mouse the point of the tag irritated the skin of the head behind the ear. After about six weeks, three of the six tags had been lost. This is an unacceptably high loss rate and this technique is not recommended for further use.

Toe Clips – Five of the six toe-clipped animals tolerated the procedure well, healed immediately, and showed no residual inflammation or irritation after the clipping. One animal exhibited some swelling of one clipped toe, which abated within 11 days. The caretaker for the animals (KEA Intern Kris Beaver) admitted to having prior expectations that toe clipping would be the least humane and most detrimental of the techniques. However, her careful and objective observations of the animals reversed this bias. In her final report on her observations, Ms. Beaver noted that "toe clipping seems to be the best tolerated, least traumatic marking method. The animals generally healed quickly, and most notably, suffered seemingly the least amount of residual stress from their marking experience. From the outset, behaviorally speaking, the animals of this group exhibit the most relaxed and balanced temperaments, calm and docile upon handling."

Monofilament Sutures – Although the suture sites appeared to heal satisfactorily in all animals, the sutured animals showed signs of discomfort throughout the study period. Frequently observed behaviors included shaking or shrugging of the sutured area, and strong resistence to being handled. Handling the animals was difficult, because the sutures were applied to the nape, where animals are usually grasped. This caused evident pain in the animals, and made observing the suture location difficult. As noted above, we removed the sutures immediately from one animal due to complications. Of the remaining five sutured animals, four succeeded in removing their sutures after 7, 13, 13, and 29 days. This is an unacceptable loss rate. This technique is not recommended for further study.

PIT Tags – The PIT tag that was inserted via surgical incision began to work its way back out of the wound, was partially extruded after several days, and was removed seven days after marking. During this period the wound was partially healed, but movements of the tag appeared to retard healing prior to its removal. The animal nevertheless appeared healthy, active, and normal in its behavior. After removal of the tag, the wound healed and the animal remained healthy.

The animals tagged via hypodermic insertion healed relatively quickly and remained active and healthy. The tags migrated somewhat day to day under the skin, sometimes bulging and causing rumpling of the hair. At times the tags appeared to be annoying the mice due to uncomfortable protruding beneath the skin.

CONCLUSIONS AND RECOMMENDATIONS

Recommended Marking Techniques

Based on initial results of this experiment, we have ruled out further use of surgical sutures as a marking technique, either on surrogate species (see Task 7) or on PPM. We also ruled out using PIT tags inserted via surgical insertion. These techniques are too difficult and traumatic (to both researcher and subject), with too many complications and potential adverse effects.

Ear tags do not seem reliable enough to warrant exclusive reliance on this technique. High rates of tag loss, continued scratching by the mice, and inflammation and tearing of the ear make this technique generally undesirable. Nevertheless, based on the first few weeks of results (before tags were lost from ears), we initiated field testing on the surrogate field population (see Task 7, below) to further test this method before discarding it.

The results indicate that toe clipping is a reasonable, safe, cost-effective, and reliable method. This observation is also backed up by numerous studies and observations by mammalogists, collected over decades of field research (*American Society of Mammalogists, Animal Care and Use Guidelines*, no date). We therefore recommend using toe clipping for future field studies on PPM or surrogate species. This will require developing a code to allow for unique marking of many individuals (perhaps using up to three clipped digits, but no more than one per foot). This will also require amending state and federal permits for individuals to trap and mark the endangered PPM in this way.

We also tentatively endorse continued testing of PIT tags using the hypodermic needle technique as an alternative to or augmentation of toe clipping. This technique was therefore also tested in the field surrogate study (see Task 7, below).

Further Uses of the Laboratory Surrogate Population

The captive individuals will be kept indefinitely for future Phase III studies, including tracking of tag retention over the life span (approximately 4 to 6 years). The captive colony could also serve as a surrogate captive-breeding colony to test breeding protocols for application to PPM if a captive breeding program and reintroductions are deemed necessary by the wildlife agencies. We therefore recommend maintaining this colony at least through Phase III, and attempting some breeding of the animals.

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TASK 7 – FIELD SURROGATE STUDY

The Phase I report recommended a multi-year field study of a surrogate subspecies to further test marking techniques and other field techniques before applying them to PPM, and to increase our knowledge of the basic life history and ecology of *Perognathus longimembris*. A field surrogate population could also be used to test various translocation techniques (e.g., use of enclosure fences, artificial burrow design) prior to attempting such techniques on the endangered PPM. During 1999 we therefore initiated studies on a population of the unlisted subspecies, *P. l. bangsi*, in the Coachella Valley, Riverside County, California. The main goals were to establish two permanent study grids, mark animals with several marking techniques to look at long-term mark retention and health effects, and to begin collecting baseline data on natural history and demography of the resident population.

METHODS

Study Site

The study was conducted near the western end of the Coachella Valley in the San Gorgonio Pass, Riverside County, California (San Bernardino Base and Meridian; USGS 7.5' White Water Quadrangle, Section 21 of Township 3 South, Range 3 East). The site was selected during the 29 March 1999 field trip by the study team. The site is ideal for a long-term intensive field study because it has an abundant population of *P. l. bangsi*, allows easy access, has low evidence of human disturbance, and is public land owned by the Bureau of Land Management.

Habitat on the site is a large expanse of relatively homogeneous creosote (*Larrea tridentata*) scrub habitat on a north-sloping bajada. Other plant species on the study site include burrobush (*Hymenoclea salsola*), California ephedra (*Ephedra californica*), white bursage (*Ambrosia dumosa*), desert encelia (*Encelia farinosa*), catclaw (*Acacia greggii*), and indigo bush (*Psorothamnus arborescens*). The site was burned in recent years. Soils in the area are Tujunga loamy fine sand, Tujunga gravelly loamy sand, Myoma fine sand, and Sosoba cobbly sand (USDA 1980). Steep and rugged topography borders the site to the south (foothills of the San Jacinto Mountains) gently sloping north to the San Gorgonio River. Much of the immediately surrounding lands are undeveloped, except for the small community of Snow Creek.

Trap Spacing and Duration

Two trapping grids (Grids A and B) were established on the study site (Figure 5). Inter-trap spacing was set at 5 m for Grid A and 7 m for Grid B to determine the best trap spacing for population studies on this species. These initial spacings were based in part on the trap-spacing study for PPM performed by Dodd and Montgomery (1998) on Marine Corps Base Camp Pendleton, and in part on personal experience of the team. The following factors were considered in choosing the initial grid configurations: (1) the total area to be sampled by a grid (i.e., number of resident mice expected within the grid relative to sample size requirements); (2) the sampling intensity within the grid relative to expected animal density and spacing (i.e., the proportion of resident individuals expected to be captured during a trapping session); and (3) the number of traps that two biologists can reasonably run in a morning when handling and marking mice. The goal is to derive a grid size and density that can be reasonably managed by two biologists while maximizing the proportion of resident animals captured during a trapping session, including all sex and age classes, and obtaining a large enough sample of individuals to draw meaningful conclusions regarding population trends.

Grid A consisted of a square configuration of 14 x 14 trap stations (196 total trap stations) and Grid B of 10 x 10 trap stations (100 total trap stations). The area trapped by each grid is thus 0.49 hectares (ha) (70 x 70 m), assuming a ½-trap-space perimeter strip around each grid (e.g., a 2.5-m perimeter strip for Grid A and a 3.5-m perimeter strip for Grid B). Each trap station was set with two traps to reduce trap saturation by non-target species (especially kangaroo rats, which often enter traps early in the evening). Thus, Grid A contained 392 traps at 196 stations and Grid B contained 200 traps at 100 stations, for a total of 592 traps per night.

Grids A and B were initially trapped for 8 consecutive nights from 27 July to 3 August 1999. This relatively long trapping period was used to ensure that the trapping duration was sufficient to mark most individuals in the resident population, and to look for an asymptote in the capture of new animals. We also trapped the grids for two nights on 1 and 2 September 1999 to check on health and mark retention for individuals marked during the first trap session and to see if the mice were still active above ground this late in the year.

Marking Techniques

Three marking techniques were used to uniquely mark captured *P. l. bangsi*: toe clipping, ear tags, and PIT tags. All individuals were marked by a unique, two-digit toe-clip combination (after Baumgartner 1940; see Task 6 methods). Toe clipping served to test this marking

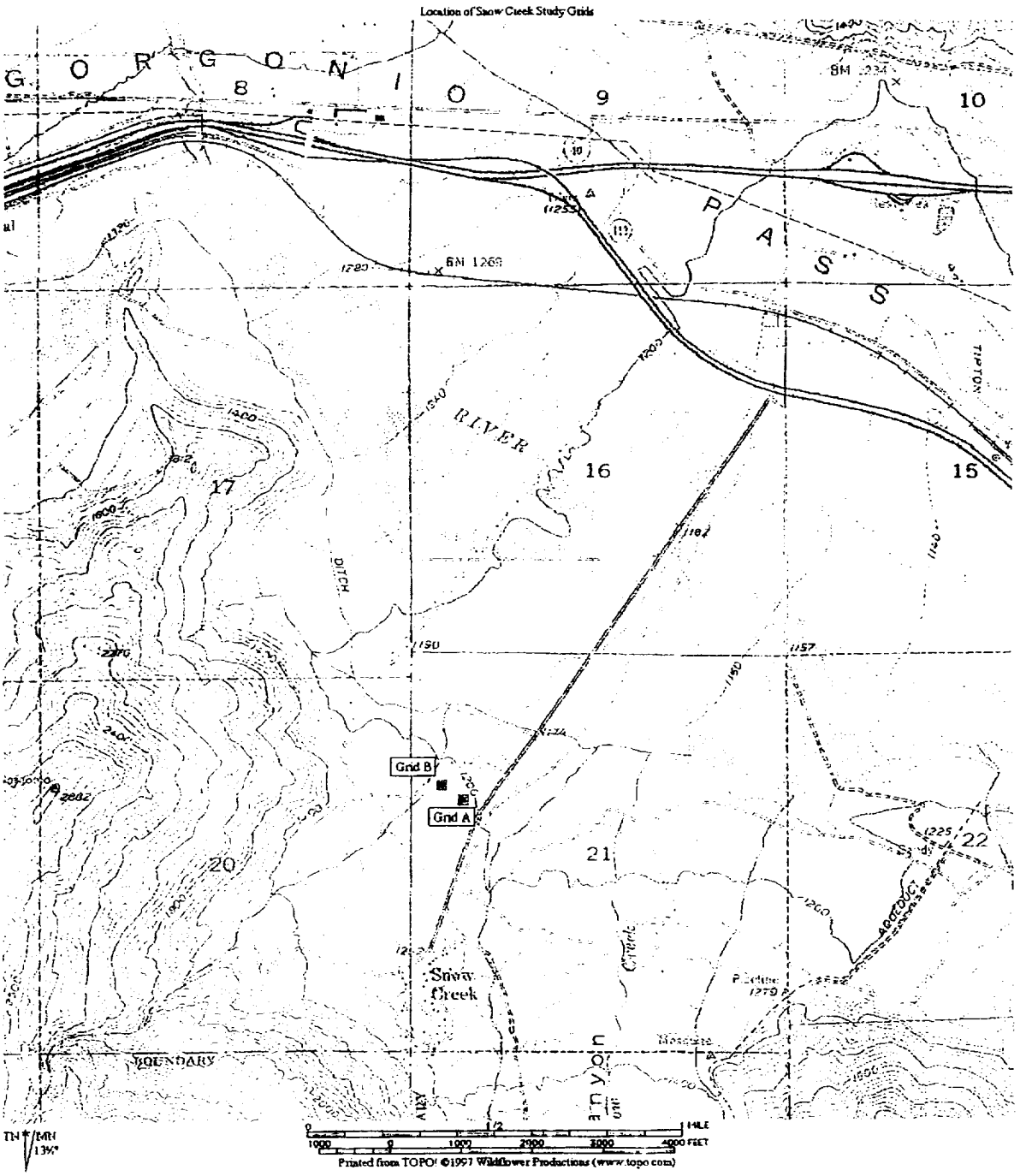

Figure 5
Location of Snow Creek Study Grids

No Scale

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technique for use in the field, as well as to provide a redundant, or "fail safe" mark for animals also marked with one of the other techniques (ear tag or PIT tags), in case these tags were lost. A subset of the mice were thus also marked by attaching a uniquely numbered ear tag on the left ear or a PIT tag inserted subcutaneously using the hypodermic needle technique (see Task 6 methods).

General Live-trapping Procedures

The corners of each grid were permanently marked with rebar stakes and all other trap stations were marked with a pin flag. The grids were spaced approximately 80 m apart to minimize movements by individual mice between grids during their normal daily activities, but to allow for potential dispersal movements between grids. Two Sherman live traps were set within approximately 1-2 m of each established trap station. Due to high winds on the site, traps were placed under the nearest shrub to the trap station or were partially buried, facing downwind, to minimize winds blowing traps away or triggering the traps. Each trap was baited in the late afternoon/early evening with mixed birdseed (with high millet content) and checked and closed the following morning. An attempt was made to adjust the sensitivity of the trigger mechanism of each trap so that animals weighing as little as 4-5 grams would be captured.

The following data were recorded on all captured *P. l. bangsi*: sex, weight, reproductive condition, age (young of the year or adult, as accurately as possible by pelage appearance), capture location, recapture status, and notes on animal condition and the condition of any previously applied marks. (During extreme wind conditions, not all individuals were weighed due to wind interference with spring scale readings.) Reproductive condition was based on the position of the testes for males and condition of the vagina and size of mammae for females. Voucher photographs were taken of a subset of all captured *P. l. bangsi*. All other small mammals caught were marked (not uniquely) by clipping a small section of hair on the top of the head to identify recaptures, and their capture location was recorded.

Data Analysis

The total number of individuals captured of each species, the sex ratio of *P. l. bangsi* captures, and results of the different marking techniques were summarized in order to evaluate the marking efforts and identify differences between Grids A and B. We calculated the minimum density *P. l. bangsi* known alive on each grid (number of individuals captured/grid area) for comparison between grids.

Differences between the 5-m and 7-m trap spacing also were analyzed by comparing the following measures of *P. l. bangsi* activity:

1. Number of times captured = the total number of times each individual was captured;

2. Number of traps visited = the total number of different trap stations visited by each individual;

3. Maximum distance moved = the greatest linear distance between the farthest two capture locations recorded for each individual; and

4. Total distance moved = the total distance traversed by each individual during the 8 nights, including all distances moved between two adjacent traps.

Only those animals captured more than once were included in the activity analysis. Means for each of the activity measures were compared between grids using the Mann-Whitney U test to detect statistically significant differences. Correlations between the activity measures were investigated using Spearman's rank correlation analysis.

RESULTS AND DISCUSSION

General Live-trapping Results

A total of 40 uniquely marked P. *l. bangsi* were captured on Grid A during the first (July-August) trap session, and an additional 4 new individuals were captured during the second (September) trap session. On Grid B, 31 uniquely marked *P. l. bangsi* were captured during the first trap session and an additional 2 new individuals during the second trap session.

Observed sex ratios differed greatly between grids: Grid A had a ratio of 1.0:1.0 (22 males:22 females) and Grid B a ratio of 2.7:1.0 (24 males:9 females) (Fisher exact test, $P = 0.06$). We do not have an explanation for this difference, but one hypothesis might be that the greater inter-trap spacing on Grid B resulted in a low proportion of females being captured due to smaller home ranges or lesser movements in females than males. This hypothesis would obviously require further testing.

Most individuals captured were identified as adults, with only a few individuals on each grid recognized as young of the year during late July-early August. However, it was difficult to

confidently distinguish adults from subadults, since the trapping was conducted so late in the season and the reproductive cycle was nearly complete. We would have been more familiar with the molt cycles of subadults (young of the year) versus adults had trapping occurred early in the reproductive cycle. However, we are confident that no juveniles were captured, because their pelage is distinctive. Reproductive condition also indicated that the breeding season was nearly complete by late July. Few individuals showed signs of recent sexual activity (perforate vagina) or sexual readiness (scrotal testes). However, it should be noted that *P. longimembris* often do not show obvious descended (scrotal) testes, even in reproductively active adult males (Hayden et al. 1966). Only one female captured was suspected of being pregnant.

Weights of individuals were similar on the two grids: Grid A (range 7.0-11.5 g; mean 8.3 g) and Grid B (range 7.5-9.5 g; mean 8.2 g). These weights also suggest that the breeding cycle was nearly over, because all individuals captured during this study were greater than 7.0 g, whereas juvenile and subadult animals usually weigh less than 7.0 g (Dodd, unpublished data).

Table 5
Summary of *P. l. bangsi* Capture Data During the First and Second Trap Sessions

Total Unique Captures	Males	Females	No. PIT tagged	No. Ear tagged	Comments
Grid A					
1st session					
40	19	21	7	30	1 animal not marked (dead in trap), plus 1 animal eaten by ants (unidentifiable mark) not included in total 1 ear tag ripped out
2nd session					
4	3	1	3	0	4 additional ear tags ripped out 2 toes re-grown 0 PIT tag recaptures
Sub-total	**22**	**22**	**10**	**30**	
Grid B					
1st session					
31	23	8	7	20	0 ear tags ripped out
2nd session					
2	1	1	1	0	3 ear tags ripped out 1 toe re-grown 0 PIT tag recaptures
Sub-total	**24**	**9**	**8**	**20**	

P. l bangsi was the second most commonly captured mammal on the grids, accounting for 36% of the total individuals of any species captured on both grids. Merriam's kangaroo rat (*Dipodomys merriami*) was the most common species captured overall, accounting for 45% of the individuals captured on Grid A and 35% on Grid B. Nine other small mammal species were captured at much lower rates: Pacific kangaroo rat (*D. agilis*), San Diego pocket mouse (*Chaetodipus fallax*), desert pocket mouse (*C. penicillatus*), deer mouse (*Peromyscus maniculatus*), cactus mouse (*P. eremicus*), southern grasshopper mouse (*Onychomys torridus*), Desert wood rat (*Neotoma lepida*), Bottas' pocket gopher (*Thomomys bottae*), and antelope ground squirrel (*Ammospermophilus leucurus*). These nine species combined accounted for only 19% of individuals captured on Grid A and 29% of individuals captured on Grid B.

Marking Technique

On both grids, a total of 18 individuals were PIT tagged, 50 were ear tagged, and all were toe clipped (including both trap sessions). By the end of the first trap session, at least a third of the ear-tagged individuals exhibited various levels of inflammation and redness, ripping around the tag insertion hole, or drooping ears. One individual had lost its ear tag when it was recaptured on the last morning, 7 days after marking. Recaptures of toe-clipped individuals showed immediate scabbing and redness on most individuals and only occasional inflammation associated with the toe clipping. The hypodermic insertion PIT-tagging procedure worked well in the field once the biologists gained experienced with several animals and knew the amount of pressure and the depth of insertion necessary for a clean and accurate insertion. Observations of the insertion wound on recaptured individuals were difficult due to hair around the wound site, but most individuals seemed to experience minor inflammation and developed a large scab, often with sandy encrustation. The wound of some individuals appeared sensitive to touch while others did not.

During the second session of trapping additional ear tag loss was detected: 4 on Grid A and 3 on Grid B. A few toe tips appeared to have re-grown. This was probably a result of the toe not being clipped far enough back from the toenail. Unfortunately, none of the individuals that were PIT tagged during the first session were recaptured during the second trap session, so we cannot ascertain health effects of PIT tagging in the field with existing data.

Density and Activity on the Grids

The minimum *P. l. bangsi* density was 81.6 individuals/ha (40 individuals/0.49 ha) on Grid A and 63.3 individuals/ha (31 individuals/0.49 ha) on Grid B (first trap session only). The higher

density found on the smaller-spaced grid (Grid A) superficially suggests that 5-m trap spacing is more efficient at capturing *P. l. bangsi* than 7-m spacing. However, the difference in densities could also reflect real density differences between grids, perhaps due to habitat quality differences between grids (although there was no obvious differences to the biologists). The difference in the number of individuals captured on the two grids is explained by far fewer females being captured on Grid B than on Grid A (Table 5). This may indicate that the wider trap spacing on grid B fails to adequately sample females, perhaps due to less extensive movements by females. However, for the individuals captured, we detected no significant differences between males and females in the measures of activity on either grid or over all individuals. Verifying greater capture probabilities on the denser grid would require replicating the experiment by switching densities between grid, which was not possible during this study.

The measures of activity do not differ significantly between the two grids, although there is a trend suggesting that the smaller-spaced grid (Grid A) was more effective at capturing individuals in different portions of their home ranges than Grid B (Table 6). While individuals tended to be recaptured more frequently on Grid B, they also tended to be captured at fewer trap stations than those on the Grid A. On Grid B, 46% of recaptured individuals were captured at only one trap station, whereas on Grid A only 21% of recaptured individuals were captured at one station.

Table 6
Summary of Activity Data Means for the Two Snow Creek Study Grids

Measures of Activity	Grid A	Grid B	Test statistic (U), p value
Number of animals*	34	24	
Number of times captured	3.76	4.58	$U = 287.0, p = 0.056$
Number of traps visited	2.18	1.95	$U = 342.5, p = 0.30$
Maximum distance moved (m)	6.52	6.60	$U = 354.0, p = 0.39$
Total distance moved (m)	9.72	13.57	$U = 391.0, p = 0.79$

*Includes only those animals captured more than once.

During the second trap session, most recaptured individuals were found on or very near (within 1-2 trap stations) the trap stations at which they were captured during the first session. Only a few individuals moved 3 or more trap stations from their original capture location. No individuals were detected moving between Grids A and B.

As expected, there was a strong correlation on both grids between the number of traps visited compared to (1) the maximum distance moved and (2) the total distance moved (Table 7). However, the results differed slightly between grids, and again suggest that the 7-m spacing may be too large to routinely capture individuals in different portions of their home range. On Grid B, there was a relatively weak Spearman's rank correlation between the number of traps visited and the number of times captured ® = 0.314) compared to a stronger correlation on Grid A ® = 0.664). One would expect that the more often an individual is captured, the more traps it should visit (if the trap interval is small enough to place many traps within a home range). However, the weak correlation on the 7-m spaced grid reflects that individuals were repeatedly captured at only one or a few trap stations on Grid B. The same trend is suggested by correlations between the total distance moved and number of times captured on the two grids (Table 7).

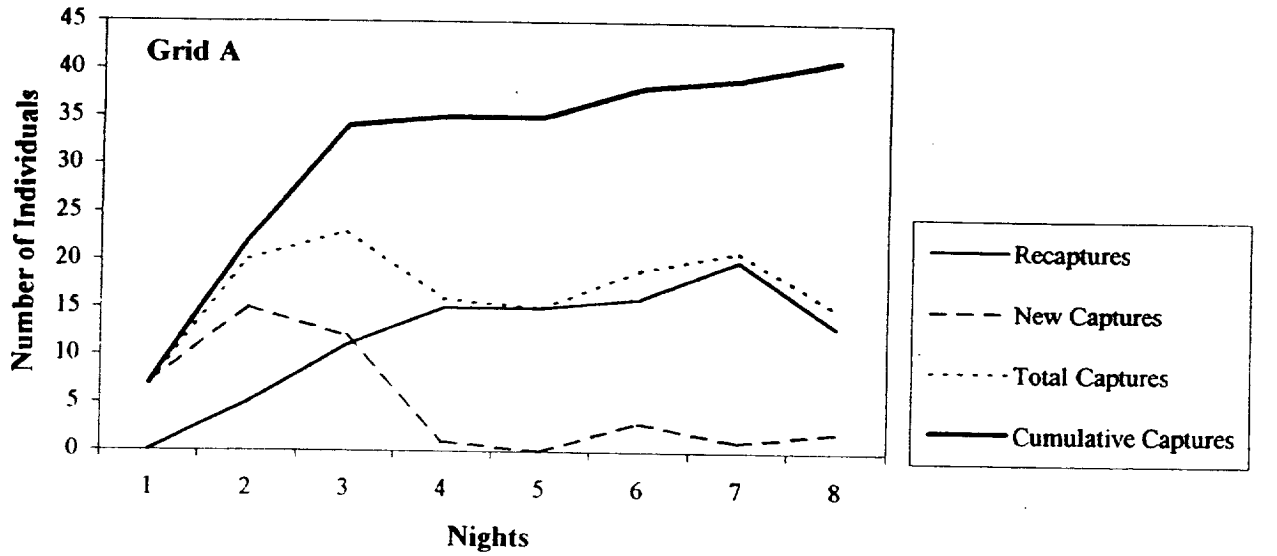
Table 7
Spearman Rank Correlations for Activity Measures on the Two Snow Creek Study Grids

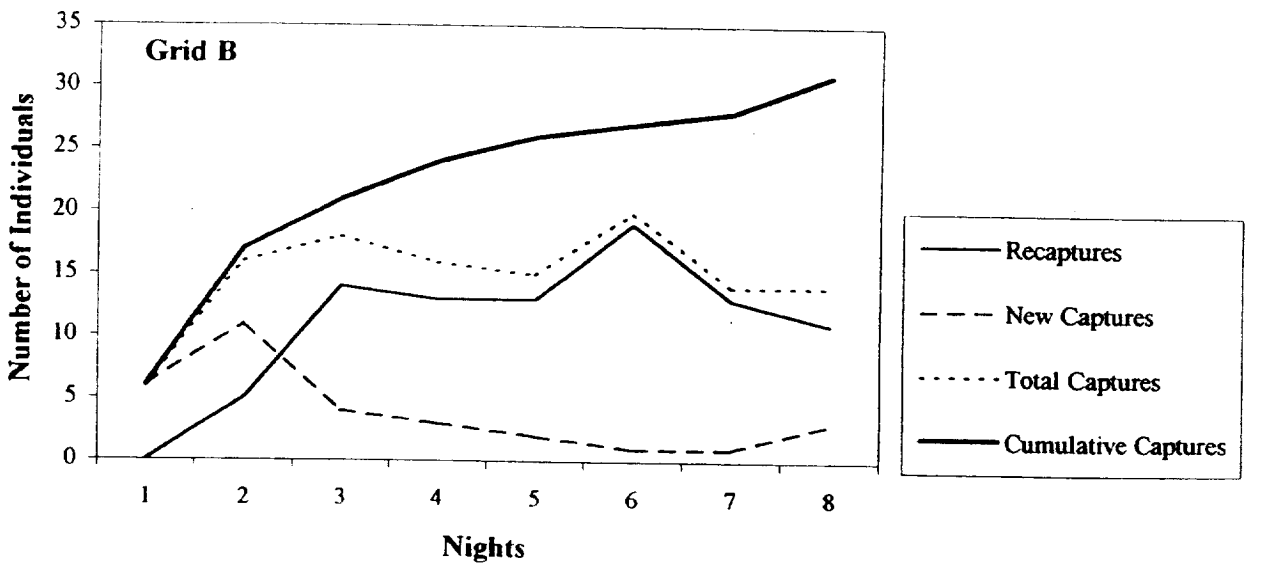
Correlations	Grid A	Grid B
	Spearman's *r**	
Total Distance Moved and # Traps Visited	0.878	0.970
# Traps Visited and # Times Captured	0.664	0.314
Total Distance Moved and # Times Captured	0.547	0.309

* *r* values range between 0 and 1; where 0 indicates no relationship and 1 indicates a perfect positive correlation between the two variables.

Figure 6 illustrates capture rates over the initial 8-night trapping session, and shows that there was a peak in new captures on the second night for both grids. Grid A appears to have produced an earlier asymptote in cumulative captures of new individuals, and Grid B appeared to take longer to capture the resident individuals (Figure 6). On Grid A, 83% of all individuals were captured by the third night and 93% by night 6; whereas on Grid B, only 67% of all individuals were captured by the third night and 87% by night 6. By nights 5 and 6, very few new individuals were being captured on either grid. Nearly all newly captured individuals on the last few nights were captured on or near the edges of each grid, indicating that they were individuals whose home ranges were centered outside of the grids. Thus, it appears that the majority of the resident population on each grid was captured within the first 6 nights, and that the denser grid captured a greater proportion of the population earlier, although the differences are slight.

Figure 6. Captures of New *Perognathus longimembris bangsi* Individuals, Recaptured Individuals, Total Individuals, and Cumulative Individuals on the Two Snow Creek Study Grids





Again, a stronger test would involve replicating this experiment by switching density treatments between grids, which was not possible during this study phase.

CONCLUSIONS AND RECOMMENDATIONS

Marking Technique

Although the ear tagging procedure improved with experience during the field trials (as compared to the laboratory study), we suspect, based on the initial results, that many of the ear tags will be lost by the next active season. Within the first week after marking, many of the tags appeared loose, and several tags were lost by the second trap session (4-5 weeks after tagging). Therefore, continued field trials for this technique, or its application to PPM, are not recommended.

PIT tagging deserves further study to look for ill effects of the tag during long-term application. A larger sample size is also recommended. PIT tagging offers several advantages over other techniques: (1) an endless supply of unique identification codes, (2) a very low rate of misreading the codes, and (3) no possibility of mistakenly giving the same code to different individuals.

Toe clipping also proved successful and is a very quick and cheap method to apply. However, the number of unique codes is finite, which may be a problem during a multi-year population study. Also, human error can result in the same code being given to multiple individuals, or of codes being misread upon recapture. Based on this limited field study, as well as the laboratory surrogate study (Task 6), toe clipping seems to have the least detrimental health effects of the marks we tried. However, due to the lack of recaptures of PIT-tagged individuals, we do not yet have a good estimate of this technique's health effects for comparison.

We recommend using a combination of toe clipping and PIT tagging for continued marking of *P. l. bangsi* or other PPM surrogate species. We also endorse use of toe clipping for field studies of PPM during monitoring studies at extant sites. Further information on the long-term health effects of PIT tagging is required before we endorse this technique for use on PPM. Consequently, we propose monitoring the Snow Creek grids during the year 2000 to recapture PIT-tagged *P. l.* bangsi for observation, and we propose to PIT tag additional *P. l. longimembris* individuals in the captive population (see Task 6).

Grid Design

The size of the sample grids (roughly 0.5 ha) seems appropriate for this species. Larger grids would be difficult to fit within relatively homogeneous habitat areas, either in the Coachella Valley or even more so in the coastal habitats occupied by PPM. The 33 to 44 resident *P. l. bangsi* captured on the two grids may be somewhat small for some statistical comparisons (e.g., detecting subtle changes in population sizes), but we suspect these samples are large enough to provide meaningful statistical analyses for most measures of interest.

Although 5-m spacing is much more work intensive than 7-m (or greater) spacing, we endorse using 5-m spacing for continued studies of the Snow Creek grids and, tentatively, for future studies at PPM sites. At Snow Creek, the 5-m grid spacing detected a higher density of *P. l. bangsi*, captured individuals at more locations on each grid, produced a more even sex ratio in captured animals, and captured a higher proportion of the known resident population in a shorter time than did the 7-m spacing. Consequently, the 5-m spacing may be more effective for long-term monitoring studies, because it would presumably be more sensitive at detecting natural changes in population densities, spacing, and movements. However, monitoring studies that intend only to gain quick relative estimates of abundance at multiple sites could probably use the less dense grid array.

Trap Duration

The known cyclical nature of the little pocket mouse's above-ground activity (Kenagy 1973) complicates determining the proper trapping duration for monitoring studies. Trapping needs to be long enough to capture a large portion of the resident population (for an accurate population estimate), but not so long as to achieve diminishing returns or draw individuals onto grids from the outside. Based on trap results from this study and studies conducted on this species in 1995 (Dodd 1996), we recommend that each trap session consist of about 6 consecutive nights. Six nights seems to be long enough after the peak of new captures (usually around night 2) to capture a large portion of the resident population while minimizing the capture of transient individuals.

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RECOMMENDED PHASE III STUDIES

Based on the results of Phases I and II, we recommend the following studies during the year 2000 (Phase III). We continue to endorse a careful and systematic approach to designing the recovery program, but should be prepared to act swiftly if extirpation of any extant PPM site seems imminent. This approach was recommended by peer reviewers of the Phase I report.

Task 5b – Continued Evaluation of Potential Translocation Receiver Sites

The study team should continue evaluating in the field the potential receiver sites outlined by the GIS receiver site model (Task 5). During January-April 2000, the team should perform a preliminary reconnaissance of all field evaluation sites identified during Phase II and narrow the selection down to five to ten sites with the greatest potential to support translocated PPM. These sites should then be subject to more intensive, quantitative study during spring/summer 2000. Before beginning the quantitative studies, the team should continue working with the USFWS and other knowledgeable biologists to develop efficient methods for characterizing soils, vegetation, rodent communities, and other pertinent factors for their suitability to support introduced PPM populations. These methods are likely to include vegetation transects and refined vegetation mapping, refined soil mapping, and trapping to characterize the resident rodent community on each site. These results should be quantitatively compared with each other and with historic and extant PPM sites to identify factors likely to favor or disfavor success of a PPM introduction. The studies should also attempt to identify potential constraints on PPM populations, such as abundant competitor or predator populations or presence of Argentine ants. The team should continue soliciting input from species experts and the scientific peer committee throughout these efforts. It is also critical that discussions begin with appropriate land use authorities for the five to ten areas selected for consideration as translocation receiver sites. The USFWS should meet with appropriate persons to begin discussing constraints and opportunities for introduction of PPM into preserve areas.

Task 6b – Continued Laboratory Surrogate Studies

The captive population of *P. l. longimembris* will continue to be maintained through the year 2000 to continue tracking tag retention and health effects. We plan to increase the sample of PIT-tagged individuals to at least 10 to better test effects of this technique. The team should also explore use of the captive colony as a surrogate captive-breeding colony to test breeding protocols for application to PPM (e.g., design of breeding arenas with attached individual nest

boxes, as used by Hayden et al. 1966). We should also explore options for a cooperative arrangement with an agency that specializes in captive breeding programs, such as the Center for Reproduction of Endangered Species (CRES) at the San Diego Zoo. It may be important to create a working relationship with such a group in case PPM must be quickly removed from extant sites and brought into a captive breeding program.

Task 7b – Continued Field Surrogate Studies

The two Snow Creek study grids should be re-trapped during three seasons in the year 2000: pre-breeding (March-April), peak breeding (May-June), and post-reproductive (August-September). This will allow us to clearly differentiate age classes and mark individuals of all age classes to begin obtaining essential life history data. The study will also allow long-term health effects and tag retention for ear and PIT tags by recaptures of previously marked individuals. Each trapping session should last up to 6 nights using the denser (5-m) trap spacing on both grids. The team should also begin investigating alternative designs for artificial burrows and enclosures as means of increasing success of a PPM translocation program. This could include creation of artificial burrows or enclosures on the study grids to test their effectiveness and refine designs. Once such techniques are perfected using the surrogate *(P. l. bangsi)*, they can be applied to a PPM translocation program.

Coordination with Other Studies

In addition to the research tasks defined above, the team should continue coordinating with PPM recovery research tasks being performed by others, including genetics studies at UC-Berkeley, vegetation thinning experiments at extant PPM sites, and ongoing monitoring of extant PPM populations. This coordination should help ensure that results of these studies are adequately incorporated into the recovery program, including design of translocation or captive breeding efforts. Relative to these other studies, the team endorses the following changes or expansions to existing programs:

- Expand the population genetics study to include nuclear microsatellite techniques as well as mitochondrial DNA techniques. Microsatellite methods can provide better information than mitochondrial DNA techniques alone (see Appendix D for a discussion of the benefits of this approach prepared by Dr. James Patton).

- Perform experimental vegetation thinning on the San Mateo north PPM site using the experimental design currently being implemented at Dana Point (pre-thinning and post-

thinning trapping of experimental and control grids). This will increase the power of the findings by providing an experimental replicate. Perhaps more important, the thinning may increase habitat quality and population size at San Mateo North, which is prudent given the very low capture rates there during summer 1999 (Miller pers. comm.).

- Re-trap all extant PPM sites during 2000 to track population changes and, if necessary, be prepared to remove individuals to establish a breeding colony. Given that very few PPM were captured at extant sites during 1999 (Dodd, Pavelka, Miller, unpublished data), it is prudent to track the populations closely so that translocations or captive breeding can commence before they are too late.

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APPENDIX A
RESPONSES TO COMMENTS BY SCIENTIFIC PEER REVIEWERS, PACIFIC POCKET MOUSE STUDIES PROGRAM
PHASE II REPORT

Appendix A

Responses to Comments
By Scientific Peer Reviewers
Pacific Pocket Mouse Studies Program
Phase II Report

The Pacific pocket mouse study team greatly appreciates the helpful comments received on the Phase II report for PPM recovery planning studies. The comments have helped invigorate the discussions and strengthen our approaches for helping recover this species. Following is a summary interpretation of substantial comments (full comment letters are attached), with the responses of the study team. Where appropriate changes are also incorporated into the document text. Pertinent recommendations will be carried forward during future phases of the recovery research.

Dr. James Patton

1. *Comment*: You should use detailed microhabitat data at the extant PPM population sites to determine what the mice need.

   Response: We agree. Although detailed microhabitat measures has not been part of this scope of work, such data are being collected by the USFWS and other team members under other contracts, and are being duly considered. Recent detailed soils work by the USFWS on the Oscar One/Edson Range area are already refining our knowledge of species microhabitat requirements, and being used to refine the GIS habitat evaluation model.

2. *Comment*: Don't limit the study area to within 8 km of the coast based on historic locations, because this historic range may be an artifact of limited collecting.

   Response: We recognize the potential bias in collecting sites and the potential biological arbitrariness of the 8-km cutoff. However, we believe that the collecting bias is not substantial in this case, and that the association of PPM with fine sandy soils near river mouths and beaches is fairly well established. Although PPM could potentially have occurred farther inland than the 4 to 6 km cited in the literature, we doubt that appropriate conditions presently occur greater than 8 km.

3. *Comment*: Discussions with the USFWS and other land-use authorities must begin immediately, because partnerships required for an effective translocation effort will take time to develop.

   Response: We agree. Discussions have begun with some landowners controlling potential PPM translocation receiver sites (e.g., the Center for Natural Lands Management, USFWS Refuges, California State Parks, and Point Loma National Monument).

4. *Comment*: Toe-clipping seems the best overall marking technique, and I recommend using this method and foregoing the others, especially ear tags and sutures. Efforts with PIT tags should be extended primarily because these offer an unlimited set of unique identifications. If toe clips are taken on any natural population of pocket mouse (any species), preserve the tissues for future DNA extraction.

   Response: We agree. Alternatives to toe-clipping were pursued largely due to resistance to using this method within the wildlife agencies. Based on results of our studies and comments from the scientific peer committee, the wildlife agencies have agreed to permit toe-clipping on a case-by-case basis for permitted PPM biologists. Toe clips from all species of pocket mice will be preserved in 95% ethanol and provided for DNA extraction.

5. *Comment*: Try additional capture methods in the field, such as pit-falls or hand captures, and try observing animals at night, perhaps aided by Beta lights or LEDs glued to the animals.

   Response: We will investigate alternative techniques as options for field studies, and test them on the surrogate population if time and budgets permit without sacrificing other study goals. Pit traps or other methods that can capture multiple animals are generally not recommended for these animals, because they may be killed by other conspecific individuals or by other species entering the traps.

6. *Comment*: The actual timing of breeding will depend on rainfall and the flush of vegetation growth. Therefore, begin trapping as animals become active above ground in the spring and be prepared to alter the trapping schedule to coincide with the breeding peak.

   Response: We agree, and do alter trapping schedules to the degree feasible. Our spring 2000 trapping did coincide with the peak of breeding.

Dr. William Longland

1. *Comment*: Why continue to test PIT tags when they weren't as reliable for the lab animals as toe-clipping?

   Response: PIT tags offer an unlimited number of unique codes, whereas toe-clipping offers a finite number that might not be sufficient for a long-term population study. PIT tags are also less prone to observer errors (mis-reading of codes or application of duplicate codes to different individuals). Finally, there has been institutional resistance within the permitting agencies to using toe-clipping.

2. *Comment*: The conclusions regarding trap spacing effects are weak because the 2 grid designs are unreplicated. If there is insufficient space or field help to create more replicate grids, I suggest re-running both grids at the 5-m spacing to re-evaluate the sex ratio and density results.

   Response: We recognize the inherent weakness of the experimental design for comparing grid densities (lack of replicates). Comparing alternative trap spacings was not the primary purpose for the grids, so the design was not specifically tailored for this purpose. Nevertheless, the unreplicated "trials" provided the field workers a better feel for the alternative trap spacings (albeit, not in a statistically strong manner). We have switched to the 5-m spacing on both grids during year 2000 efforts, so we can re-evaluate the results with this year's data.

Wayne Spencer

From: James L. Patton [patton@uclink4.berkeley.edu]
Sent: Monday, March 06, 2000 8:32 AM
To: Wayne Spencer

Hi Wayne: Took time over the weekend to review the Phase II report. Seems to me like you guys are right on track. My few comments are below.
The mtDNA genetic work continues. Haplotypes for all samples sent last year have been determined, and we're continuing to work to get data from museum specimens. The numbers from last year are limited; hopefully this will be a more productive year. I'm also in contact with a commercial vendor to develop the microsat libraries--I just don't have the time to do that. I'm going to retire a year from July; maybe then.
Cheers,
Jim

Comments on Pacific Pocket Mouse Studies Program. Phase II Report

James L. Patton
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My overall impression is that Study Team has carefully designed the second phase of the recovery program for the Pacific Pocket Mouse, has adequately dealt with concerns or suggestions made by the Peer Review Committee, and is on track to make good use of the second year of necessary data gathering and analysis.

Specific comments
Task 5 (Translocation receiver site study): - In general, the goal of identifying appropriate habitat for potential release sites has been carefully developed and presented. While I'm not familiar with the region, I am none-the-less impressed with the apparent amount and size of potential areas. If ground-truth bears these out, and translocation methods can be worked out, that bodes well for the long-term of the PPM. The approach taken to develop a mapping effort based on GIS layers and then ground-truthing specific areas is excellent, as it avoid the pitfalls of the necessarily coarse-scale and potential wrong information in the GIS data. However, if you have not been determining in detail microhabitat parameters for each of the extant populations of the PPM, you should be. After all, the mice can tell you much more about "what they need" than a GIS map--these populations are remnants for good biological reasons, so let the mice tell you what those reasons are. (1)

I would not worry so much about the "8 km of the coast" requirement. The "historic" range of the PPM is, in part, an artifact of limited collecting--the fact that the PPM was not taken further inland is thus potentially misleading. I'd hate to see really good sites eliminated for such an arbitrary reason. (2)

Finally, I would certainly agree that additional study would be profitable, particularly the ground truthing the potential sites but also using data from the existing populations in the evaluation of suitable habitat and the development of a ranking scheme for these areas.

Recommended studies: I agree fully with the proposed effort in Task 5b- Continued evaluation (pg. 39). But, to reiterate, use data from the extant populations to inform you of the suitability of other sites, where possible. I also agree that evaluation of sites especially with high potential predators (e.g., sites near housing developments where the number of feral cats might be unusually high) is critical. I don't have an opinion of the possible negative effects of Argentine ants, but this is something that could be tested in the lab population. Finally, clearly discussions between the USFWS and other land-use authorities must begin immediately. Again, while I am not familiar with this general region, I suspect that any necessary partnership required for an effective translocation site will take time. It is, therefore, never too early to begin. (3)

Task 6 (Laboratory surrogate study): - This effort to identify the best long-term marking method without harm to individual animals has been carefully developed and the results seem unambiguous. Toe-clipping seems best overall, and I would recommend using that method and foregoing the others, especially ear tags and sutures. Effort with PIT tags should be extended, primarily because these offer an unlimited set of unique identifications. **If toe-clips are to be taken on any natural populations (PPM or other subspecies), make sure that the toes are preserved in vials of 95% ethanol (or some other tissue preservative) for future DNA extraction.** (4)

Recommended studies: I agree. This colony should be maintained and efforts should be made to develop functional breeding protocols, as well as to continue the monitoring of tag methods, etc.

Task 7 (Surrogate field study): - Nothing that happens in the laboratory can take the place of a carefully monitored field study of the same issues of importance. Consequently, continuing this field study is imperative. As I said in earlier comments, I would take advantage of the field site to develop additional means to assess the presence of mice rather than relying solely on traps (such as using a hand light at night). You might also try additional trapping methods (pit-falls with drift fences and traps other than Shermans) to determine suitability and increase effective trapping. Importantly, if individuals are being marked by toe-clipping, **SAVE THE TOES IN 95% ETHANOL FOR FUTURE DNA STUDIES.** (5)

I have no other suggestions to make on this Task; the trapping design was carefully considered and the "right" kinds of data are being gathered. If you were to add anything, it would be (again) to spend time at night actually watching animals, trying to determine travel path, time spent above-ground, etc. If the habitat is sufficiently open, it might be possible to glue beta lights or other similar devises (LEDs with microswitch) and use either night vision equipment or unaided eyes. People here have had good success following Peromyscus in oak-bay woodland.

Recommended studies: I agree totally that this population should be trapped during the three seasons of spring, summer, and early fall. However, the actual timing of breeding will depend on rainfall amounts and timing, and the flush of vegetation growth. It is very important, therefore, to begin trapping as animals become active above ground in the spring and be prepared to alter your trapping schedule so that it can coincide with the peak breeding period. (6)

Overall, I continue to be very impressed with the scope of this entire effort and the care with which each element has been developed, and modified as needed.
****

James L. Patton
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Christina Schaefer

From: Bill Longland <longland@scs.unr.edu>
To: Christina Schaefer <cschaefer@keasd.com>
Cc: <wdspencer@consbio.org>
Sent: Wednesday, March 29, 2000 1:23 PM
Subject: Re: Pacific Pocket Mouse Recovery Study: comments on Phase II Peer Review Draft by April 5, please.

Christina,

My apologies for not responding to the Phase II report earlier. Based on the priorities indicated by you and Wayne Spencer, I'll limit my comments to the part of the report on "Recommended Phase III studies". Most of these points may come out in the meeting tomorrow, but since I can only participate briefly by phone, and for the sake of completeness, I'll give you my thoughts in writing, too.

I fully agree with the goals outlined in Task 5b to contnue evaluating possible translocation sites for PPM, and believe that the proposed refinements in vegetation and soil mapping should receive attention.

Task 6b -- Continued laboratory surrogate studies:

1 Why continue to test PIT tags when they weren't as reliable for the lab animals as toe clipping? Is this due to concern that permission will not be granted to use toe clipping on PPM, and PIT tags are second best?

I've commented previously on the difficult nature of captive breeding for heteromyid species, and the team appears to be fully aware of this problem, so I won't reiterate. There was a group at Berkeley that was attempting captive breeding with an endangered coastal k-rat species (Morro Bay k-rat?). Have they been able to provide any information to further inform the team about the feasibility of this option?

Task 7b -- Continued field surrogate studies.

I agree with the idea of seasonal trapping of the surrogate population to attain important life history data, but is there any plan to trap more than the same 2 grids? (Is there even sufficient space at the site for more grids?) I found the conclusions regarding trap spacing effects on estimated densities and sex ratios of the surrogate population to be very weak, because the 2 grid designs were unreplicated. Therefore, the purported trap-spacing effects may simply be effects of spatial pseudoreplication. If there is not sufficient space or field help to run additional grids, I'd suggest re-evaluating sex ratios and densities on the 2 replicated grids using the 5-m spacing on both grids.

2

I have some experience with enclosures and artificial burrows for use in heteromyid field studies, and suggest the following. If you're using

hardware cloth to contruct fences, it has to be no larger that 1/4" mesh to prevent P. longimembris individuals from penetrating it (they can get through 1/2" mesh, which means that you must also be very diligent about patching all holes, even small ones). Enclosure fences must be buried suffiently deep to prevent burrowing under them by PPM; this depth would vary with different soil types, but probably should be no less than about 1/2 m deep. If using mesh for fences, a strip of sheet metal or something they can't climb should be firmly attached to the top of the fence.

Heteromyids tend to reject artificial burrows if the diameter of entry tunnels is not appropriate for their body size. If entry tunnels exceed by much the minimum size neccesary for the animals to pass through, they tend to not use them. We use 1" diameter PVC pipe for P. longimembris tunnels, and glue sand to the inner surfaces of the pipes to make for better traction and a more natural substrate. They usually will not use burrows with only one entrance/exit (may be an anti-snake behavior). We use two entry/exit tubes fastened to opposite sides of a plastic burrow chamber (bucket). We also have noticed that the animals seem to adopt artificial burrows better if there is some complexity to the inner chambers of the burrow, so we subdivide the chamber buckets into 3 distinct levels (floors) using plywood dividers with a hole drilled in each floor to permit passage between floors. The burrow entrances (PVC tubes) are fastened to opposite sides of the top and bottom levels. Finally, I'm not sure how much P. longimembris plugs its burrows from inside (k-mice and certain k-rats do it a lot), but it may help to devise some way that they can plug openings of tubes when they are inside. Perhaps cutting the ends of the tubes at the soil surface ends into semicircles and placing them so there is no PVC tube bottom (only a top to prevent collapse) to the tunnels wood make them more attractive to animals that plug their burrows, but I haven't experimented with that idea.

Hope some of this is useful.

Sincerely,

Bill Longland

****

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APPENDIX B
SOIL TYPES IN ORANGE AND SAN DIEGO COUNTIES, RANKED FOR POTENTIAL TO SUPPORT PACIFIC POCKET MICE

SAN DIEGO COUNTY SOILS

DESCRIPTION	TEXTURE RANK	PHASE	COMMENTS	ACRES	MODIFIED RANK
Bonsall sandy loam, 2 to 9 percent slopes	HIGH	sandy loam		35.31	HIGH
Bonsall sandy loam, 2 to 9 percent slopes, eroded	HIGH	sandy loam		194.37	HIGH
Bonsall sandy loam, 9 to 15 percent slopes, eroded	HIGH	sandy loam		26.3	HIGH
Chesterton fine sandy loam, 2 to 5 percent slopes	HIGH	fine sandy loam		3,461.00	HIGH
Chesterton fine sandy loam, 5 to 9 percent slopes	HIGH	fine sandy loam		1,986.07	HIGH
Chesterton fine sandy loam, 9 to 15 percent slopes, eroded	HIGH	fine sandy loam		615.51	HIGH
Chesterton-Urban land complex, 2 to 9 percent slopes	NONE	land complex		4,772.10	NONE
Fallbrook rocky sandy loam, 9 to 30 percent slopes, eroded	LOW	sandy loam		113.91	LOW
Fallbrook sandy loam, 5 to 9 percent slopes, eroded	LOW	sandy loam		21.29	LOW
Greenfield sandy loam, 0 to 2 percent slopes	HIGH	sandy loam		403.62	HIGH
Greenfield sandy loam, 2 to 5 percent slopes	HIGH	sandy loam		194.77	HIGH
Greenfield sandy loam, 5 to 9 percent slopes	HIGH	sandy loam		48.4	HIGH
Huerhuero loam, 15 to 30 percent slopes, eroded	LOW	loam		6,077.35	LOW
Huerhuero loam, 2 to 9 percent slopes	LOW	loam		9,017.03	LOW
Huerhuero loam, 5 to 9 percent slopes, eroded	LOW	loam		2,301.19	LOW
Huerhuero loam, 9 to 15 percent slopes	LOW	loam		1,708.40	LOW
Huerhuero loam, 9 to 15 percent slopes, eroded	LOW	loam		1,662.48	LOW
Huerhuero-Urban land complex, 2 to 9 percent slopes	NONE	land complex		12,294.72	NONE
Huerhuero-Urban land complex, 9 to 30 percent slopes	NONE	land complex		2,825.42	NONE
Las Flores loamy fine sand, 15 to 30 percent slopes	HIGH	loamy fine sand		3,286.45	HIGH
Las Flores loamy fine sand, 15 to 30 percent slopes, eroded	HIGH	loamy fine sand		2,502.61	HIGH
Las Flores loamy fine sand, 2 to 9 percent slopes	HIGH	loamy fine sand		1,629.50	HIGH
Las Flores loamy fine sand, 5 to 9 percent slopes	HIGH	loamy fine sand		2,101.97	HIGH
Las Flores loamy fine sand, 9 to 15 percent slopes	HIGH	loamy fine sand		1,611.71	HIGH
Las Flores loamy fine sand, 9 to 15 percent slopes, eroded	HIGH	loamy fine sand		2,649.88	HIGH
Las Flores loamy fine sand, 9 to 30 percent slopes, severely eroded	HIGH	loamy fine sand		1,555.44	HIGH
Las Flores-Urban land complex, 2 to 9 percent slopes	NONE	land complex		680.4	NONE
Las Flores-Urban land complex, 9 to 30 percent slopes	NONE	land complex		564.07	NONE
Las Posas fine sandy loam, 5 to 9 percent slopes	LOW	fine sandy loam		33.27	LOW
Las Posas stony fine sandy loam, 30 to 65 percent slopes	LOW	stony fine sandy loam		55.11	LOW
Las Posas stony fine sandy loam, 9 to 15 percent slopes	LOW	stony fine sandy loam		21.73	LOW
Loamy alluvial land-Huerhuero complex, 9 to 50 percent slopes, severely eroded	LOW			6,157.22	LOW
Olivenhain cobbly loam, 2 to 9 percent slopes	LOW	cobbly loam		1,814.05	LOW
Olivenhain cobbly loam, 30 to 50 percent slopes	LOW	cobbly loam		3,469.01	LOW

Olivenhain cobbly loam, 9 to 30 percent slopes	LOW	cobbly loam		3,851.91	LOW
Olivenhain-Urban land complex, 2 to 9 percent slopes	NONE	land complex		1,102.13	NONE
Olivenhain-Urban land complex, 9 to 30 percent slopes	NONE	land complex		1,282.54	NONE
Placentia sandy loam, thick surface, 2 to 9 percent slopes	HIGH	sandy loam		95.74	HIGH
Ramona gravelly sandy loam, 15 to 30 percent slopes	HIGH	gravelly sandy loam		44.42	HIGH
Ramona sandy loam, 2 to 5 percent slopes	LOW	sandy loam	deep A horizon; 15-20% gravel; includes sandy loams	306.87	HIGH
Ramona sandy loam, 5 to 9 percent slopes	HIGH	sandy loam		69.17	HIGH
Ramona sandy loam, 9 to 15 percent slopes, eroded	HIGH	sandy loam		17.41	HIGH
Redding cobbly loam, 9 to 30 percent slopes	LOW	cobbly loam		719.51	LOW
Redding cobbly loam, dissected, 15 to 30 percent slopes	LOW	cobbly loam		323.49	LOW
Redding gravelly loam, 2 to 9 percent slopes	LOW	gravelly loam		2,211.88	LOW
Redding-Urban land complex, 2 to 9 percent slopes	NONE	land complex		1,932.91	NONE
Redding-Urban land complex, 9 to 30 percent slopes	NONE	land complex		126.45	NONE
San Miguel rocky silt loam, 9 to 30 percent slopes	LOW	rocky silt loam		302.63	LOW
San Miguel-Exchequer rocky silt loams, 9 to 70 percent slopes	LOW	rocky silt loam		706.11	LOW
Anderson very gravelly sandy loam, 9 to 45 percent slopes	NONE	very gravelly sandy loam		19.83	NONE
Cieneba coarse sandy loam, 15 to 30 percent slopes, eroded	HIGH	coarse sandy loam		260.29	HIGH
Cieneba coarse sandy loam, 30 to 65 percent slopes, eroded	HIGH	coarse sandy loam		204.15	HIGH
Cieneba coarse sandy loam, 5 to 15 percent slopes, eroded	HIGH	coarse sandy loam		298.82	HIGH
Cieneba rocky coarse sandy loam, 9 to 30 percent slopes, eroded	HIGH	rocky coarse sandy loam		40.73	HIGH
Cieneba very rocky coarse sandy loam, 30 to 75 percent slopes	HIGH	very rocky coarse sandy loam		131.62	HIGH
Cieneba-Fallbrook rocky sandy loam,9 to 30 percent slope,eroded	HIGH	rocky sandy loam		438.37	HIGH
Cieneba-Fallbrook rocky sandy loams, 30 to 65 percent slopes, eroded	HIGH	rocky sandy loam		147.7	HIGH
Corralitos loamy sand, 0 to 5 percent slopes	HIGH	loamy sand		1,550.95	HIGH
Corralitos loamy sand, 5 to 9 percent slopes	HIGH	loamy sand		2,752.65	HIGH
Corralitos loamy sand, 9 to 15 percent slopes	HIGH	loamy sand		1,955.97	HIGH
Exchequer rocky silt loam, 30 to 70 percent slopes	LOW	rocky silt loam	A = 10 in.; includes silt and fine sandy loams	383.27	HIGH
Exchequer rocky silt loam, 9 to 30 percent slopes	LOW	rocky silt loam		677.74	HIGH
Gaviota fine sandy loam, 30 to 50 percent slopes	HIGH	fine sandy loam		12,026.48	HIGH
Gaviota fine sandy loam, 9 to 30 percent slopes	HIGH	fine sandy loam		1,596.74	HIGH
Marina loamy coarse sand, 2 to 9 percent slopes	HIGH	loamy coarse sand		13,172.82	HIGH
Marina loamy coarse sand, 9 to 30 percent slopes	HIGH	loamy coarse sand		2,019.33	HIGH
Reiff fine sandy loam, 0 to 2 percent slopes	HIGH	fine sandy loam		162.78	HIGH
Reiff fine sandy loam, 2 to 5 percent slopes	HIGH	fine sandy loam		625.63	HIGH
Reiff fine sandy loam, 5 to 9 percent slopes	HIGH	fine sandy loam		388.61	HIGH
Tujunga sand, 0 to 5 percent slopes	HIGH	sand		5,558.44	HIGH
Carlsbad gravelly loamy sand, 15 to 30 percent slopes	HIGH	gravelly loamy sand		427.97	HIGH
Carlsbad gravelly loamy sand, 2 to 5 percent slopes	HIGH	gravelly loamy sand		1,568.27	HIGH
Carlsbad gravelly loamy sand, 5 to 9 percent slopes	HIGH	gravelly loamy sand		2,511.02	HIGH

Carlsbad gravelly loamy sand, 9 to 15 percent slopes	HIGH	gravelly loamy sand		801.57	HIGH
Carlsbad-Urban land complex, 2 to 9 percent slopes	NONE	land complex		1,344.84	NONE
Carlsbad-Urban land complex, 9 to 30 percent slopes	NONE	land complex		573.4	NONE
Escondido very fine sandy loam, 15 to 30 percent slopes, eroded	HIGH	very fine sandy loam		15.74	HIGH
Vista coarse sandy loam, 30 to 65 percent slopes	HIGH	coarse sandy loam		4.22	HIGH
Vista coarse sandy loam, 5 to 9 percent slopes	HIGH	coarse sandy loam		84.35	HIGH
Vista coarse sandy loam, 9 to 15 percent slopes	HIGH	coarse sandy loam		49.56	HIGH
Vista coarse sandy loam, 9 to 15 percent slopes, eroded	HIGH	coarse sandy loam		0.3	HIGH
Chino fine sandy loam, 0 to 2 percent slopes	HIGH	fine sandy loam		190.58	HIGH
Chino silt loam, saline, 0 to 2 percent slopes	LOW	silt loam	includes sandy loams	3,859.74	HIGH
Elder shaly fine sandy loam, 2 to 9 percent slopes	HIGH	shaly fine sandy loam		1,330.40	HIGH
Friant rocky fine sandy loam, 30 to 70 percent slopes	HIGH	rocky fine sandy loam		11.66	HIGH
Friant rocky fine sandy loam, 9 to 30 percent slopes	HIGH	rocky fine sandy loam		330.43	HIGH
Grangeville fine sandy loam, 0 to 2 percent slopes	HIGH	fine sandy loam		1,449.37	HIGH
Hambright gravelly clay loam, 30 to 75 percent slopes	NONE	gravelly clay loam		9,906.12	NONE
La Posta rocky loamy coarse sand, 5 to 30 percent slopes, eroded	HIGH	rocky loamy coarse sand		283.74	HIGH
Linne clay loam, 30 to 50 percent slopes	NONE	clay loam		2,956.61	NONE
Linne clay loam, 9 to 30 percent slopes	NONE	clay loam		1,483.92	NONE
Salinas clay loam, 0 to 2 percent slopes	NONE	clay loam		1,030.13	NONE
Salinas clay loam, 2 to 9 percent slopes	NONE	clay loam		5,282.15	NONE
Salinas clay, 0 to 2 percent slopes	NONE	clay loam		900.47	NONE
Salinas clay, 2 to 5 percent slopes	NONE	clay loam		784.63	NONE
Visalia gravelly sandy loam, 2 to 5 percent slopes	HIGH	gravelly sandy loam		449.43	HIGH
Visalia gravelly sandy loam, 5 to 9 percent slopes	HIGH	gravelly sandy loam		193.47	HIGH
Visalia sandy loam, 0 to 2 percent slopes	HIGH	sandy loam		1,298.57	HIGH
Visalia sandy loam, 2 to 5 percent slopes	HIGH	sandy loam		1,600.04	HIGH
Visalia sandy loam, 5 to 9 percent slopes	HIGH	sandy loam		309.8	HIGH
Visalia sandy loam, 9 to 15 percent slopes	HIGH	sandy loam		98.35	HIGH
	NONE			3,367.75	NONE
Coastal beaches	NONE			2,385.07	NONE
GRAVEL PIT	NONE			896	NONE
Made land	NONE			5,451.12	NONE
Mine and quarry	NONE			276.43	NONE
Riverwash	LOW			3,235.00	LOW
Rough broken land	LOW			1,965.87	LOW
Steep gullied land	LOW			646.43	LOW
Stony land	LOW		consists of many stones, cobbles, and boulders	690.73	NONE
Terrace escarpments	LOW			14,046.02	LOW
Tidal flats	NONE			3,155.81	NONE
Unclassified area due to both yearly or perennial water accumulation	NONE			74.11	NONE
Urban land	NONE			18,788.10	NONE

Altamont clay, 15 to 30 percent slopes	NONE	clay	1,876.21	NONE
Altamont clay, 15 to 30 percent slopes, eroded	NONE	clay	1,063.89	NONE
Altamont clay, 30 to 50 percent slopes	NONE	clay	3,897.32	NONE
Altamont clay, 5 to 9 percent slopes	NONE	clay	1,328.17	NONE
Altamont clay, 9 to 15 percent slopes	NONE	clay	1,313.03	NONE
Altamont clay, 9 to 15 percent slopes, eroded	NONE	clay	300.67	NONE
Auld clay, 5 to 9 percent slopes	NONE	clay	36.14	NONE
Auld clay, 9 to 15 percent slopes	NONE	clay	5.92	NONE
Diablo clay, 15 to 30 percent slopes	NONE	clay	1,060.27	NONE
Diablo clay, 15 to 30 percent slopes	NONE	clay	1,633.56	NONE
Diablo clay, 2 to 9 percent slopes	NONE	clay	860.4	NONE
Diablo clay, 30 to 50 percent slopes	NONE	clay	1,384.99	NONE
Diablo clay, 9 to 15 percent slopes	NONE	clay	1,660.63	NONE
Diablo-Olivenhain complex, 9 to 30 percent slopes	NONE	land complex	121.19	NONE
Diablo-Urban land complex, 15 to 50 percent slopes	NONE	land complex	471.44	NONE
Diablo-Urban land complex, 5 to 15 percent slopes	NONE	land complex	926.84	NONE
WATER	NONE		787.13	NONE

ORANGE COUNTY SOILS

MAP UNIT NAME	TEXTURE RANK	SURFACE TEXTURE	COMMENTS	ACRES	MODIFIED RANK
ALO CLAY, 15 TO 30 PERCENT SLOPES	NONE	CLAY		4,458.41	NONE
ALO CLAY, 30 TO 50 PERCENT SLOPES	NONE	CLAY		5,707.02	NONE
ALO CLAY, 9 TO 15 PERCENT SLOPES	NONE	CLAY		2,085.01	NONE
ALO VARIANT CLAY, 15 TO 30 PERCENT SLOPES	NONE	CLAY		8.86	NONE
ALO VARIANT CLAY, 30 TO 50 PERCENT SLOPES	NONE	CLAY		39.08	NONE
ALO VARIANT CLAY, 9 TO 15 PERCENT SLOPES	NONE	CLAY		40.18	NONE
ANAHEIM CLAY LOAM, 15 TO 30 PERCENT SLOPES	NONE	CLAY LOAM		281.52	NONE
ANAHEIM CLAY LOAM, 30 TO 50 PERCENT SLOPES	NONE	CLAY LOAM		820.12	NONE
ANAHEIM CLAY LOAM, 50 TO 75 PERCENT SLOPES	NONE	CLAY LOAM		510.11	NONE
ANAHEIM LOAM, 15 TO 30 PERCENT SLOPES	LOW	LOAM		552.86	LOW
ANAHEIM LOAM, 30 TO 50 PERCENT SLOPES	LOW	LOAM		831.29	LOW
BALCOM CLAY LOAM, 15 TO 30 PERCENT SLOPES	NONE	CLAY LOAM		481.47	NONE
BALCOM CLAY LOAM, 30 TO 50 PERCENT SLOPES	NONE	CLAY LOAM		765.39	NONE
BALCOM CLAY LOAM, 9 TO 15 PERCENT SLOPES	NONE	CLAY LOAM		57.28	NONE
BALCOM-ROCK OUTCROP COMPLEX, 15 TO 50 PERCENT SLOPES	NONE	ROCK OUTCROP		214.43	NONE
BEACHES	NONE			4,533.75	NONE
BLASINGAME STONY LOAM, 30 TO 65 PERCENT SLOPES	LOW	STONY LOAM	A = 5"; clay subsoil	55.79	NONE
BOLSA SILT LOAM	LOW	SILT LOAM		944.22	LOW
BOLSA SILT LOAM, DRAINED	LOW	SILT LOAM		9,875.66	LOW
BOLSA SILTY CLAY LOAM	NONE	SILTY CLAY LOAM		925.88	NONE
BOLSA SILTY CLAY LOAM, DRAINED	NONE	SILTY CLAY LOAM		4,711.85	NONE
BOSANKO CLAY, 15 TO 30 PERCENT SLOPES	NONE	CLAY		2,084.08	NONE
BOSANKO CLAY, 30 TO 50 PERCENT SLOPES	NONE	CLAY		1,492.97	NONE
BOSANKO CLAY, 9 TO 15 PERCENT SLOPES	NONE	CLAY		918.12	NONE
BOSANKO-BALCOM COMPLEX, 15 TO 30 PERCENT SLOPES	NONE			507.79	NONE
BOSANKO-BALCOM COMPLEX, 30 TO 50 PERCENT SLOPES	NONE			316.03	NONE
BOTELLA CLAY LOAM, 2 TO 9 PERCENT SLOPES	NONE	CLAY LOAM		593.94	NONE
BOTELLA CLAY LOAM, 9 TO 15 PERCENT SLOPES	NONE	CLAY LOAM		673.73	NONE
BOTELLA LOAM, 2 TO 9 PERCENT SLOPES	LOW	LOAM		378.87	LOW
CALLEGUAS CLAY LOAM, 50 TO 75 PERCENT SLOPES, ERODED	NONE	CLAY LOAM		10,431.56	NONE
CAPISTRANO SANDY LOAM, 2 TO 9 PERCENT SLOPES	HIGH	SANDY LOAM		1,082.18	HIGH
CAPISTRANO SANDY LOAM, 9 TO 15 PERCENT SLOPES	HIGH	SANDY LOAM		412.07	HIGH
CHESTERTON LOAM SAND, 15 TO 30 PERCENT SLOPES	HIGH	LOAMY SAND		99.4	HIGH
CHESTERTON LOAMY SAND, 2 TO 15 PERCENT SLOPES	HIGH	LOAMY SAND		320.9	HIGH

CHINO SILTY CLAY LOAM	NONE	SILTY CLAY LOAM		270.05	NONE
CHINO SILTY CLAY LOAM, DRAINED	NONE	SILTY CLAY LOAM		90.18	NONE
CIENEBA SANDY LOAM, 15 TO 30 PERCENT SLOPES	HIGH	SANDY LOAM		751.64	HIGH
CIENEBA SANDY LOAM, 30 TO 75 PERCENT SLOPES, ERODED	HIGH	SANDY LOAM		3,341.07	HIGH
CIENEBA-BLASINGAME-ROCK OUTCROP COMPLEX, 9 TO 30 PERCENT SLOPES	HIGH	ROCK OUTCROP		2.32	HIGH
CIENEBA-ROCK OUTCROP COMPLEX, 30 TO 75 PERCENT SLOPES	HIGH	ROCK OUTCROP		6,583.70	HIGH
CORRALITOS LOAMY SAND	HIGH	LOAMY SAND		356.49	HIGH
CORRALITOS LOAMY SAND, MODERATELY FINE SUBSTRATUM	HIGH	LOAMY SAND		239.33	HIGH
CROPLEY CLAY, 0 TO 2 PERCENT SLOPES	NONE	CLAY		67.22	NONE
CROPLEY CLAY, 2 TO 9 PERCENT SLOPES	NONE	CLAY		2,986.71	NONE
GABINO GRAVELLY CLAY LOAM, 15 TO 50 PERCENT SLOPES	NONE	GRAVELLY CLAY LOAM		24.53	NONE
HUENEME FINE SANDY LOAM	HIGH	FINE SANDY LOAM		493.24	HIGH
HUENEME FINE SANDY LOAM, DRAINED	HIGH	FINE SANDY LOAM		6,647.57	HIGH
MARINA LOAMY SAND, 0 TO 2 PERCENT SLOPES	HIGH	LOAMY SAND		554	HIGH
MARINA LOAMY SAND, 2 TO 9 PERCENT SLOPES	HIGH	LOAMY SAND		4,371.95	HIGH
METZ LOAMY SAND	HIGH	LOAMY SAND		707.99	HIGH
METZ LOAMY SAND, MODERATELY FINE SUBSTRATUM	HIGH	LOAMY SAND		751.02	HIGH
MOCHO LOAM, 0 TO 2 PERCENT SLOPES	LOW	LOAM		266.55	LOW
MOCHO LOAM, 2 TO 9 PERCENT SLOPES	LOW	LOAM		70.88	LOW
MOCHO SANDY LOAM, 0 TO 2 PERCENT SLOPES	HIGH	SANDY LOAM		44.8	HIGH
MODJESKA GRAVELLY LOAM, 15 TO 30 PERCENT SLOPES	LOW	GRAVELLY LOAM		169.43	LOW
MODJESKA GRAVELLY LOAM, 9 TO 15 PERCENT SLOPES	LOW	GRAVELLY LOAM		265.43	LOW
MYFORD SANDY LOAM, 0 TO 2 PERCENT SLOPES	HIGH	SANDY LOAM		2,852.58	HIGH
MYFORD SANDY LOAM, 15 TO 30 PERCENT SLOPES	HIGH	SANDY LOAM		509.19	HIGH
MYFORD SANDY LOAM, 2 TO 9 PERCENT SLOPES	HIGH	SANDY LOAM		6,117.56	HIGH
MYFORD SANDY LOAM, 2 TO 9 PERCENT SLOPES, ERODED	HIGH	SANDY LOAM		1,213.70	HIGH
MYFORD SANDY LOAM, 9 TO 15 PERCENT SLOPES	HIGH	SANDY LOAM		2,123.07	HIGH
MYFORD SANDY LOAM, 9 TO 30 PERCENT SLOPES, ERODED	HIGH	SANDY LOAM		1,779.36	HIGH
MYFORD SANDY LOAM, THICK SURFACE, 0 TO 2 PERCENT SLOPES	HIGH	SANDY LOAM		1,884.76	HIGH
MYFORD SANDY LOAM, THICK SURFACE, 2 TO 9 PERCENT SLOPES	HIGH	SANDY LOAM		1,162.61	HIGH
OMNI CLAY, DRAINED	NONE	CLAY		1,318.91	NONE
OMNI SILT LOAM, DRAINED	LOW	SILT LOAM	Moist; poorly drained	308.32	NONE
PITS	NONE			377.83	NONE
RIVERWASH	LOW			881.95	LOW
ROCK OUTCROP-CIENEBA COMPLEX, 30 TO 75 PERCENT SLOPES	LOW	ROCK OUTCROP		1,244.17	LOW
SAN ANDREAS SANDY LOAM, 15 TO 30 PERCENT SLOPES	HIGH	SANDY LOAM		443.09	HIGH
SAN EMIGDIO FINE SANDY LOAM, 0 TO 2 PERCENT SLOPES	HIGH	FINE SANDY LOAM		78.31	HIGH

SAN EMIGDIO FINE SANDY LOAM, 2 TO 9 PERCENT SLOPES	HIGH	FINE SANDY LOAM		14.23	HIGH
SAN EMIGDIO FINE SANDY LOAM, MODERATELY FINE SUBSTRATUM, 0 TO 2 PERCENT SLOPES	HIGH	FINE SANDY LOAM		87.12	HIGH
SOBOBA COBBLY LOAMY SAND, 0 TO 15 PERCENT SLOPES	HIGH	COBBLY LOAMY SAND	A = 10" over very	27.88	LOW
SOBOBA GRAVELLY LOAMY SAND, 0 TO 5 PERCENT SLOPES	HIGH	GRAVELLY LOAMY SAND	gravelly material	155.83	LOW
SOPER COBBLY LOAM, 15 TO 50 PERCENT SLOPES	LOW	COBBLY LOAM		17.72	LOW
SOPER GRAVELLY LOAM, 15 TO 30 PERCENT SLOPES	LOW	GRAVELLY LOAM		572.27	LOW
SOPER GRAVELLY LOAM, 30 TO 50 PERCENT SLOPES	LOW	GRAVELLY LOAM		1,828.21	LOW
SOPER LOAM, 15 TO 30 PERCENT SLOPES	LOW	LOAM		9.08	LOW
SOPER LOAM, 30 TO 50 PERCENT SLOPES	LOW	LOAM		10.29	LOW
SOPER-ROCK OUTCROP COMPLEX, 30 TO 75 PERCENT SLOPES	LOW	ROCK OUTCROP	A = shallow	738.77	NONE
SORRENTO CLAY LOAM, 0 TO 2 PERCENT SLOPES	NONE	CLAY LOAM		380.67	NONE
SORRENTO CLAY LOAM, 2 TO 9 PERCENT SLOPES	NONE	CLAY LOAM		1,284.09	NONE
SORRENTO LOAM, 0 TO 2 PERCENT SLOPES	LOW	LOAM		573.35	LOW
SORRENTO LOAM, 2 TO 9 PERCENT SLOPES	LOW	LOAM		1,186.68	LOW
SORRENTO SANDY LOAM, 0 TO 2 PERCENT SLOPES	HIGH	SANDY LOAM		17.8	HIGH
THAPTO-HISTIC FLUVAQUENTS	NONE			92.34	NONE
TIDAL FLATS	NONE			3,043.04	NONE
WATER	NONE			2,301.80	NONE
XERALFIC ARENTS, LOAMY, 2 TO 9 PERCENT SLOPES	NONE	LOAMY		951.97	NONE
XERALFIC ARENTS, LOAMY, 9 TO 15 PERCENT SLOPES	NONE	LOAMY		203.39	NONE
XERORTHENTS LOAMY, CUT AND FILL AREAS, 15 TO 30 PERCENT SLOPES	NONE	LOAMY		331.78	NONE
XERORTHENTS LOAMY, CUT AND FILL AREAS, 9 TO 15 PERCENT SLOPES	NONE	LOAMY		230.71	NONE
YORBA COBBLY SANDY LOAM, 30 TO 50 PERCENT SLOPES	HIGH	COBBLY SANDY LOAM		451.26	LOW
YORBA COBBLY SANDY LOAM, 9 TO 30 PERCENT SLOPES	HIGH	COBBLY SANDY LOAM		120.07	LOW
YORBA COBBLY SANDY LOAM, 9 TO 30 PERCENT SLOPES, ERODED	HIGH	COBBLY SANDY LOAM	A = 11"	310.26	LOW
YORBA GRAVELLY SANDY LOAM, 15 TO 30 PERCENT SLOPES	HIGH	GRAVELLY SANDY LOAM		117.96	LOW
YORBA GRAVELLY SANDY LOAM, 2 TO 9 PERCENT SLOPES	HIGH	GRAVELLY SANDY LOAM		168.65	LOW
YORBA GRAVELLY SANDY LOAM, 9 TO 15 PERCENT SLOPES	HIGH	GRAVELLY SANDY LOAM	A = 11"	190.87	LOW

APPENDIX C
DATA SHEET FOR INITIAL HABITAT QUALITY RECONNAISSANCE AT POTENTIAL PPM TRANSLOCATION RECEIVER SITES

Potential Receiver Site Data Sheet

Date _____ Observers _____ Page 1 of ____

Site Location _____ County _____

Habitat

1) Location _____

Habitat Type _____

Shrub Layer 0 1 2 4 5 6 7 8 9 10; Comments (exotics?)_____

Dom. Species _____

Sub-Shrub Layer 0 1 2 4 5 6 7 8 9 10; Comments_____

Dom. Species _____

Herb Layer 0 1 2 3 4 5 6 7 8 9 10; Comments_____

Dom. Species _____

Ground surface cover: % Open Ground 0 1 2 3 4 5 6 7 8 9 10 _____

Detritus (wood/leaf litter)0 1 2 3 4 5 6 7 8 9 10; Pebble/Cobble/Rock 0 1 2 3 4 5 6 7 8 9 10

Soil Conditions (sand/loam/clay) (compact/loosely packed) (depth?_____)

Comments_____

Slope, Topography _____

Surrounding Habitat and Land Use _____

Management Needs _____

Rating (prime/high/medium-high/medium-low/low)_____

Add'l Comments: (cats, ants?)_____

_____

APPENDIX D
ANALYSIS OF GENETIC DIVERSITY IN THE PACIFIC POCKET MOUSE (*PEROGNATHUS LONGIMEMBRIS PACIFICUS*): A PROPOSAL FROM DR. JAMES PATTON

Analysis of genetic diversity in the Pacific pocket mouse (Perognathus longimembris pacificus)

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Proposal

In the comments below, I summarize what is known about the genetic diversity and population genetic structure of the long-tailed pocket mouse, Perognathus longimembris, in southern California. I do this in the context of identifying the types of questions to which genetic data can be applied, and which may be of significance to the recovery planning for this taxon. Only one genetic study of these animals has been accomplished to date; that involves a comparative phylogeographic analysis of relationships among sampled populations of all of the subspecies of P. longimembris that occur in southern California. This study employed a gene sequence from the maternally inherited mitochondrial genome which can be used to infer the degrees of historical gene flow between populations as well as the relationship between geographic genetic structure and current subspecies boundaries (Brylski and Patton, in manuscript).

Genetic questions of potential importance to the recovery of the Pacific pocket mouse (PPM) fall into three general categories. The first of these is: How unique is the Pacific pocket mouse? The second is: How interconnected are extant populations of the PPM by current, or at least recent past, gene flow? And the third is: Have populations of PPM lost genetic diversity as a result of population decline and/or habitat fragmentation?

(1) The first question, that of genetic uniqueness, can be readily assessed by use of comparative mitochondrial DNA (mtDNA) sequences. This DNA is maternally inherited, has no recombination, and has a high rate of mutation in comparison to nuclear genes. Consequently, populations are more likely to exhibit differences in their mtDNA sequences. If a subspecies, such as the PPM, is "reciprocally monophyletic" for its mtDNA sequences (i.e., has both a unique set of mtDNA sequences with those sequences forming a genealogical lineage), then that subspecies has been genetically isolated from others for a substantial amount of time. The degree of divergence can indicate the temporal length of that separation.

To answer this general question, we will examine both cytochrome b and Control-region (=D-loop) sequences from all individual PPM available for analysis. DNA is already available from the Dana Point sample (six individuals) and from several samples each of the other subspecies in southern California, and cytochrome b sequences have been generated from these specimens (see Brylski and Patton, in manuscript). Maximally, DNA should be extracted from hairs or skin biopsies from all PPM captured during current survey work, at Dana Point and any other known population. Sample size is a critical issue, and all available individuals (up to perhaps 20 per population sample) should be sequenced.

(2) The degree of gene flow between extant populations of the PPM can be assessed both by the sequences generated from Question 1, above, and by the application of nuclear DNA markers, such as microsatellites. Since mtDNA is maternally inherited, the pattern of haplotype distribution in relation to the geographic proximity of sampled populations will give information only on female-mediated gene flow. Either a Y-chromosome specific probe (unique to males) or several segregating autosomal nuclear gene loci would be needed for a population view of gene flow that incorporates both males and females.

Microsatellites evolve at an extremely rapid rate, and each species must have their microsats both identified and optimized for analysis. The technology to do this is expensive in both time and money. For one to start from scratch to build and screen libraries and then to optimize primers once microsats are identified (the two necessary precursor steps prior to the examination of microsat variability within the desired samples) would likely take a full year, or perhaps more. Commercial companies can be contracted for these initial phases, and I recommend use of such a company.

Microsatellites will provide great potential rewards. These, as above, can be used in combination with mtDNA sequences to examine gene flow trends for males and females separately, and particularly to determine the degree of genetic differences among extant populations of the PPM. Equally importantly, however, microsatellites offer a richer source of genetic variation, and thus provide greater insights into the third question of whether, or not, genetic diversity has been lost. Moreover, because of the high rate of mutation at these loci, it is also possible to determine those variants that remained following an historical bottleneck relative to those that have evolved since the bottleneck. It is thus possible to track the genetic history of extant populations in a very "fine-tuned" manner. Microsats can also be used effectively to examine local genetic population structure, including mating system (e.g., paternity analysis).

(3) To determine whether the pool of genetic diversity (in both mtDNA sequences and microsats) has decreased in populations of the PPM as a result of population decline and fragmentation, we will extract DNA from available

specimens preserved in museum collections. These include samples collected prior to decline (the Museum of Vertebrate Zoology, for example, has 35 specimens of PPM from LA and San Diego counties, all collected prior to 1935). I would anticipate that 100 individuals are possibly available for such analysis. Sequencing costs for both cytochrome b and Control region would be somewhat higher than specified above--"ancient" DNA is more degraded and thus requires more PCR amplifications and sequencing events for the same amount of data.

Budget:

1. Reagents and expendables for extraction, amplification, and sequencing (non-"ancient" DNA) 90 individuals at $15/specimen

2. Reagents and expendables for extraction, amplification, and sequencing ("ancient" DNA) 100 individuals at $20/specimen

3. Build and screen libraries, sequence clones, identify 20 microsatellite loci (commercial vendor)

4. Optimize PCR reactions and screen population samples for 20 microsatellite loci for 100 individuals

4. Undergraduate work-study salary (10 hours per week for 30 weeks @ $9.99/hour [lab assistant I salary, UCB])

total request:

Budget Justification:

DNA extraction, PCR amplification, and sequencing run approximately $15 per individual specimen for each gene examined, based on experience in our laboratory. Costs for extraction, etc. for "ancient" DNA from museum specimens will be higher since that DNA is more degraded, and thus requires an increased number of PCR amplification and sequencing efforts. Costs for making and screening libraries to develop microsatellite loci are those identified by commercial

biotech companies. Costs to screen population samples include costs of primers, fluorochrome dye terminators, and all sequencing reaction materials. Again, estimates given here are based on actual costs in our lab.

Cost for technical help is based on University of California at Berkeley personnel hourly wages for a Lab Assistant I position. A student who is fully trained and interested in pursuing aspects of the project for a senior honors thesis has been identified and is available.

Comments on possible genetic studies of the Pacific pocket mouse (Perognathus longimembris pacificus)

As a preamble, conservation genetics has usually been directed to two general issues regarding genetic variation: (1) the erosion of genetic variability within impacted population and (2) the amount of inbreeding in local populations. While these are interrelated issues, to a degree, they address different questions of concern regarding the recovery of an impacted species. The first issue, the amount of genetic variation present, addresses the long-term ability of the species to adapt to changing environments; the second issue addresses the potential momentary decline of a population due to the recurrence of recessive lethals to a point closer to the level where demographic stochasticity rules subsequent events.

There are, minimally, however, three different "genetic" questions of importance to the identification of the status of and recovery efforts for an impacted taxon, such as the Pacific pocket mouse (PPM).

(1) to what degree is the PPM an "evolutionarily significant unit" (ESU)? In other words, how genetically unique is the PPM as a taxon, or any of its member populations?

(2) what is the level of genetic diversity contained within the PPM and how is this diversity apportioned among its member populations? How much gene flow existed in the past among populations that are now physically isolated due to fragmentation of its range? How much genetic diversity has been lost in the extant populations relative to pre-impacted ones?

(3) what is the nature of the local genetic unit? Is the species monogamous, polygynous, or promiscuous, and is dispersal male or female biased, if at all?

The type of genetic markers employed in any study of genetic diversity in this, or other taxa, will optimally depend on which of these questions one wishes to address. All three are general areas of considerable significance to endangered species, and each can provide data pertinent to recovery, depending upon how that recovery is defined. There are two general classes of genetic markers currently employed in analyses of within and among-population variation: maternally inherited mtDNA sequence haplotypes and nuclear microsatellite loci, The former is advantageous to addressing the first and second questions, above, particularly for determining the phyletic history of the target taxon and its member populations relative to others. MtDNA evolves at a faster rate than the average nuclear gene, is relatively easy to extract and amplify even from historic, museum specimens, and gives direct evidence on the degree of female structure (since it is maternally inherited). Microsatellite markers offer the advantage of

any Mendelian genetic system and, as nuclear genes, provide direct measures of gene diversity of nuclear DNA. Both mtDNA and microsatellites are, grossly, neutral in their evolutionary trajectory, and hence their diversities are uncomplicated by local selection. Rather, the diversities observed are most likely to reflect simple population history, such as numbers of breeding adults, degree of fragmentation, and so forth.

Both types of genetic markers are applicable to the first two general question areas, but, of the two, only microsatellites can address issues of mating system and paternity/maternity. MtDNA is perhaps better for the question of evolutionary uniqueness (question 1), and it has the advantage of being more readily recoverable from museum specimens. Because DNA is usually highly degraded in such "ancient" specimens, the high copy-number of mtDNA relative to that of nuclear loci is a distinct advantage in assessing genetic diversity from museum specimens which would represent pre-impacted populations. Hence, mtDNA data can perhaps more readily determine how much genetic erosion has occurred in populations over time. If microsatellites are recoverable from museum samples, then this question can be addressed by both sets of markers. The question of the extent of gene flow among populations can be assessed by both sets of markers; mtDNA, by virtue of its maternal inheritance, gives a female-biased view (i.e., female philopatry will generate lower levels of mtDNA gene flow than would be found for microsatellite loci), and the combination of mtDNA and nuclear gene perspectives is a powerful approach that can, potentially, distinguish between historic gene flow from that occurring today.

Only microsatellite loci can be used to the dynamics of the local mating system and to determine the level of inbreeding, since markers exhibiting Mendelian inheritance are necessary to determine parentage. If mating patterns and inbreeding levels are important aspects of the recovery design, then effort should be made to develop 6-12 variable microsatellite loci.

MtDNA sequence analysis is simple and straightforward, and a large number of "universal" primers are available to enable one to amplify and sequence any segment of the mitochondrial genome. Measures of mtDNA haplotype diversity are equally simple to perform. This technology is, thus, already fully available for studies of population genetics of the PPM, and preliminary data using the cytochrome b sequences are available that document the diversity and distinctness of the Dana Point population of the PPM relative to those of adjacent subspecies (<u>brevinasus</u>, <u>bangsi</u>, and <u>internationalis</u>; Brylski and Patton, in manuscript). Microsatellite technology is, however, a considerably more difficult one. First, libraries of DNA sequences potentially containing a microsatellite locus (a string of short tandem repeat elements) need to be constructed and subsequently cloned, and the clones individually examined for the requisite repeat sequence. Once such sequences are found, oligonucleotide primers must be constructed that are unique to the flanking regions of each repeat sequence, and the conditions for amplification must be optimized. Then, a prospective loci must be screened for a number of individuals of interest to determine if it has

sufficient variation to be useful (i.e., that a sufficient number of alleles will be present). The full range of these steps is most efficiently accomplished by a commercial laboratory. My preliminary discussions with Amplicon Inc., in Idaho, suggests that a development cost of approximately $15,000 would result in 6-10 variable microsatellite loci retrievable from hair samples.

APPENDIX E
SUMMARY DATA ON
PEROGNATHUS LONGIMEMBRIS BANGSI
CAPTURES ON THE SNOW CREEK
STUDY GRIDS, 1999

Grid A

Morning	*P. lon.* new	*P. lon.* recap	*D. mer.* new	*D. mer.* recap	*C. fal.* new	*C. fal.* recap	*C. pen.* new	*C. pen.* recap	*P. man.* new	*P. man.* recap	*O. tor.* new	*O. tor.* recap	*T. bot.* new	*T. bot.* recap	*Amno.*
1	7	0	28	0	1	0	0	0	4	0	0	0	0	0	0
2	15	5	10	18	0	1	1	0	0	3	0	0	0	0	0
3	12	11	4	24	2	1	1	1	1	5	0	0	0	0	0
4	1	14	1	19	0	2	0	1	1	2	1	0	1	0	1
5	0	16	1	19	0	1	0	1	0	1	1	0	0	1	0
6	3	16	1	13	1	1	1	1	2	1	2	0	0	0	0
7	1	20	2	7	0	2	0	2	0	2	0	0	0	0	0
8	1	14	3	7	0	3	0	2	0	4	0	2	0	0	0
Totals	40	96	50	107	4	11	3	8	8	18	4	2	1	1	1

Grid B

Morning	*P. lon.* new	*P. lon.* recap	*D. mer.* new	*D. mer.* recap	*D. agi.* new	*D. agi.* recap	*C. fal.* new	*C. fal.* recap	*C. pen.* new	*C. pen.* recap	*P. man.* new	*P. man.* recap	*P. ere.* new	*P. ere.* recap	*O. tor.* new	*O.tor.* recap	*Amno.*
1	6	0	9	0	0	0	0	0	0	0	5	0	1	0	0	0	0
2	11	5	10	5	0	0	1	0	0	0	2	4	0	0	0	0	0
3	4	14	3	10	0	0	1	0	0	0	2	3	0	0	0	0	0
4	3	13	0	8	0	0	0	1	0	0	0	2	0	0	0	0	0
5	2	13	2	7	1	0	0	1	0	0	1	2	1	0	1	0	0
6	1	19	2	10	0	1	1	1	0	0	0	3	0	1	0	1	0
7	1	13	3	7	0	1	1	2	1	0	2	5	0	0	1	0	1
8	3	12	1	5	0	0	0	2	0	1	0	2	0	0	1	0	1
Totals	31	89	30	52	1	2	4	7	1	1	12	21	2	1	3	1	2

GRID A

Animal #	Mark	Sex	Age	1	2	3	4	5
1	T1; E404	M	A	E2 E good	E2 E good	F2	E2 E good	E2
2	T13; E24	M	A	F3 T blood	**	F3	F3	**
3	T12; E25	F	A	G2 E good; T no blood	G2	G2	**	G1 E little swollen
4	T11; E26	M	A	J1 E too far back	J1 E crimped	**	**	J1
5	T11; --	F	A	J3 E (rt)-lt ear ripped; T blood	J3	L2	L2	K3
6	T10; E28	M	A	I8 E good; T blood	I8	I8	I7 E little swollen	**
7	T8; E29	M	A	L7 E ctr of ear	**	**	**	L7 E scab, little swollen
8	T38; E18	M	A	**	A3 E deep	**	**	C4 E red/swollen
9	T40; E20	F	A	**	A6 E low	**	**	**
10	T41; E16	M	A	**	A7	A7	A7 E good	**
11	T31; D241B6D	M	A	**	C12	**	C12	**
12	T30; D242027	F	A	**	C11	**	**	**
13	T27; --	M	A	**	D9 T blood; PIT removed	**	**	**
14	T37; E17	F	A	**	C3	D3	**	C3 E little swollen
15	T26; D237871	F	A	**	E7 P bleeding, felt deep	**	**	**
16	T28; D302745	F	A	**	H5 T blood	**	**	**
17	T36; E93	M	A	**	G1 E folded lwr ear	G1	**	**
18	T35; E4	M	A	**	I1 E far back	I1	I1 E drooping	**
19	T32; D24173A	F	A	**	K10	L9	**	K10
20	T33; D240428	M	A	**	L4	**	L4 P over lt hind leg, sm scab	**
21	T34; E12	F	A	**	N4	**	N5 E good	N5 E good
22	T42; E13	M	A	**	N13 E crimped; T blood	M13	**	**

Morning 6	7	8	1	2
E1 E good	F1	D1 E ripped, no tag	D2 no E tag	D1
F3 E good	G3 E good	G3 E hole forming	**	**
G2 E little swollen	**	**	**	G3 E no tag
**	J2	J3 E hole forming	**	G3 E good, T1 regrown
**	**	K3	K3	K3
H7 E good	H8 E little swollen	**	H6 no E tag	H6
I8 E little red	**	**	**	**
A4 E swollen	**	**	**	**
**	**	**	**	**
A7	A5	**	**	**
**	D11 P good	**	**	**
**	**	**	**	**
**	**	**	**	**
**	**	D3 E good	**	**
E7 P scab, raised	D6 P raised swollen	**	**	**
H3 P scabby wound	**	**	**	**
**	G1	**	**	**
**	J1 E good	J1 E ripping	**	**
**	L9 P wound good	K10 P wound good	**	**
**	**	**	**	**
N5 E good	N5 E swollen; T 30 swollen	**	**	M4 E droopy, reversed, tight
**	**	**	**	**

GRID A Animal #	Mark	Sex	Age	1	2	3	4	5
23	T43; E5	F	A	**	**	C14	**	**
24	T47; E9	M	A	**	**	D8	**	D8 E good
25	T44; E80	F	A	**	**	C5	**	C5 E good
26	T45; E64	F	A	**	**	F4	**	F4 E red
27	T46; E7	M	A	**	**	H9 E (rt ear)	H9 E good	H9
28	T48; E22	M	A	**	**	H1	I1 E good	baseline?
29	T50; E92	M	A	**	**	J12 E far back	**	**
30	T51; E74	M	A	**	**	J14	J14 E good	**
31	T52; E15	F	A	**	**	L8	**	L10
32	T54; E99	M	A	**	**	N4	N4	**
33	T53; E8	F	A	**	**	N7	**	N8 E good
34	T55; E97	F	A	**	**	M13	M10 E little swollen/red	**
35	T61; E72	F	A	**	**	**	K2 E high on ear	**
36	T70; D2A7832	F	A	**	**	**	**	**
37	T67; E 84	M	A	**	**	**	**	**
38	Dead in door	F	A	**	**	**	**	**
39	T71; E3	F	SA/A	**	**	**	**	**
40	T80; E78	F	A	**	**	**	**	**
41	Unknown (ant eaten)							
42	T83; D237A01	M	A	**	**	**	**	**
43	T82; D2B1F31	M	A	**	**	**	**	**
44	T75; D305459	F	A	**	**	**	**	**

Morning 6	7	8	1	2
**	**	C14 hd ft mangled, half tail	**	**
**	E10 E good	G9 E good	**	**
**	**	**	B5 E folded, not ripped	B5 E drooping
G5 E good	G5 E pulling forward	**	**	**
**	**	H10	**	**
I1 E good	I1 E little swollen	**	J1 E drooping, tag reversed, T 4 re-grown	J2
J14 E good	**	J14 E good	I11 no E tag; T red not swollen	**
**	**	**	**	**
L10 E good	L9 E little swollen/red	M10 E little swollen	L12 E grown in and really snug	L12
**	N4 E folded, good	**	**	**
N8 E good	**	**	**	M13 E droopy, reversed
N12 E swollen	M12 E good, little red	**	**	**
**	K3 E real swollen/red	**	**	**
M2	M1 P scab enlarged	**	**	**
M7	M7	M7 E good	**	**
N14	**	**	**	**
**	B1	**	**	**
**	**	N8 E high & far out	M10 no E tag	N11
		M12 (Recap T4_?)	**	**
**	**	**	B1 half tail	**
**	**	**	A11	**
**	**	**	E11 P fine	A12 P sandy scab

Morning				
6	7	8	1	2
**	**	**	N13 P failed entry	**

GRID B

Animal #	Mark	Sex	Age	1	2	3	4	5	6
							Morning		
1	T2; E37	M	A	B10 T blood; E good	**	**	**	**	**
2	T3; E 36	F	A	C8 E far out; stubby tail	C8 E drooping	C8	C8 E drooping	C8	D7 E drooping
3	T4; E35	F	A	C3	D3 E little droop	C3	**	**	D5 E ok but drooping
4	T5; E34	M	A	F9 T blood; E little far out	E9 E little droop	E9	F9	E9 E drooping	F8 E drooping
5	T6; E33	M	A	G5 E good	G8 E good	F7	F8 E good	G8 E good	F8 E good
6	T7; E31	M	A	I9 T blood	I9 E good	I9	I9 E good	H8 E good	I9
7	T21; E21	M	A	**	A1 half tail	A1	A1 E little swollen	A1	A1 E good
8	T20; E100	M	A	**	A5	A5	**	**	A5 E good
9	T18; E1	M	A	**	A8	A8	A8	**	**
10	T17; D2B4B1B	F	A	**	B7	**	**	**	**
11	T16; E2	M	A	**	B10	B9	C8 E good	B9 E good	C9 E good
12	T23; D2B0042	M	A	**	D5 P hair in wound	G6 P sandy wound	**	**	E5 P wound ok
13	T24; --	F	A	**	D2 no tail	**	E3	D3	D3
14	T22; D242D74	M	A	**	C5	C5 P sandy wound	**	C5 P sandy wound	C5 P sandy, sensitive
15	T15; E23	M	A	**	E10	E10	E10 E good	**	E10 E good
16	T14; D31702F	M	A	**	H9	H9	H9 P sandy wound	G9	J10 P scabby wound
17	T25; D30180B	M	A	**	H2	H2 P little sandy	H2 T no scabs	H2	H2 P good, no scab
18	T56; E98	M	A	**	**	D10	E10	**	D10 E good
19	T57; E83	F	A	**	**	E10	**	**	E10 E good
20	T58; E19	M	A	**	**	G1	**	**	**
21	T60; E81	M	A	**	**	I2 E lwr little folded	I2 E swollen/red	I2 E swollen	I2 E swollen

GRID B Morning

Animal #	Mark	Sex	Age	1	2	3	4	5	6
22	T62; E71	M	A	**	**	**	A7 E high but good	A7 E drooping	A7 E good
23	T63; --	F	A	**	**	**	D1	D1	C1
24	T64; E89	M	A	**	**	**	F10 E too far back & out	**	**
25	T65; --	F	A	**	**	**	**	A2	**
26	T66; --	M	A	**	**	**	**	I1	**
27	T68; D2C2E11	M	A	**	**	**	**	**	J2
28	T72; D2B3354	M	A	**	**	**	**	**	**
30	T73; E77	F	A	**	**	**	**	**	**
31	T74; E79	M	A	**	**	**	**	**	**
32	T81; E82	M	A	**	**	**	**	**	**
33	T77; D2C054F	F	A	**	**	**	**	**	**
34	T88; --	M	A	**	**	**	**	**	**

7	8	1	2
**	**	**	**
D7 E drooping but ok	**	**	**
**	**	**	**
**	**	E9 E drooping, reversed, T re-grown	D9
G8	**	**	**
I8	I9 E good	**	**
A1	**	**	**
A5 T swollen; E ok	A5	**	**
**	A8 E little swollen/red	A8 E no tag	A8
**	A7 P scabby wound	**	**
**	**	**	D6 E no tag
**	**	**	**
	E2	**	D3
C5 P sandy, sensitive	**	**	**
**	E10	E6 E no tag	**
**	**	**	**
H2 P little scab	H2 P wound good	**	**
**	D10	**	**
E10	**	**	**
G1 E ok	**	**	**
I2 E swollen	I2	**	**

7	8	1	2
A7	**	**	**
D1	**	**	**
F10 T60 swollen; E scabby	F10 E swollen	**	**
**	**	**	**
**	**	**	**
**	J2 P scabby	**	**
J5	**	**	**
**	A9	**	**
**	G4 E good	**	**
**	I1 E little crimped	**	**
**	**	E1 half tail	**
**	**	J4 P came out second hole	J4

GRID A

Animal #	Mark	Sex	Age	1	2	3	4	5
45	T76; --	M	A	**	**	**	**	**

APPENDIX F
MEASUREMENTS ON
PEROGNATHUS LONGIMEMBRIS LONGIMEMBRIS
INDIVIDUALS USED IN LABORATORY
MARKING EXPERIMENT, 1999

7-2-99

Initial data sheet for Pacific Pocket Mouse surrogate species

Room temperature: 23° - 24° C

ID #	Age	Sex	Ear Length (mm)	Hind Foot (mm)	Tail Length (mm)	Weight (~~mm~~) g	Comments
1	A	NSM	7.3	18.6	82	~~8.2~~ 8.15	Healthy / No Deformities
2	A	NSM	6.7	19	70	6.45	Healthy / No Deformities
3	A	F	7.2	18	74	8.5	HEALTHY / NO DEFORMITIES
4	A	NSM	6.7	20	81	8.4	HEALTHY / NO DEFORMITIES
5	A	F	7.2	18	72	9.6	HEALTHY / NO DEF.
6	A	NSM	6.0	18	62	8.3	SINGLE Bump on tail - Tip gone
7	A	F	6.0	18	70	8.1	HEALTHY / NO DEF / ACTIVE
8	A	NSM	6.0	18	73	7.5	Healthy / No Def
9	A	F	6.0	19	70	~~6.0~~ 7.0	HEALTHY / NO DEF
10	(NO ANIMAL) Died in cage within past 4 days.						
11	A	F	5	19	72	7.0	HEALTHY / NO DEF / TORPORIC
12	A	F	8	19	71	6.9	HEALTHY / NO DEF
13	A	M	5	16	75	8.8	Healthy / No Def
14	A	F	7	19	68	8.0	Healthy / No Def
15	A	F	7	19	71	9.55	Healthy / No Def / Active
16	A	F	8	18	72	9.0	Healthy / No Def
17	A	M	6	18	72	8.6	Healthy / No Def
18	A	F	7	17	77	8.8	Healthy / Active / No Def
19	A	F	5	19	77	8.8	Healthy / No Def
~~unhealthy~~ 20	A	NSM	7	18	73	6.3	Deformed ~~Lt~~ rear center (left) / vent is on tail)
21	A	F	6	20	73	9.0	HEALTHY / ACTIVE / NO DEF.
22	A	NSM	6	17	68	8.8	HEALTHY / NO DEF. / ACTIVE
23	A	F	6	18	70	8.8	HEALTHY / NO DEF. / ACTIVE
24	A	NSM	5	20	70	7.0	HEALTHY / NO DEF. / ACTIVE
25	A	F	5	18	70	8.3	HEALTHY / NO DEF.
26	A	NSM	5	18	78	7.45	HEALTHY / NO DEF / ACTIVE
27	A	NSM	5	19	83	8.8	HEALTHY / NO DEF / ACTIVE

* #20 - was malnourished, food gone. Ate upon adding food. ~~Bumpy~~
Bumpy tail due to loss of fat reserves?

Summary Data
Perognathus longimembris longimembris Laboratory Marking Study

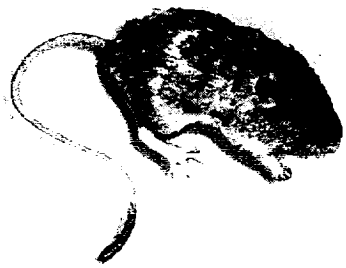
Animal ID	Treatment	Age	Sex	Beginning Comments	Beginning Weight (7/2/99)	Ending Weight (12/20/99)	Final Comments, December 1999
1	control	A	M	healthy, no deformities	8.15	9.00	glossy coat, very active, healthy
2	control	A	M	healthy, no deformities	6.45	9.30	glossy coat, healthy, molting
12	control	A	F	healthy, no deformities	6.90	8.00	molting, active
14	control	A	F	healthy, no deformities	8.00	8.10	active, healthy
15	control	A	F	healthy, no deformities	9.55	9.40	active, glossy coat, healthy
9	toe-clip	A	F	healthy, no deformities	7.00	8.80	nail re-growing, healthy, active
13	toe-clip	A	M	healthy, no deformities	8.80	6.20 (12/10)	healthy on 12/10, nail re-growing, deceased on 12/20
17	toe-clip	A	M	healthy, no deformities	8.60	7.70	molting, healthy, active
19	toe-clip	A	F	healthy, no deformities	8.80	8.30	healthy, active
25	toe-clip	A	F	healthy, no deformities	8.30	8.90	active, nails re-grown and growing
27	toe-clip	A	M	healthy, no deformities	8.80	8.90	very active, nail re-growing
3	ear-tag	A	F	healthy, no deformities	8.50	8.60	healthy
18	ear-tag	A	F	healthy, no deformities	8.80	8.90	molting, active, healthy
20	ear-tag	A	M	heatlhy, deformed rear toe	6.30	8.60	healthy, alert
23	ear-tag	A	F	healthy, no deformities	8.80	7.20	molting, healthy
24	ear-tag	A	M	healthy, no deformities	7.00	9.00	molting, healthy, active
26	ear-tag	A	M	healthy, no deformities	7.45	8.70	drooping ear-tag, active, healthy
4	suture	A	M	healthy, no deformities	8.40	9.60	healthy, active
5	suture	A	F	healthy, no deformities	9.60	9.00	healthy, active, sutures gone
7	suture	A	F	healthy, no deformities	8.10	8.50	molting, healthy, sutures gone
8	suture	A	M	healthy, no deformities	7.50	6.00	active, molting, healthy, sutures gone, weight increases in January
16	suture	A	F	healthy, no deformities	9.00	9.40	active, healthy, sutures gone
22	suture	A	M	healthy, no deformities	8.80	7.80	alert, healthy
6	PIT tag	A	M	healthy, no tip on tail	8.30	9.20	healthy, no discomfort, PIT fell out
11	PIT tag	A	F	healthy, no deformities	7.00	7.80	active, healthy, tag over right shoulder
21	PIT tag	A	F	healthy, no deformities	9.00	8.10	active, healthy, tag over left hip

Peer Review Draft

Pacific Pocket Mouse Studies Program

Phase III Report:

Task 5- Translocation Receiver Site Study
Task 6- Laboratory Surrogate Study
Task 7- Field Surrogate Study and Other Associated Studies



Prepared for:

Foothill/Eastern Transportation Corridor Agency

And

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Shana Dodd
Stephen J. Montgomery
Charles Holland

February 2001

Final ~~Internal Review~~ Draft

Also: Change cover

Pacific Pocket Mouse Studies Program

Phase III Report:

Task 5—Translocation Receiver Site Study
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And
Other Associated Studies

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August ~~February~~ 2001

TABLE OF CONTENTS

Section **Page**

ABSTRACT iii

ACKNOWLEDGEMENTS vi

INTRODUCTION 1

TASK 5 — TRANSLOCATION RECEIVER SITE STUDY 3
- Methods 3
- Results and Discussion 6
- Conclusions and Recommendations 13

TASK 6 – LABORATORY SURROGATE STUDY 15
- Methods 15
- Results and Discussion 15
- Conclusions and Recommendations 16

TASK 7 — FIELD SURROGATE STUDY 19
- Methods 19
- Results and Discussion 20
- Conclusions and Recommendations 23

OTHER ASSOCIATED STUDIES 25
- Genetics Analyses 25
- Dana Point Habitat Management 26

RECOMMENDED PHASE IV STUDIES 29
- TCA Funded Tasks 29
- Associated Tasks Not Funded by TCA 31

REFERENCES CITED 35

APPENDICES

A. Soil Types in Orange and San Diego Counties, Rated for Potential to Support Pacific Pocket Mice
B. Data Sheet for Rapid Evaluation of Potential PPM Translocation Receiver Sites
C. Summary Results for Potential Receiver Sites not Rated in the Top Seven
D. Summary Data on *Perognathus longimembris bangsi* captures on the Snow Creek Study Grids, 1999
E. Diffendorfer and Longland Translocation Study Design
F. Letter summary from Jim Patton regarding *P. longimembris* genetics analyses
G. Responses to Comments by Scientific Peer Reviewers, Phase III

LIST OF FIGURES

Figure		Page
1	Initial Surface Texture Rankings for Soils in GIS PPM Habitat Evaluation Model	4
2	Habitat Potential to Support Translocated Pacific Pocket Mouse Populations and Areas Evaluated in the Field, Camp Pendleton/Orange County	8
3	Habitat Potential to Support Translocated Pacific Pocket Mouse Populations and Areas Evaluated in the Field, Camp Pendleton/San Diego County	9

LIST OF TABLES

Table		Page
1	Habitat Potential to Support PPM Based on Soils and Vegetation	5
2	Areas of Potential Habitat to Support Translocated PPM in Orange and San Diego Counties Predicted Using GIS Habitat Evaluation Model	6
3	Top Seven Potential Receiver Sites (Dodd and Montgomery Observations).	10
4	Selected observations on *P. L. longimembris* marked by different methods.	17
5	*P. l. bangsi* ~~Captured~~ Individuals Captured During 1999 and 2000.	20
6	Capture/Recapture Records for *P. l. bangsi*, Pooling Both Grids.	22
7	Minimum *P. l. bangsi* Density on Grids A and B.	23

ABSTRACT

During Phase III (2000) of the Pacific pocket mouse (PPM; *Perognathus longimembris pacificus*) study program, the study team continued several tasks initiated during Phase II as high priority for steering recovery of the species: (1) a systematic search for possible translocation receiver sites, (2) a controlled laboratory investigation of alternative marking techniques using an unlisted surrogate subspecies (*P. l. longimembris*), and (3) a field surrogate study (using the unlisted *P. l. bangsi*) to test marking and other study techniques. We also continued coordinating with PPM research being performed by us or others under separate funding, including population genetics studies, field work for the translocation receiver site search, experimental shrub thinning at the Dana Point PPM Reserve, and PPM population monitoring. After three years of intensive study, the team feels that PPM translocations are feasible in the near future, provided that research continues filling critical information gaps in the interim and beyond.

Translocation Receiver Site Study — The GIS habitat evaluation model developed during Phase II to identify potential translocation receiver sites was refined during Phase III based on recent micro-habitat soil selection studies on the Oscar One PPM site. The refined model discriminates soil criteria more precisely than the original model and adds a "very high" category for soil types likely to include fine loamy sands with low gravel, rock, and clay content. Under separate funding provided by the wildlife agencies, the team also completed field reconnaissance on those areas identified, with the aid of the model, as having potential to support translocated PPM. Shana Dodd (Dodd) and Stephen Montgomery (Montgomery) rated all sites they investigated in the field and selected the seven highest-rated sites for more detailed field investigations during the year 2001.

Laboratory Surrogate Marking Study — We continued monitoring the *P. l. longimembris* marked using four techniques during Phase II: custom-designed ear tags, color-coded surgical sutures, subcutaneous PIT tags, and toe clipping. Ear tags and surgical sutures were ruled out as useful methods during Phase II, so no new individuals were marked with these techniques. In June 2000, the sample of PIT-tagged individuals increased from three to seven. As during Phase II, most marked individuals remained healthy and active, but concerns remain regarding the size of PIT tags for this species. Overall, toe clipping still appears to be the easiest, most reliable, and least harmful of the available techniques, although PIT tags would offer substantial benefits if they could be made smaller.

Field Surrogate Study — The two 0.5-ha study grids established in *P. l. bangsi* habitat in the Coachella Valley were trapped again during spring and summer 2000 to assess over-winter survival of marked individuals, mark additional individuals with PIT tags and toe clips, and obtain additional life-history data. Both grids were trapped in 2000 using a 5-m inter-trap spacing, for five consecutive nights in late April and four consecutive nights in late July. Captured *P. l. bangsi* were sexed, aged, and assessed for reproductive condition, condition of any previous marks, and other pertinent information. Previously unmarked individuals were either toe clipped or PIT tagged.

The *P. l. bangsi* population more than doubled from 1999 to 2000, due to large reproductive output in spring-summer 2000. This resulted in a large turnover from 1999 to 2000 in individuals resident on the grids. Sex ratios did not differ from each other or from a 1:1 ratio for grids trapped using the 5-m spacing in 1999 and 2000; however, the grid trapped in 1999 using 7-m spacing had a strongly male-biased ratio, which differed significantly from 1:1 and nearly differed significantly from the

ratio observed using 5-m spacing. Only 12 individuals toe-clipped in 1999 were recaptured in 2000s; and no individuals were recaptured bearing PIT tags or ear tags. This low return rate prevents drawing conclusions regarding survivorship effects.

Population Genetics Study — Genetics analysis of recent and historic PPM samples were performed by James Patton and Andrea Swei at UC Berkeley (under separate funding). To date, they have examined haplotype variation in the mitochondrial cytochrome b gene from 37 PPM specimens collected in 1995-2000, and partial DNA sequences from 12 museum skins. Full 810 base pair (bp) sequences were obtained from the live-caught specimens, and 430 bp fragments were amplified from the museum specimens. Low measures of gene flow between both historical and extant populations suggest that genetic drift has strongly affected genetic diversification between populations and will continue to erode genetic diversity within each. Among the subspecies of little pocket mice, PPM has the lowest haplotype diversity, particularly in the Dana Point population (9 unique haplotypes from 27 individuals sampled). About 79% of PPM haplotype variation is within populations, with only 19% found between populations within a time period, and 2% between modern and historic samples. The pattern of haplotype differentiation suggests that populations were already largely isolated from one another by the 1930s, and that the current low level of diversity and high inter-population divergence is due to natural, pre-development isolation. Finally, although PPM haplotypes are largely apportioned among populations, they are all closely related genealogically, which suggests that a PPM translocation program could move individuals from any or all extant sites to create new populations or bolster existing populations.

Experimental Shrub-thinning Study — Experimental habitat thinning was initiated, under separate funding, at the Dana Point PPM reserve during 1999-2000 in hopes of improving habitat quality and PPM population size. Dodd and Montgomery established and trapped 11 grids during the spring and summer of 1999 (pre-thinning) and 2000 (post-thinning): three control grids in known, occupied PPM habitat having relatively low shrub cover, and eight experimental grids in dense shrub cover not known to harbor PPM, but having appropriate soils. Four ~~25~~ 30 by ~~50-m~~ 60 areas were thinned of shrubs, overlapping ½ of each of the experimental grids. In January 2000, individual shrubs were removed at ground level, reducing mean shrub cover from 83% to 32%. Grids were trapped for seven consecutive nights during spring and again during summer. Captured PPM were individually marked by clipping hair and using indelible colored markers (during 1999), or by toe clipping (during 2000). PPM seemed to respond quickly and positively to the shrub thinning by redistributing themselves into the newly thinned habitat areas. During 1999 (pre-thinning), nine of eleven individual PPM were captured on the known occupied control grids, and only two were captured in areas to be thinned. After thinning, nine of ten individual mice were captured in thinned areas. The significant ($\chi^2 = 7.31$, $P = 0.026$) shift in captures after shrub thinning suggests a strong behavioral preference by individuals to use the newly thinned habitat areas.

Recommendations for Phase IV — Based on results of these Phase III studies, the team recommends the following studies for Phase IV (year 2001): update the 1998 feasibility analysis for PPM translocations and develop a framework translocation protocol based on information collected during the past three years; design and implement one or more translocation experiments (using *P. l. bangsi* as a surrogate, or using salvaged PPM) to test specific methods and fill remaining information gaps; continue the fine-filter field evaluation of potential translocation receiver sites; and continue coordinating with other associated studies, including genetic analyses using nuclear microsatellite DNA, the Dana Point shrub thinning study, and population monitoring at extant PPM

sites. We also urge that funding be pursued to design a smaller PIT tag for use on PPM, and that long-term monitoring of at least the Oscar One/Edson Range population begin as soon as possible, with individuals permanently marked by toe clip or miniaturized PIT tags. Finally, we recommend expanding habitat management efforts (e.g., shrub thinning or controlled burns) at all extant PPM sites where shrub cover seems too dense for optimal PPM habitat (perhaps where cover exceeds about 50%). These efforts must include careful monitoring for invasions by exotic species, with appropriate management responses at the ready.

ACKNOWLEDGEMENTS

The Transportation Corridor Agencies (TCA) continued providing much needed funding for the work reported herein, with guidance provided by Ann Johnston and Macie Cleary-Milan. Comments and email discussions with members of the scientific peer committee (James Patton, James Diffendorfer, William Longland, Howard Shellhammer, Nicholas Holler, and Richard Reading) have been invaluable in guiding these studies. Wendy Barto and Debbie Turner performed all GIS work included in the report with direction from Pat Atchison. GIS data were used with the permission of the San Diego Association of Governments and County of Orange, with special thanks to Gary Meideros. Mark Pavelka, Will Miller, Clark Winchell, and Loren Hays of the U.S. Fish and Wildlife Service have continued providing data, helpful discussion, and advice on all phases of this work. David Lawhead, William Tippets, and John Gustafson of the California Department of Fish and Game have also provided guidance as well as additional monetary support for the fieldwork and genetic analyses reported herein. William Berry and Deborah Bieber provided coordination with Marine Corps Base Camp Pendleton and organized the controlled burn at the San Mateo North site. Michael Wellik maintained and cared for the laboratory population of *P. l. longimembris* during this Phase.

INTRODUCTION

In 1998, the Foothill/Eastern Transportation Corridor Agencies (TCA), in cooperation with the U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Game (CDFG), and Marine Corps Base Camp Pendleton, initiated a series of focused research tasks designed to help recover populations of the critically endangered Pacific pocket mouse (PPM; *Perognathus longimembris pacificus*). At the end of our first year (Phase I) the study team concluded that translocations designed to establish new populations of PPM were probably necessary to recover the species, but that we knew too little about the species' biology or the availability of translocation receiver sites to recommend or design a translocation program. During Phase II (1999) research priorities were therefore refocused on several tasks deemed most critical to answering immediate questions: (1) a systematic search for possible translocation receiver sites, (2) a controlled laboratory investigation of alternative marking techniques using an unlisted surrogate subspecies (*P. l. longimembris*), and (3) a field surrogate study (using the unlisted *P. l. bangsi*) to test marking and other study techniques and gain basic biological information on the species. We also recommended and coordinated with several related studies being carried out by others, or by our team members under separate funding: (1) a population genetics study to establish baseline measures of genetic diversity within and among extant PPM and historic PPM populations; (2) experimental habitat management at extant PPM sites; and (3) continued population monitoring at extant sites. Progress on all of these efforts was summarized in our Phase I (Spencer et al. 2000a) and Phase II (Spencer et al. 2000b) reports.

This Phase III report summarizes results of these continuing studies through the year 2000 and recommends high-priority tasks for the year 2001 and beyond. Chief among these recommended studies are a comprehensive update of our original (Phase I) feasibility assessment for establishing new PPM populations and a framework design for a PPM translocation program. Based on the last three years of information gathered on this species and its habitat, the study team believes that translocations designed to help recover the PPM are feasible in the near future, provided that research continues to fill critical information gaps in the interim. We therefore believe it is time, based on all the information collated to date, to outline how and where transactions should be performed and to identify those remaining information gaps most critical to performing translocations. To help answer these questions, we also recommend designing and performing one or more translocation experiments beginning in 2001, using a surrogate subspecies or using salvaged PPM if salvage becomes necessary due to impacts at an occupied site.

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TASK 5 — TRANSLOCATION RECEIVER SITE STUDY

During Phase II (1999), the study team had initiated a systematic search for potential habitat areas in which it might be possible to establish new PPM populations via translocations. We continued this search during Phase III, refining the GIS habitat evaluation model and completing our coarse-filter field review of sites identified with the aid of the model. The fieldwork was performed by Dodd and Montgomery under separate funding (Section 6 contract through San Diego State University Foundation, with funding provided by CDFG and USFWS).

METHODS

The GIS habitat evaluation model developed during Phase II was refined during Phase III based on recent micro-habitat soil selection studies on the Oscar One PPM site (USFWS, unpublished data). The original model (see Phase II report) used conservative assumptions and existing digital soils and vegetation maps to rate sites along the Pacific coast as having high, moderate, low, or no potential to support translocated PPM populations. The USFWS micro-habitat studies subsequently revealed a strong association between PPM occupancy, on a fine scale (20 by 20-m trapping grids), with deep (more than 30 cm) fine loamy sands (not sandy loams) having less than 5 or 7% by volume of clay, and less than 4% by weight of gravel and rock. At this scale and site, PPM appear not to occupy other soils, including loams, silts, and clays that predominate around the finer, deeper sand pockets. Our refined GIS model therefore discriminates soil criteria more precisely than the previous model, and adds a "very high" category for soils that might have inclusions meeting the criteria observed at occupied micro-sites at Oscar One. All soil types mapped within this study area (USDA 1973, 1978) were thus rated as having very high, high, low, or no potential to support PPM based on surface horizon texture, soil depth, and other factors (e.g., presence of a hardpan, high gravel or cobble content). Figure 1 illustrates the initial surface texture ratings using the classic soil textural triangle (USDA 1997). These initial ratings were then modified based on other soil attributes included in the detailed soils descriptions (USDA 1973, 1978), such as depth of surface horizon or presence of rock, gravel, hardpan, or other features (Appendix A presents the soil rankings).

Vegetation types were rated as having high, low, or no potential to support PPM using regional GIS vegetation maps (SANDAG and Ogden 1997 for San Diego County; County of Orange 1993 for Orange County). PPM have historically been associated with open coastal scrub and grassland habitats having a diversity of annual herbs, so these vegetation communities were rated high. PPM probably cannot persist in denser shrub communities, wetlands, or woodlands. However, the regional vegetation maps are coarse in scale, and some upland areas mapped as generally unsuitable natural vegetation may contain small areas of open scrub or grassland. Therefore, all natural vegetation types were considered to have at least a low potential to support PPM. Areas mapped as agriculture, developed, disturbed, rock, or open water were rated as having no potential.

The soil and vegetation rankings were combined to create overall habitat ratings within 8 km of the coast (Table 1). The logic behind these ratings is as follows: evidence to date suggests that soils are the primary determinant of habitat quality, at least within areas of natural vegetation near the coast. So long as the soils are highly suitable to support PPM, low suitability vegetation (e.g., chaparral) may reduce PPM habitat potential somewhat, but vegetation management (e.g., burning or thinning)

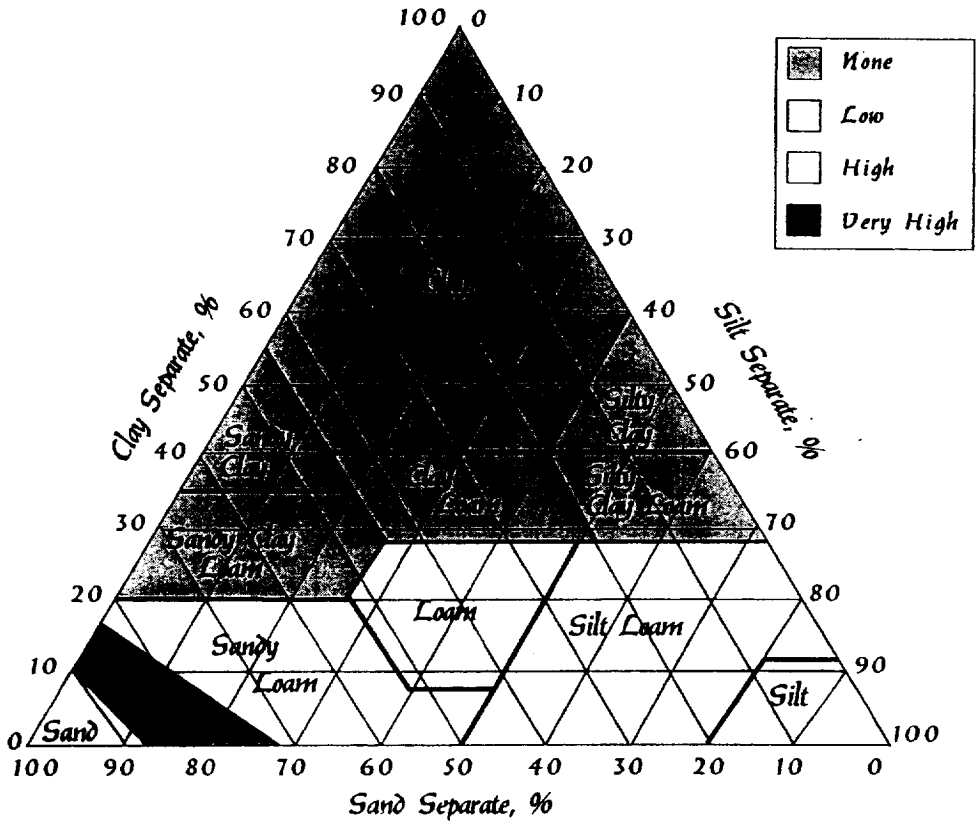

Figure 1
Initial Surface Texture Rankings
for Soils in GIS PPM Habitat Evaluation Model

might be used to increase habitat quality. Therefore, the presence of low-quality vegetation on high-quality soils only slightly reduces the overall habitat potential to support PPM. However, if the soils are low quality for PPM, the vegetation community type or vegetation management will probably have little effect on PPM habitat potential; consequently, the overall rating reflects the low soil potential. If soils and vegetation are inappropriate (e.g., clay soils or agricultural fields), the site has no PPM potential.

Please note that although Los Angeles County also once supported PPM, it was excluded from this study due primarily to lack of USDA soils maps. Furthermore, most of the remnant undeveloped areas in Los Angeles County are not currently considered suitable to support translocated PPM populations due to inappropriate soils, habitat degradation, abundant exotic species, and other factors. Nevertheless, this omission of Los Angeles County from the search for possible translocation receiver sites at this time should not be construed as meaning that the county cannot support remnant PPM populations or should be exempt from species survey requirements for development projects.

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Table 1. Habitat Potential to Support PPM Based on Soils and Vegetation

Soil Suitability[1]	Vegetation Suitability[2]	Potential to Support PPM
Very High	High	Very High
Very High	Low	High
Very High	None	None
High	High	High
High	Low	Moderate
High	None	None
Low	High	Low
Low	Low	Low
Low	None	None
None	All Categories	None

[1] See Appendix A for soil suitability rankings.
[2] All coastal scrub, grassland, and dune vegetation communities were ranked high; all other natural vegetation communities were ranked low; all developed, disturbed, agricultural, rock, and open water areas were ranked none.

Once maps of the overall habitat potential were created, we identified relatively large blocks (≥ about 20 ha) of moderate to very high habitat value that we considered worthy of field evaluation as potential receiver sites. We also evaluated habitat in and adjacent to the two San Mateo PPM sites. This was done to investigate whether natural expansions of the San Mateo populations are possible, perhaps aided by habitat management. Rating the known occupied areas at San Mateo also helped to validate use of the rapid-evaluation methods.

Not all areas predicted by the model to support potential PPM habitat were included in the current field study, due to known biological or land-use issues. For example, several areas in Orange County, between Newport Bay and Bolsa Chica, were rated very high by the model, but are

considered too highly disturbed and constrained by existing and planned development to have potential as receiver sites. Also, some large areas of Camp Pendleton predicted to have high or very high value have already been extensively surveyed and deemed unsuitable due to extreme disturbance by military training, soil compaction, and type conversions in vegetation communities (e.g., areas mapped as grassland or coastal sage scrub that have converted to exotic, weedy vegetation). Nevertheless, the team surveyed all areas outlined as "field evaluation sites" on Figures 2 and 3, including portions of Camp Pendleton both inside and outside of active training areas.

Montgomery and Dodd evaluated these sites in the field during 1999-2000 using a rapid evaluation data sheet (Appendix B) to record vegetation, soil, and other site characteristics. Based on their results, the seven highest-rated sites have been selected for more detailed field investigations during the year 2001.

RESULTS AND DISCUSSION

Table 2 summarizes acreages of habitat potential to support translocated PPM in Orange and San Diego Counties based on the GIS habitat evaluation model, and Figures 2 and 3 map these areas. These acreages surely overestimate the actual amount of high and very high quality habitat, due to the conservative model assumptions, the coarse nature of the available soils and vegetation data, and the inclusion of habitat areas as far as 8 km inland from the coast (nearly twice as far inland as PPM were historically recorded). In addition, much of this acreage is distributed in small, scattered habitat fragments or is on steep slopes, which may not represent suitable habitat for PPM. Nevertheless, these results suggest that there are sufficient areas of potential habitat to warrant further fieldwork and consideration of translocation as a recovery tool for PPM.

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Table 2. Areas of Potential Habitat to Support Translocated PPM in Orange and San Diego Counties Predicted Using GIS Habitat Evaluation Model [1].

Habitat Potential	Orange County ha (ac)	San Diego Count ha (ac)	Total ha (ac)
Very High	1,535 (3,793)	7,859 (19,419)	9,394 (23,212)
High	3,114 (7,696)	3,751 (9,270)	6,866 (16,966)
Moderate	1,486 (3,671)	1,802 (4,452)	3,287 (8,123)
Low	2,900 (7,166)	11,714 (28,947)	14,614 (36,113)
None	40,810 (100,844)	127,657 (315,439)	168,464 (416,283)
Total	**49,845 (123,170)**	**152,780 (377,527)**	**202,625 (500,697)**

[1] Los Angeles County was omitted due to lack of USDA soils maps and levels of habitat disturbance. However, LA County may still harbor PPM populations, and species surveys may still be required in potential habitat areas.

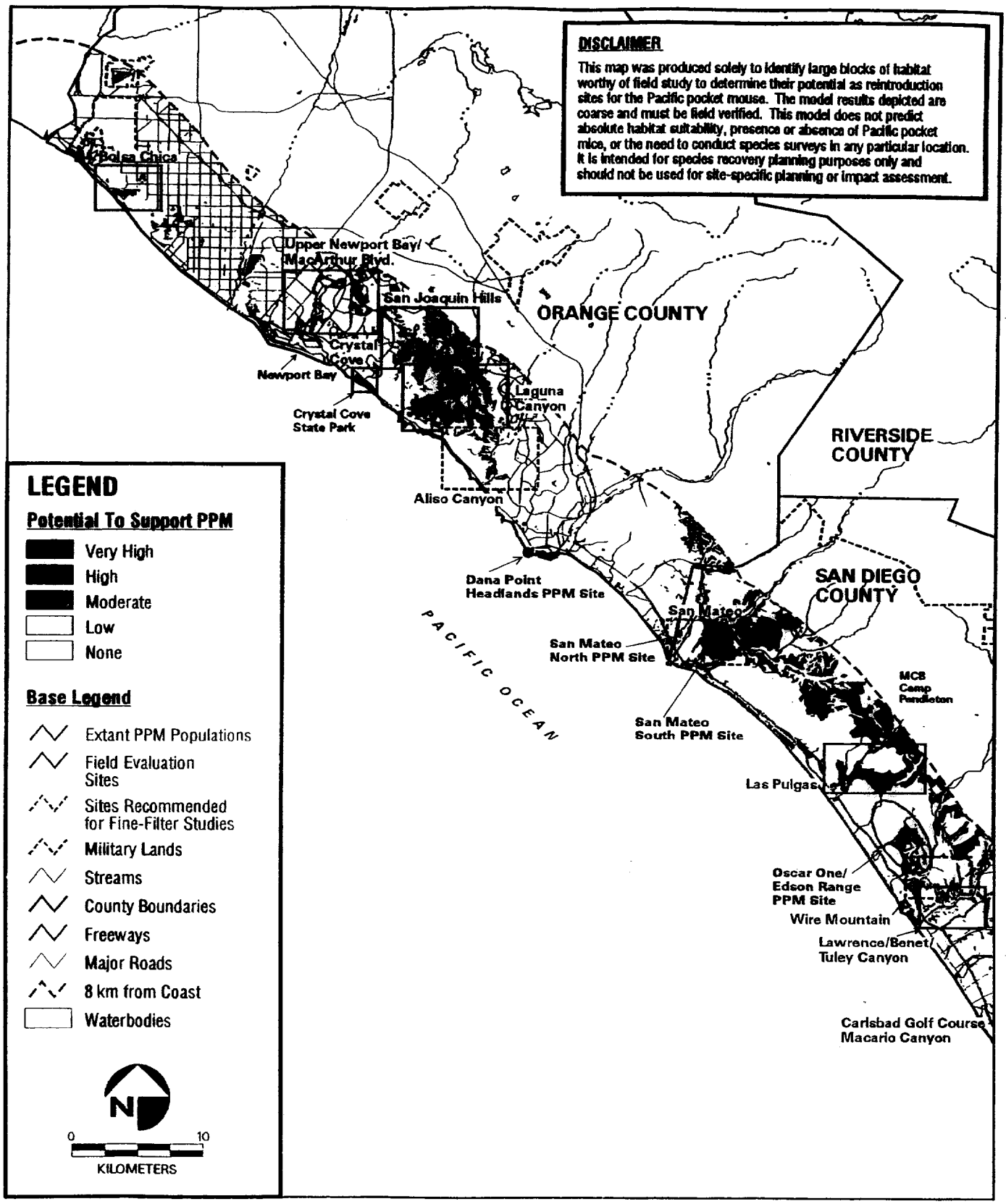
Figures 2 and 3 also illustrate the areas that Dodd and Montgomery ranked in the field. Some areas not considered worthy of field reconnaissance during Phase II were added during Phase III, including the Manchester Conservation Area in Encinitas, the Torrey Pines State Reserve Extension Trails in Del Mar, and the Wire Mountain area of Camp Pendleton. The first two sites were overlooked during Phase II due to their relatively small sizes compared with other highly ranked

sites in their vicinity; however, their status as reserves and the presence of very high quality soils elevated their potential during Phase III studies. Portions of the Wire Mountain area were also initially overlooked, because soils there were mapped by USDA as cobbly loam; however, field observations indicate a predominance of deep loamy sands that appear ideal for PPM. ~~These and other observations of inaccuracies in existing soils~~

As expected, the field survey team tended to rate most areas as lower value than did the GIS habitat evaluation model. For example, some areas predicted from USDA soil maps to be of high or very high value were found to be low quality during field evaluations (e.g., soils in the Las Pulgas area of Camp Pendleton mapped as fine sandy loams appeared instead to be clay loams). However, in a few cases the field survey rated some areas higher than did the model, due mainly to presence of high quality soils that were not accurately mapped on the USDA soils maps (e.g., loamy sands at Wire Mountain that are mapped as cobbly loams). Overall, the field team felt that the model provided good general guidance for identifying the most promising locations, but that it misidentified habitat quality in many areas due to inaccuracies in available soils and vegetation maps, or due to factors that are only discernable in the field (e.g., soil compaction or vegetation disturbance). USDA soil series maps are too coarse in scale to be ~~good predictions of~~ PPM habitat quality, and do not necessarily consider the factors most critical to PPM. good predictors

Table 3 and the following text sections summarize qualities of the 7 sites ranked by Dodd and Montgomery as having the greatest potential to support PPM. These 7 sites are also highlighted (dashed lines) on Figures 2 and 3. One of these sites (Aliso Canyon in Orange County) lies north of all extant PPM sites, whereas the other six sites are in San Diego County, south of all extant PPM sites. They range as far south as the southernmost extent of the historic PPM range (Tijuana River Valley). The following descriptions are cursory. More detailed descriptions and maps of the highest-ranking habitat patches will be provided in Dodd and Montgomery's report to the wildlife agencies, per their Section 6 contract.

Wire Mountain — Dodd, Montgomery, and Spencer surveyed undeveloped portions of the Wire Mountain area, near the southern end of Marine Corps Base Camp Pendleton. Although this area was initially overlooked as a potential receiver site, due in part to possible inaccuracies in soils maps, some portions were rated "prime" (the highest rating given) by the field study team. The GIS model predicted scattered patches of fine sandy loams to be of high or very high value. However, at least one area identified by the field team as prime habitat was misidentified by the GIS model as having low value. This area, lying north and northwest of the water tanks near the northern extent of the Wire Mountain military housing area, was mapped by the USDA as cobbly loams; but field evaluation determined it to have deep, loose, loamy sands that are very low in clay, gravel, cobble, and rock content. The vegetation on this gentle plateau is very open, with coastal sage shrub cover ranging from 0 to 50% and an overall average of about 20%. The herb layer is relatively dense, averaging about 80% overall, with *Erodium*, *Croton*, *Lessingia*, and other native and non-native herbs. Although it is near military family housing and has a jeep trail through it, the area appears to be relatively undisturbed, with low levels of off-road vehicle use, dumping, and litter. The Wire Mountain area was intensively trapped for PPM in the mid-1990s (Ogden 1997) with no individuals captured. The lack of PPM captures there was considered surprising by biologists, particularly since the site lies directly across the Santa Margarita River from the Oscar One population and shares similar geology. This area appears highly suitable for a possible PPM translocation, provided that the receiver site is fenced to limit human access. It may have once been occupied as part of the



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Habitat Potential to Support Translocated Pacific Pocket Mouse Populations and Areas Evaluated in the Field Camp Pendleton/Orange County

FIGURE

2

/gis1/cappm/plots/figures/ppmhab811.aml

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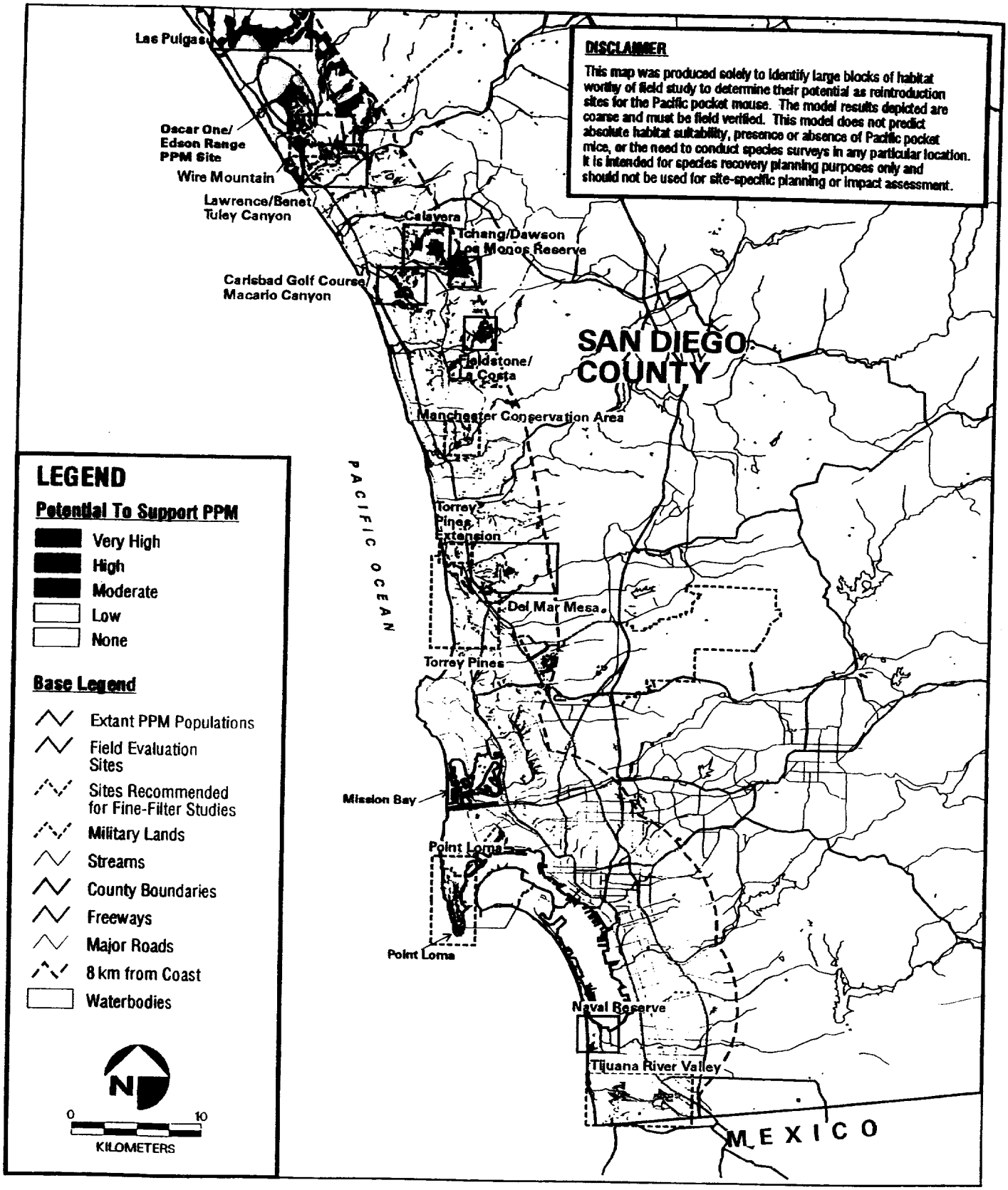

OGDEN

Habitat Potential to Support Translocated Pacific Pocket Mouse Populations and Areas Evaluated in the Field San Diego County

FIGURE

3

/gis1/cappm/plots/figures/ppmhab811.aml

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Table 3. Top Seven Potential Receiver Sites (Dodd and Montgomery Observations).

Site	Portions with Best Habitat	Approximate Area (ha (ac))[1]
Wire Mountain Area, Camp Pendleton	Plateau northwest of water tanks	8-12 (20-30)
Torrey Pines State Reserve	Around Parry's Grove and Guy Fleming trails	<32 (< 80)
	Southern half of reserve, scattered patches	40 (100)
	Area west of La Jolla Farms Road	8 (20)
Torrey Pines State Reserve Extension Trails	Coastal sage scrub scattered throughout	40 (100)
Manchester Conservation Area	Valley floor	24 (60)
Point Loma Ecological Reserve	Patch near lower lighthouse	4 (10)
	Scattered coastal sage scrub patches on ridges and slopes throughout	34 (85)
Aliso Canyon Area	Patch near Moulton Meadows Park	<20 (<50)
	Patch north of Aliso Creek	<20 (<50)
Tijuana River Valley	Patch near Tijuana bullfight ring (near the PPM type locality)	6 (15)
	Spooner's Mesa	<40 (<100)

[1] Approximate visual estimate of areas for higher quality habitat patches as reported by Dodd.

historic PPM population near the mouths of the San Luis Rey and Santa Margarita Rivers. The area is not used for military training. A new water tank has been recently constructed in the area of highest-quality habitat, and the Corps should be advised to limit further disturbance there until ultimate use of the area for PPM is determined.

Torrey Pines State Reserve — Dodd and Montgomery surveyed Torrey Pines State Reserve and surrounding undeveloped lands. Although the GIS model mapped most of the area as only moderate to low quality habitat, Dodd and Montgomery noted several areas that appear to be very high quality. Within the larger area surveyed, PPM habitat ratings ranged from prime to not suitable. The highest rated areas are near the north end of the park, especially in and around Parry's Grove and Guy Flemming trails, where soils are loosely packed sandy loams (although the USDA mapped this area as terrace escarpments). Vegetation ranges from relatively open to dense sage scrub, with some chaparral. The sage scrub throughout the reserve seems to be of high quality, with a very diverse array of native shrub and herb species and few exotic species. The area rated as prime habitat occurs along the Guy Flemming trail, where a burn has substantially thinned the vegetation. Several other highly rated areas are interspersed with medium-high and medium-low habitat, especially in the central and southern portions of the reserve around Yucca Point, and a relatively small patch of habitat on a hilltop west of the houses near the start of La Jolla Farms Road. Several areas on the reserve seem highly suitable for a PPM introduction, especially if some vegetation management (i.e., vegetation thinning) were performed. The land is already managed for biological resources by the State of California Department of Parks and Recreation. The reserve supports a number of rare plants and animals, which must be considered in recommending habitat management actions to benefit PPM.

Torrey Pines State Reserve Extension Trails — The Torrey Pines extension trails are located north of the main reserve and can be accessed via Del Mar Scenic Parkway (north of Los Peñasquitos Lagoon and Carmel Valley Road). The Penasquitos Lagoon area is considered a probable historic

PPM location (USFWS 1998). The GIS model rated Torrey Pines extension from very high to low suitability. The field survey generally confirmed the model predictions, but some areas rated low by the model were field-ranked as moderate to high quality. Habitat in the extension area is similar to that on the main reserve, with diverse coastal sage scrub ranging from small open patches to dense, closed-canopy scrub. Soils are mostly loosely packed sands. The site (as with the main reserve) contains soft sandstone ridgelines, which are highly erosive. The valley floors therefore accumulate deep sands, which were rated as high to very high PPM habitat value. The team rated chaparral on the upper slopes as medium-high to medium-low habitat value. The higher valued chaparral occurs where sand has accumulated and adjacent sage scrub habitat is high quality. This site also seems a suitable candidate for a PPM introduction provided that adequate vegetation management can be performed. It is also managed by the Department of Parks and Recreation with similar biological goals as the main Torrey Pines State Reserve.

Manchester Conservation Area — The Manchester Conservation Area is an approximately 50-ha (125-acre) preserve owned and managed by The Center for Natural Lands Management. The GIS model generally agreed with the field evaluation that the highest quality habitat occurs in the valleys, with lower quality habitat on the steep slopes and ridgelines. The survey team rated the valleys as high to medium-high suitability. The higher valued areas are pockets of relatively open sage scrub on deep, loose sandy soils. The medium-high patches occur where the vegetation becomes very dense or the soil becomes less suitable (i.e., more compact). Active vegetation management (especially thinning) might make a relatively large block on this preserve highly suitable for a PPM introduction. Geology of the site is similar to Torrey Pines, with soft sandstone ridges that erode to create deep sandy soils below. Habitat on the slopes and plateaus above the valleys were rated from medium-high to medium-low because the soils are more compact, there is a lot of foot-traffic and human disturbance, and chaparral is the dominant vegetation. The valley floor may have been historically farmed, which might reduce its habitat value. PPM introduction or habitat management in the preserve would have to be in concordance with management for other species on the site, including several narrow endemic plant species.

Point Loma Ecological Reserve — The study team surveyed the Point Loma Ecological Reserve, including lands within Cabrillo National Monument and lands managed by the U. S. Navy. Much of the area is conserved as open space and managed for biological resources by the National Park Service and the U. S. Navy. Overall, the ridge-tops and gentler slopes of the peninsula had the highest habitat values. They were rated in the field as having high to medium-high suitability, in general concordance with the GIS model. Soils on these ridges and gentle slopes consist mostly of loosely packed sands. Much of the sage scrub and chaparral habitat on the peninsula is very dense, with scattered openings. The best patch is quite small (about 4 ha; 10 acres) and occurs just above the lower lighthouse on Cabrillo National Monument. Large blocks of lower-quality habitat occur throughout the peninsula on the steep east- and west-facing slopes. The main drawback for this site is that the best habitat patches are generally small and widely scattered amongst lower-quality habitat or between Naval or National Monument facilities. Vegetation management (i.e., shrub thinning and exotics removal) would increase the amount of higher-quality habitat on the reserve. The peninsula supports an abundance of rare species and localized concentrations of narrow endemic plant species. Therefore, any habitat management for the benefit of PPM would need to avoid adverse effects on these rare plants and be in compliance with the Point Loma Natural Resource Management Plan.

Aliso and Wood Canyons Wilderness Park — The team surveyed portions of ~~the Aliso Canyon~~ the Wilderness Park, from the coast to just east of where Wood Canyon intersects with Aliso Canyon. The GIS model mapped much of this as low suitability, with only scattered patches of high and moderate suitability (mostly north of Aliso Creek). The survey team generally agreed with this assessment; however, the field surveys revealed one patch of habitat that deserved a high rating, on the north side of Aliso Creek, adjacent to Moulton Meadows Park. This area was rated high because it possessed loose, fine-grained, sandy soils and diverse sage scrub habitat. The shrub cover is quite dense in areas and would definitely require thinning before a PPM introduction would be appropriate. The area is relatively small (<20 ha; <50 acres) and is somewhat disturbed by human presence (as evidenced by many walking trails and abundant dog feces). The survey team found only one other area (a couple of patches in the bottom of Aliso Canyon, north of the creek) that had some potential and was rated medium-high to medium-low. This area consisted of dense non-native grassland on loosely packed loams. It would definitely need vegetation management to create more suitable habitat. The fine-filter soils studies should reveal if the loamy soils in this area are appropriate for a PPM translocation. The rest of the park consisted mostly of more compact soils and/or steep slopes. This wilderness park is owned and managed by the County of Orange Harbors, Beaches and Parks Department.

Tijuana River Valley — The surveyed area includes undeveloped lands throughout the Tijuana River Valley, from the coast to Interstate 5. This area historically supported one of the largest and most extensive PPM populations, but it has been highly disturbed by agriculture, heavy human use (e.g., illegal border crossings and U.S. Border Patrol activities), and altered hydrological regimes. Much of the valley is mapped as tidal marsh, riparian vegetation (with abundant exotic species), and agriculture. The GIS model rated most of this area as having no suitability to only moderate suitability for PPM, with only small, scattered patches of high habitat suitability. The field team agreed with the GIS model that the site was generally low quality, due to historic and current disturbance. However, most patches rated as high quality by the GIS model were rated by the field team as low quality; and one area (Spooner's Mesa) predicted to have no habitat suitability (because vegetation is mapped as agricultural fields) was field-rated as medium-high quality. Spooner's Mesa has been historically farmed, as recent as the early 1990s, and currently supports sparse, disturbed scrub and ruderal vegetation dominated by exotic weeds. Nevertheless, the field team felt the area has many good qualities, including loosely packed sandy soils, low shrub cover, level terrain, and relatively large size roughly 40 ha (100 acres). The USDA mapped the soils there as Carlsbad gravelly loamy sand (which was rated as high quality for the GIS model). Fine-filter soils studies will be important in determining if the soils on this ~~plateau~~ mesa are suitable, especially considering the past agricultural use of this area, because PPM distribution patterns suggest that they are not found on historically cultivated areas. The field team also rated as high quality one small patch of habitat (roughly 6 ha; 15 acres) very close to the type locality for this species, near the southwestern-most corner of the United States, just north of the Tijuana Bull Ring. This area appears very suitable, with a relatively open shrub cover and fine-grain sandy soils. The USDA maps this patch as Marina loamy coarse sand.

San Mateo — Although not ~~technically~~ considered ~~a~~ translocation receiver sites because they are currently occupied by PPM, the field team also rated the San Mateo North and South PPM sites and adjacent habitat. As expected, the occupied sites ranked high to prime, and adjacent (possibly unoccupied areas) as medium to high. Lower ratings for areas adjacent to the known, occupied areas are primarily due to denser vegetation and previous agricultural uses. The occupied areas are open coastal sage scrub (overall average about

45% shrub cover), with abundant open ground. Soils are primarily deep, loose, sandy loams, with some coarse sands present. Some adjacent areas (especially north, east, and southeast of the occupied San Mateo South site) appear to be suitable for PPM occupancy if vegetation were thinned. The study team believes that controlled burns or hand thinning in these areas should be instituted experimentally to attempt to expand the population into adjacent habitat or to facilitate natural dispersal into disjunct patches. Thus, although not considered a receiver site for active translocations, this area could serve to further species recovery via natural population expansion or establishment of new, disjunct populations.

Appendix C summarizes observations for the remaining, lower-rated sites, which ranged from medium-high to low quality and are characterized as having few areas of appropriate fine sandy soils. More detailed results and analyses will be included in the report prepared by Dodd and Montgomery per their Section 6 contract.

CONCLUSIONS AND RECOMMENDATIONS

Based on results to date, the study team believes that habitat potential is sufficient to warrant pursuing PPM translocations as a recovery tool, provided that more quantitative field analyses and habitat management actions are performed prior to any such attempt. Potential receiver sites rated as medium high to prime habitat value were found throughout much of the historic PPM range, from Aliso Canyon in Orange County to the Tijuana River Valley (near the southernmost historic site and PPM type locality).

At least the seven highest-rated sites described here should be further evaluated in the field for their potential to support translocated PPM. All discernable factors affecting the potential of these sites to support translocated PPM should be ascertained to the degree feasible during the year 2001. Field evaluations should include the following:

- Quantitative soils analyses and mapping to compare soil characteristics on the potential receiver sites to those on known occupied sites and microhabitats, in coordination with the detailed soils studies conducted by the USFWS at Oscar One. At a minimum, this should entail measuring particle size composition and bulk density on the best two to three patches of habitat at each potential receiver site. At least five soil samples should be collected per patch.

- Refined vegetation mapping and descriptions to compare vegetation composition and structure among potential receiver sites and between potential receiver sites and known, occupied PPM sites. Vegetation will probably be characterized using Releve protocols (Sawyer and Keeler-Wolf 1995). This method allows rapid classification of plant cover at a scale relevant to PPM habitat potential.

- Trapping to characterize the extant mammalian fauna. Trapping should be done for at least three consecutive nights at each site, preferably during June and July, in order to characterize the small mammal communities at each. Results will be compared with mammal communities at occupied and historic PPM sites. Current thinking is that occupied PPM sites have low overall mammal diversity, with few other heteromyid species or individuals and few or no exotic mammals (especially *Mus musculus* and *Rattus* spp.).

- Characterization of potential threats to PPM populations or habitat, including presence and distribution of exotic plant and animal species (exotic ants, house cats, *Mus*, *Rattus*, etc.); evidence of soil compaction, soil contaminants, or historic cultivation; or any other natural or unnatural disturbance factors that may reduce PPM population viability.

We also encourage immediate and intensified coordination with appropriate land use and management authorities, including the wildlife agencies, Marine Corps, U.S. Park Service, California State Parks Department, Center for Natural Lands Management, and local city and county governments having jurisdiction over the highest rated habitat areas.

USDA soil series maps, and habitat value maps based on them, should be used with extreme caution in predicting areas of suitable habitat for PPM or other small mammals. Our field results indicate that these maps are too coarse in scale to detect important variations in soil texture and depth, and may be inaccurate. Consequently, our habitat value maps and USDA soils maps should not be used to decide where PPM surveys are unnecessary for impact assessments.

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TASK 6 – LABORATORY SURROGATE STUDY

During Phase II, the study team tested four individual marking methods on *P. l. longimembris* in a laboratory setting, and concluded that two methods (toe clipping and PIT tagging) deserved further consideration (ear tags and color-coded surgical sutures were ruled out as potential marking techniques). During Phase III we continued monitoring the previously marked animals for long-term health and mark retention, and increased the sample of PIT-tagged and control animals.

METHODS

Four *P. l. longimembris* each were added to the PIT tag and control groups, using new individuals captured by Dodd during May 2000 at the same location (Yucca Valley) and using the same methods as described in the Phase II report. Individuals were initially weighed, sexed, and assessed for health problems or physical abnormalities, and then assigned to either of the two groups by random draw. Charles Holland and Shana Dodd PIT-tagged the four animals on 29 June 2000, using the hypodermic insertion method described in the Phase II report.

Following marking, these eight animals were added to the 27 *P. l. longimembris* initially marked during Phase II, raising sample sizes to nine control and seven PIT-tagged individuals. All animals were monitored weekly to twice monthly from the end of Phase II (in November 1999) to the end of Phase III (November 2000). During each monitoring session, each individual was observed in the cage, weighed, and handled to identify any distinct behavioral traits and to examine the condition of the marking site and the overall health of the animal. General comments were recorded for the condition of each animal. Food and tubing for shelter were provided *ad libatum*.

RESULTS AND DISCUSSION

Both biologists were more adept at the hypodermic insertion method than during Phase II, due to increased practice in both the laboratory and field (see Task 7). This reduced tagging time slightly, to less than two minutes per animal. Trauma to the mice also seemed somewhat reduced during the Phase III marking efforts. Nevertheless, two attempts were required to successfully insert the tag into two of the four mice. The limited space for needle insertion and the thickness of the animals' hair sometimes inhibits the initial marking effort, but all four newly marked animals showed limited disturbance from the marking effort. Some temporary hair loss resulted at the nape of the neck, but overall the newly marked individuals seemed to recover more quickly, with less evidence of stress, than the animals PIT-tagged during Phase II (when post-marking behaviors included lethargic and stiff body movements, repeated body shaking or twitching, scratching at insertion point, and vigorous dust bathing when released). All animals, both in Phase II and Phase III, were quick to recover, with all wounds healed in two weeks and most healed in one week. Within two weeks of tagging all activity seemed normal. The only noticeable physical abnormalities were limited hair loss at the nape, and PIT tags often were perpendicular to insertion direction, causing the skin to bulge. Following healing of the wound, the animals exhibited no apparent discomfort in the area of the PIT tag insertion.

During the interim between Phase II and Phase III, two toe-clipped and 12 unmarked animals died. This coincided with a change in maintenance personnel and care procedures that resulted in insufficient food being provided for several weeks. Nearly all mice (regardless of marking method)

experienced severe weight loss at this time. Twelve of 20 newly captured, yet unmarked animals died along with the two toe-clipped individuals. The lower death rate in the existing versus newly added animals was undoubtedly due to the existence of seed caches in their cages prior to the sudden reduction in food provision. Once the care situation was rectified, all living mice regained weight and health. We do not believe that toe clipping contributed to the death of the two mice. ~~although we cannot rule out that too~~

Individual abnormalities occurred among animals in all groups, including temporary loss of body hair to molt (but with no apparent seasonal trigger), redness and balding of the tail, and abnormal sleeping patterns, but no marking groups showed a higher incidence of such observations (Table 4).

CONCLUSIONS AND RECOMMENDATIONS

We endorse the use of toe clipping to begin marking PPM at extant sites and begin studying population sizes and demography of these populations. Based in part on results of this study, and in part on endorsements from the American Society of Mammalogists and the PPM Scientific Peer Review Committee, we received permission from the USFWS and CDFG to toe clip PPM for field study on a case-by-case basis. If a smaller PIT tag were available, PIT tagging would offer several benefits over toe clipping, including a reduced human error, unlimited codes, and greater reliability. However, we feel that a smaller capsule, which could be inserted using a smaller hypodermic needle, must be developed before recommending PIT tagging for PPM. Potential sources for funding development of a miniaturized PIT tag should be pursued.

We do not recommend continuing the laboratory marking study, unless smaller PIT tags become available for testing. At this time, we understand that the San Diego Natural History Museum will be using the captive population as part of a taxonomic study on *P. longimembris*, including spectral analysis of pelage differences between subspecies. Funding for this effort has been provided by the USFWS.

(William Haas) in KEA docs

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Table 4. Selected observations on *Perognathus longimembris longimembris* marked by different methods.

Animal - Sex	Weight				Physical condition	Tag notes
	Beginning	High	Low	Ending		
Ear Tag						
24 - M	8.3	10.0	7.8	8.2	4 month hair loss-start 12/2/99, bald tail 7 months	Tag swivels but remains attached
23 - F	8.3	10.6	6.9	9.6	6 month hair loss-start 10/14/99, brief period of tail redness	Lost ear tag after 3 weeks
20 - M	9.9	10.4	7.6	9.7	6 month hair loss-start 11/11/99	Tag hangs loose but remains attached
18 - F	9.5	7.3	10.0	10.0	6 month hair loss-start 11/11/99	Lost ear tag after 3 weeks
3 - F	8.5	10.5	7.1	8.7	5 months of red/ bald tail, one molt	Lost ear tag after 2 weeks
26 - M	8.3	9.4	7.3	9.4	multiple recordings of sluggish/torporus behavior	Tag hangs loose but remains attached
Suture						
16 - F	9.0	10.5	8.3	8.7	2 brief occurrences of red/bald tail (2 mo., 0.5 mo.)	Suture attempt failed, wound healed smoothly
8 - M	7.2	8.3	5.2	8.2	8.5 months bald legs and tail, tail pink/thin-start 12/2/99	Wound healed/suture lost at 2 weeks
7 - F	8.0	9.9	6.9	9.9	8.5 months of bald/red tail, 3 molt periods-start 12/2/99	Suture lost, wound healed with skin bunched
5 - F	9.0	11.4	8.0	10.2	brief tail baldness	Suture lost at 4 weeks, wound healed
4 - M	9.3	11.3	8.3	11.3	Excessive body shrugging evident while suture in place	Suture lost at 12 weeks, wound healed
22 - M	8.0	9.5	6.7	8.0	bouts of torpor, esp. in winter	Suture lost at 2 weeks, swollen 2 more weeks
Toe Clip						
27 - M	8.7	11.0	6.7	9.6	2 distinct molt periods	Toe healed at 2 weeks, started to regrow nail
25 - F	9.7	10.1	8.0	9.0	12 months bald legs and tail, tail pink/thin-start 12/10/99	Toe healed at 1 week, fully regrown nail
19 - F	9.3	10.1	6.8	8.1	bouts of torpor throughout year	Toe healed in 1.5 weeks
17 - M	9.6			Dead	Died due to insufficient food provision	Toe healed in 1 week, fully regrown nail
13 - M	9.4			Dead	Died due to insufficient food provision	Toe swollen but healed in 2 weeks
9 - F	8.4	9.4	7.6	8.1	4 month hair loss-start 9/24/99, 7/15-10/5/00 eye infection	Toe healed in 1.5 weeks, starting to regrow nail
PIT Tag						
21 - F	9.0	10.0	7.3	8.4	6 months red/bald tail-start 5/11/99	Tag located at left hip, flush with body
11 - F	8.2	9.3	6.9	8.9	4 months red/bald tail-start 2/25/99	Tag located at right shoulder, flush with body
6 - M	8.3	9.7	7.7	8.5	9/14/00 eye infection	PIT tagging failed, wound healed
34 - M	11.0	11.7	8.8	11.0	1 month molt	Tag located on right side, flush with body
36 - F	9.0	10.7	8.4	9.3	1 month molt	Tag located at right shoulder, flush with body
41 - F	6.7	7.3	6.5	7.3	new/healthy	PIT tag over neck, perpendicular to body
48 - M	9.0	9.9	6.5	9.9	new/healthy	Tag located on right side, flush with body

Animal - Sex	Weight				Physical condition	Tag notes
	Beginning	High	Low	Ending		
Control						
15 - M	9.6	10.1	8.0	8.9	torporus in winter	
14 - F	7.3	9.2	6.9	8.7	sluggish/torporous through year, red tail (only observed 1 visit)	
12 - F	8.4	9.8	6.9	8.8	8 month molt-start 10/8/99, torporus in winter	
2 - M	8.3	9.3	6.4	8.5	5.5 month molt-start 10/2899, 3 month red/bald tail - start 1/3	
1 - M	8.0	9.7	7.6	9.4	3.5 month red/bald tail, 2 short molts, eye infection 9/14/00	
30 - M	7.1	8.5	6.5	7.9	5 month red/bald tail and legs, molting-start 7/5/99	
31 - F	8.4	9.9	7.1	9.9	2 month molt, brief red tail (only observed 1 visit)	
37 - F	6.8	7.8	6.4	7.8	3.5 month molt	
42 - M	7.7	7.7	6.7	6.7	new/healthy	

TASK 7 — FIELD SURROGATE STUDY

During Phase II we began a field study of the Palm Springs pocket mouse (*P. longimembris bangsi*), to serve as a surrogate for PPM. We established and trapped two permanent study grids in the Coachella Valley, California, marked resident pocket mice with three different marking techniques (ear tags, PIT tags, and toe clips), and collected baseline natural history and demographic data. During this Phase III report period, our primary objectives were to recapture marked individuals in hopes of detecting differences in tag retention and possible health effects, and to continue marking new individuals and collecting demographic data (e.g., population numbers, sex ratios, reproductive rates). We also evaluated whether to use this surrogate population as a model for testing translocation methods or other studies.

METHODS

We continued using the two grids established during 1999 near Snow Creek, Coachella Valley, California (see Phase II report for description). The vegetation and rodent communities remained similar between years, although black mustard (*Brassica nigra*) became abundant on the site during spring 2000, forming a moderately dense ground cover. The mustard dried by the end of July, resulting in a sparse ground cover between widely spaced creosote (*Larrea tridentata*) and other shrubs.

Similar trapping methods were used in both years, with the exception that 5-m inter-trap spacing was used on both grids in 2000, versus 5-m spacing on Grid A and 7-m spacing on Grid B during 1999. Each grid therefore consisted of a square configuration of 14 by 14 trap stations (196 total trap stations) and covered 0.49 ha, assuming a ½-trap-space perimeter strip around each grid. Two traps were set at each trap station to reduce trap saturation by non-target species. Thus, during 2000, each grid contained 392 traps at 196 stations.

During August 1999 we trapped for eight consecutive nights to detect how many nights were needed to capture the majority of residents. Based on these results, shorter trap sessions were used in 2000, with a goal of trapping one to two nights after the asymptote in capture of new individuals. Thus, the grids were trapped for five consecutive nights on 24-29 April 2000 and for four consecutive nights on 24-28 July 2000.

Individuals captured in 1999 had been marked with three marking techniques: all animals were toe clipped, and subsets were also ear tagged or PIT tagged. Due to the high loss rate for ear tags during both the 1999 laboratory (Task 6) and field (Task 7) marking studies, we discontinued ear tagging in 2000. Therefore, the 2000 field studies focused on the effectiveness and potential health effects of PIT tags and toe clips. Unlike the 1999 marking, during 2000 mice were either marked with PIT tags or toe clips, but not both. We also went to a 4-digit toe clip code during 2000, versus a 2-digit code in 1999, to allow for more unique combinations. Otherwise marking methods remained similar between years.

The following data were recorded on all captured *P. l. bangsi*: sex, reproductive condition, age, capture location, recapture status, and notes on animal conditions and the condition of any previously applied marks. Most animals during the spring 2000 trap session were weighed with an electronic balance. However, during the summer 2000 trap session we did not weigh all individuals

due to high wind interference and extreme heat, which required rapid release of captured animals to avoid heat exhaustion or trap death. Reproductive condition was based on the position of the testes for males and condition of the vagina and size of mammae and abdomen for females. All other small mammals captured were identified and released.

The number and type of problems associated with each marking technique were summarized; and the minimum density of *P. l. bangsi* known alive (number of individuals captured/grid area) was calculated for comparison between grids. Numbers of males and females captured were compared between grids, seasons, and years, and were compared with a null hypothesis of an even sex ratio, using Chi-square statistics and $P < 0.05$ as the significance threshold. The primary question of interest was whether the 7-m inter-trap spacing used on Grid B during 1999 may have resulted in a male-biased capture rate compared to the 5-m spacing used on Grid A in both years, and on Grid B in 2000. Because sex ratios did not vary significantly between trapping sessions within years on either grid, the spring and summer results were pooled for comparisons between years (and hence between 7-m and 5-m trap spacing on Grid B).

RESULTS AND DISCUSSION

Table 5 summarizes captures of male and female *P. l. bangsi* on the two grids in 1999 and 2000. Recorded sex ratios on grids using 5-m trap spacing (Grid A during both years and Grid B during 2000) did not differ significantly from each other nor from 1:1 ($\chi^2 = 0$ to 0.5; df = 1; $P > 0.25$ for all comparisons). However, during 1999, when Grid B used 7-m inter-trap spacing, the recorded sex ratio strongly favored males due to lower numbers of captured females (24 males:9 females = 2.67:1). This very nearly differed significantly from the ratio recorded on the same grid using the 5-m spacing in 2000 ($\chi^2 = 3.79$; df = 1; $P = 0.051$), and did differ significantly from an even ratio ($\chi^2 = 6.82$; df = 1; $P < 0.01$). These results further support our hypothesis in the Phase II report (based on 1999 results) that the 7-m spacing may have under-sampled females on Grid B during 1999. However, we recognize that this conclusion is weak due to a lack of grid replication.

Table 5. ***P. l. bangsi*** **~~Captures~~ Individuals Captured During 1999 and 2000.**

Trap Session	Sex		Total
	Male	Female	
Grid A			
Summer 1999	22	22	44
Spring 2000	15	20	35
Summer 2000	53	40	97 (4 not sexed)
Grid B			
Summer 1999[1]	24	9	33
Spring 2000	17	15	32
Summer 2000	37	32	71 (2 not sexed)

[1]Traps on Grid B had 7-m inter-trap spacing in summer 1999; otherwise, all traps had 5-m inter-trap spacing.

Captures on both grids more than doubled between summer 1999 and summer 2000. This reflects a large reproductive output in 2000, with 126 of 162 aged individuals (78%) identified as young of the year during summer 2000. Although the high capture rate of young animals during 2000 may have reduced captures of resident (over-wintered) adults, we do not believe that this potential trap-saturation effect was significant in part due to our use of two traps at each station and the number of empty traps available on the grid. We identified all individuals captured during spring (April 2000) as adults. Although it is difficult to distinguish subadult from adult pocket mice in the hand because pelage and behavioral differences are subtle, it is highly unlikely that subadults could have been produced by this early date. The reproductive season seemed near a peak during April, with most individuals showing signs of sexual activity, including descended testes in males or perforate vagina in females. Eight females were obviously pregnant, and others may have been. By July very few individuals showed signs of sexual activity, no females were obviously pregnant, and we were able to distinguish three age classes adult, subadult, and juvenile. Pooling subadults and juveniles as young of the year, and defining adults as individuals born the previous year, as many as 68 young of the year on Grid A and 58 young of the year on Grid B were detected during the summer trap session. This high reproductive output during 2000 indicates a very successful breeding season compared to 1999.

Also, fewer adults were captured on both grids during the summer compared to the spring trap session in 2000. We do not have an explanation for this difference, but one hypothesis might be that because the adults have been active above ground since the spring they are better prepared (i.e., have substantial seed caches) for the onset of winter hibernation. Consequently, they may reduce their above-ground activity early. In contrast, young of the year are still establishing territories and winter seed caches, and therefore remain above-ground longer.

Relative to other species, *P. l. bangsi* was the second-most captured species in 1999, accounting for 36% of mammal captures (*Dipodomys merriami* was most-captured, accounting for 45% of captures). However, *P. l. bangsi* was the most common species captured in 2000, accounting for 88% of all captures on Grid A and 90% on Grid B. Thus, six other species accounted for only 10-12% of all captures during 2000: Merriam's kangaroo rat (*Dipodomys merriami*), San Diego pocket mouse (*Chaetodipus fallax*), desert pocket mouse (*C. penicillatus*), Desert wood rat (*Neotoma lepida*), southern grasshopper mouse (*Onychomys torridus*), and deer mouse (*Peromyscus maniculatus*). We do not know why captures of other species, relative to *P. l. bangsi*, dropped so dramatically from 1999 to 2000, although the great increase in *P. l. bangsi* captures may have reduced trap availability to other species, or there may be competitive interaction effects. In occupied PPM habitat, small mammal diversity and captures of other species tend to be very low relative to PPM captures (Dodd, Pavelka, Montgomery, unpublished data).

Marking Technique

Considering all trap sessions (in 1999 and 2000) a total of 248 individuals were toe clipped, 34 were PIT tagged, and 50 were ear tagged on both grids (Table 6). As discussed in the Phase II report, considerable ear-tag loss was discovered during 1999, so ear tagging was discontinued in 2000. Only four ear tags were recorded on individuals captured during the spring 2000 trap session, and no ear tags were detected during the summer session.

Toe clipping was the fastest and easiest marking technique under field conditions, but toe clipping is not without problems. The study team detected about 25 problem incidences (out of 248 toe clipped individuals) due to natural causes or human error: (1) ten cases of naturally missing,

deformed, or injured toes, which would make toe clipping potentially confusing; (2) six or seven cases where field workers apparently read the wrong code on a previously toe-clipped animal; (3) three or four cases where the toe tip grew back, apparently due to not clipping far enough back; and (4) four cases were two individuals were mistakenly given the same toe clip code. It is possible that other errors went undetected, but also likely that human error problems would be reduced with careful field technique and increased experience. Toe clipping also permits for a limited number of codes, which might be exceeded in a multi-year study of a large PPM population, such as on the Oscar One/Edson site.

Several circumstances limited the number of mice we PIT tagged, including difficulties with hypodermic insertion and time constraints due to severe weather. First, the ease of inserting the tag hypodermically varied with animal size, disposition, and skin toughness. It was more difficult to insert tags in smaller individuals without tearing skin, and some individuals were more aggressive or struggled more than others. The team abandoned about six attempts to PIT tag individuals, opting instead to toe clip them to avoid further harm once PIT-tagging problems arose. Also, several successful PIT taggings required several attempts to fully insert the needle so that the tag did not push out of the insertion point. These types of errors decreased with experience of the biologists. Second, during the summer 2000 trap session, extremely rapid temperature increases following sunrise, coupled with very high population and capture rates, made speed in measuring, marking, and releasing captured animals imperative to avoid heat exhaustion or death. This convinced the team to toe clip most new individuals to speed up processing.

Table 6. Capture/Recapture Records for *P. l. bangsi*, Pooling Both Grids.

		Spring 2000		Summer 2000		
Mark	Summer 1999	New Captures	1999 Recaptures (Over-wintered)	New Captures	1999 Recaptures (Over-wintered)	Spring 2000 Recaptures (Not over-wintered)
Toe Clip	77[1]	25	26[2]	146	12[2,4]	1
PIT Tag	18[1]	16	1	0	0	5
Ear Tag	50[1]	0	4[3]	0	0[3]	0

[1]All individuals were toe clipped in 1999, with a subset of these also PIT tagged or ear tagged.
[2]Some of these were also ear tagged in 1999, but lost their tags prior to recapture.
[3]Excludes individuals that lost ear tags before recapture. These individuals also were toe clipped.
[4]Eleven of these 12 individuals marked in 1999 were recaptured in both spring and summer 2000.

Despite the problems that occurred with PIT tagging, a few previously PIT-tagged individuals were recaptured. One individual that was tagged in 1999 was recaptured in the spring 2000. A total of five mice PIT-tagged during spring 2000 were recaptured during summer 2000. All PIT-tagged individuals that were recaptured appeared healthy, with fully healed insertion wounds.

Population Density

The ~~minimum~~ apparent *P. l. bangsi* density substantially increased in the summer 2000 compared to all previous trapping sessions (Table 7). Interestingly, the ~~minimum~~ density on Grid A was still higher

than the density on Grid B in 2000 even though the trap spacing on both grids were identical (recall in 1999 the trap spacing was different on both grids). In 1999, we were unsure if lower capture rates on Grid B was due to the larger trap spacing or whether there were actually fewer *P. l. bangsi* on Grid B then Grid A.

Table 7. ~~Minimum~~ *P. l. bangsi* Density on Grids A and B.

Trap Session	Minimum Individuals/ha	
	Grid A	Grid B
Summer 1999	82	63
Spring 2000	71	65
Summer 2000	198	145

CONCLUSIONS AND RECOMMENDATIONS

This method is also endorsed by the American Society of Mammalogists and was recommended by the PPM Scientific Peer Committee during Phases I and II.

A goal of the field surrogate study during 2000 was to further evaluate toe clipping and PIT tagging as permanent marking techniques for *P. longimembris*. Unfortunately, the low recapture rate for marked individuals reduced our ability to fully assess each technique. However, based on the field experience and the data collected, we recommend toe clipping as the best permanent marking technique currently available. Toe clipping was the quickest and least expensive method to apply under field conditions, and it appeared to have few detrimental health effects. We also recommend training and practice on surrogates before any biologists attempt toe clipping on PPM.

At this time, we do not endorse the use of PIT tags for permanently marking PPM, due to the size of the tags and hypodermic needle relative to the animals, and potential for adverse health effects. However, the team strongly feels that if PIT tags and needles can be made smaller, PIT tagging would be the best method. Smaller PIT tags would offer several advantages over toe clipping: (1) an endless supply of unique identification codes, (2) a very low rate of misreading codes or individuals, and (3) no possibility of mistakenly giving the same code to different individuals. PIT tags not only reduce the amount of human error, but also the amount of "natural" error that occurs due to injuries or deformities in toes. We therefore recommend pursuing funding to allow microchip manufacturers to make a smaller PIT tag.

The grid size (about 0.5 ha) and trap density (5-m inter-trap spacing) used here seems generally appropriate for this species, although these may need to be adjusted for PPM studies based on the size and shape of occupied habitat areas and study objectives. We feel that 7-m spacing may be too wide to provide accurate population results for this species.

Although some additional field experience and life history and demographic information was gained during this study, there is a growing concern that these data may not translate well from *P. l. bangsi* to *P. l. pacificus* due to very different environmental conditions in coastal versus desert habitats. We therefore do not recommend continuing the field surrogate study for collecting life history data or for further testing of marking methods. However, the study grids may still remain useful for performing future experiments, such as potential surrogate translocation trials to perfect techniques.

The following studies are being conducted under separate funding and are not among the specific research tasks included in this report. However, these studies are closely coordinated with our research tasks, so we summarize pertinent results here.

OTHER ASSOCIATED STUDIES

GENETICS ANALYSES

In our Phase I report we recommended initiating a study to determine genetic variability both within and between the extant PPM populations (using tissue samples from extant individuals) and within and between all historic populations (using museum specimens). Such information is critical to informing species recovery decisions, including genetic goals for a translocation program. Such a population genetics study was initiated during Phase II, under separate funding (Section 6 money from CDFG via San Diego State University Foundation) with preliminary results now becoming available during Phase III. These findings have filled some very important information gaps for PPM recovery planning.

Methods

Genetics analysis of recent and historic PPM samples are being performed by James Patton and Andrea Swei at UC Berkeley. To date they have examined haplotype variation in the mitochondrial cytochrome b gene from 37 PPM specimens collected in 1995-2000 (mostly by pulling hairs from live-caught individuals) and partial DNA sequences from 12 museum skins collected in the 1930's. Full 810 base pair (bp) sequences were obtained from the live-caught specimens, and 430 bp fragments were amplified from the museum specimens (see Swei 2000 and citations therein for complete laboratory and analytical methods). To date the following live-caught samples have been analyzed: Dana Point (N = 27), San Mateo South (N = 6), San Mateo North (N = 2), and Oscar One (N = 2). Additional samples collected during 2000 are currently being analyzed to permit better estimates of within- and between-population measures, although Dr. Patton (in litt.) does not expect these to alter the general conclusions emerging based on existing analyses. In addition, the researchers are building a genomic library to recover microsatellite loci from the nuclear genome.

Results and Discussion — Swei (2000) and Patton (2000, in litt., Appendix F) summarized the limited genetic analyses completed to date with the following general conclusions: First, all PPM haplotypes analyzed to date are unique to that subspecies and all are closely linked genealogically. Hence, while the PPM has not achieved complete reciprocal monophyly, and is therefore not by itself an Evolutionary Significant Unit (ESU), historically the PPM has been diverging genetically from its closest geographic conspecific subspecies (*P. l. brevinasus*, *P. l. bangsi*, *P. l. internationalis*, and *P. l. longimembris*). There is no evidence for ongoing gene flow between any population of PPM and other subspecies of little pocket mouse.

Second, measures of gene flow between both historical and extant PPM populations are quite low. This suggests that genetic drift is and has been an important factor in genetic diversification of PPM populations, and that given current levels of fragmentation and low population sizes, drift will continue to differentiate the populations and erode genetic diversity within each.

Third, relative to other subspecies of little pocket mice, PPM has much lower overall haplotype diversity (roughly half that of other subspecies). This seems particularly true for the Dana Point population, which had only 9 unique haplotypes recovered from 27 individuals sampled. By comparison, nearly every individual of the other subspecies possesses a unique haplotype, and seven of eight PPM individuals from the San Mateo area (pooling the north and south San Mateo sites) had

unique haplotypes. This suggests that the Dana Point PPM population has been isolated as a small population for a longer period than the others.

Fourth, the pattern of haplotype differentiation suggests that the historical populations (in the 1930s) were already largely genetically isolated from one another, and that the current low level of diversity and high inter-population divergence is due to natural isolation of these populations prior to the modern urbanization of coastal California. Of the total genetic variation among samples, 79% of the variation is within populations, with only 19% found between populations within a time period (1930s or 1990s), and only 2% of the variation between modern and historic samples. The pattern of haplotype variation suggests that even the genetic differentiation between the Dana Point and San Mateo sites is likely due to a long history of genetic isolation, at least partially preceding modern development of the California coast.

Finally, although the haplotypes of extant PPM populations are largely apportioned among populations, they are all genealogically closely related. This suggests that, genetically, individuals could be translocated from any or all extant sites to create new populations or to bolster or reestablish an extant population should it suffer an extreme decline.

Conclusions and Recommendations

Patton (in litt.) recommended that sample sizes be enlarged, especially for the San Mateo and Oscar One populations, to permit better estimates of within-population genetic diversity and gene flow between extant sites (e.g., between San Mateo North and San Mateo South sites). Increased samples were made available during summer 2000, and are currently being analyzed. Patton also recommended constructing genomic libraries to recover highly variable microsatellite loci from the nuclear genome. Then primers can be constructed to determine genotypes at each locus for all available samples. This will facilitate more precise analyses of population structure within and between these populations and can serve as a genetic monitoring tool into the future.

DANA POINT HABITAT MANAGEMENT

A variety of evidence suggests that vegetation has become too dense at some of the occupied PPM sites for optimal habitat condition, and that thinning the vegetation by fire or other means might increase habitat value and PPM population sizes. Experimental habitat thinning was therefore initiated within the Dana Point PPM reserve during 1999. It was not possible to obtain permission for a controlled burn at the site, so shrub cover was thinned by hand on experimental plots. This project was also performed using Section 6 money from CDFG via San Diego State University Foundation.

Methods

Eleven trapping grids (40 traps arranged in 4 by 10 arrays with 3-m spacing) were established and trapped during the spring and summer of 1999 (pre-thinning) and 2000 (post-thinning): three control grids and eight experimental grids. The three control grids were established in known, occupied PPM habitat having relatively low shrub cover; the eight experimental grids were established in areas of dense shrub cover not known to harbor PPM, but having appropriate soils. The experimental grids overlapped four ~~28~~ 30 by ~~50~~ 60-m shrub thinning plots, such that ½ of each of the

experimental grids was in an area to be thinned, and ½ in an area not to be thinned. In the results, we refer to these halves as thinned and unthinned subgrids.

Before thinning, shrub canopies on the experimental plots covered a mean of about 83% (range 75-87%), measured at 21-60 cm above ground using point-intercept transects. During January 2000, shrub cover was thinned on the four plots to a mean of 32% (range 26-36%). Thinning was done by removing individual shrubs at ground level, using chainsaws and pruning tools, to avoid soil disturbance. Concentrations of woody duff and litter were also lightly raked to uncover mineral soils.

Traplines were run for seven-night trapping sessions, once during spring (late April-early May) and once during summer (mid August). Captured PPM were individually marked by clipping hair and using indelible colored markers (during 1999) or by toe clipping (during 2000). Use by PPM of the control grids and thinned and unthinned subgrids was compared between the pre-thinning (1999) and post-thinning (2000) periods using Chi-square. For this analysis, spring and summer trapping sessions were pooled within each year, and the sample frequencies were calculated as the cumulative sum of all unique individuals captured on a grid. Thus, a recapture of an individual on the same grid was not counted as an independent observation, but a recapture on another grid was, because individuals could choose to move from one grid (e.g., a control grid) to another (e.g., a thinned subgrid) during the study.

Results and Discussion

PPM seemed to respond quickly and positively to the shrub thinning by redistributing themselves into the newly thinned habitat areas. During 1999 (pre-thinning), 11 individual PPM were captured, yielding 12 independent grid observations (i.e., one individual was captured on 2 different grids)—9 observations (9 individuals) were on the known occupied control grids, 2 were on subgrids to be thinned (including 1 individual that also used a control grid), and 1 on a subgrid not to be thinned. In contrast, during the year 2000 (post-thinning), 10 individual mice were captured for a total of 18 unique observations—4 on control grids, 11 on thinned subgrids, and 3 on unthinned subgrids. This shift in the distribution of captures is statistically significant ($p = 0.026$), largely due to the ~~great~~ increase in use of the thinned subgrids. During the year 2000, 6 of 10 individuals were captured only on thinned subgrids (5 were captured on only 1 subgrid, but 1 male was captured on 3 different thinned subgrids). Three of the 4 individuals captured on control grids were also captured on thinned subgrids. No individuals were captured only on unthinned subgrids—all 3 individuals captured on unthinned subgrids were also captured on the adjacent thinned subgrid. In fact, all captures on unthinned subgrids were less than 6 m (2 trap distances) from the thinned area that these individuals also used. Moreover, all capture locations on unthinned subgrids were connected to the thinned plots via natural inter-shrub openings.

Conclusions and Recommendations

The pattern of captures before and after the thinning suggests a strong shift in distribution of individuals into the newly thinned habitat areas. This reinforces observations that PPM, like other little pocket mice, restrict their activities largely to open habitats. Although they may forage under shrubs near openings, PPM do not seem to frequent interior portions of closed-canopy shrub cover when other options are available.

Whether this behavioral shift by individuals to newly opened habitat areas results in a positive population response remains to be seen. Continued monitoring with permanently marked individuals should incorporate capture-recapture population estimates. Moreover we recommend that an attempt be made to model the effects of this habitat manipulation on population growth rates. Meanwhile, the team is optimistic that the shrub thinning has improved habitat conditions for the species, at least in the short term, and the experiment should be expanded on Dana Point and replicated at other sites (especially San Mateo North and South) where shrub cover has become dense. If possible, it seems preferable to use the more natural process of fire to set back vegetation succession and open the habitats. However, both methods (fire or hand thinning) must carefully consider ancillary effects, such as the increased potential for invasions by exotic plant species into recently thinned habitats. Rapid increases in exotic species could offset any short-term gains in PPM habitat quality. Careful monitoring and active management to control such invasions must be carried out. [redacted]

RECOMMENDED PHASE IV STUDIES

During Phase I (1998), the study team concluded that PPM translocations were necessary to achieve species recovery, but that existing information was insufficient to design a translocation program. We therefore refocused the program on several new research tasks to answer those questions most critical to designing a translocation program. Results of Phases II and III (1999 and 2000) have now answered enough of these questions to warrant reevaluating our Phase I conclusions and begin designing a translocation program as a recovery tool. Phase IV would therefore comprehensively update our Phase I evaluation of translocation feasibility, design a framework translocation program based on the updated information, and identify outstanding questions that must be answered before the translocation program is implemented. Previously funded tasks will only be continued where their results are critical to the overall goal. Previous tasks that have been completed or that have become low priority would be discontinued. Phase IV would also include one new task that is considered critical to designing a translocation program—a translocation experiment that uses a surrogate subspecies or salvaged PPM to test translocation methods.

Please note that the program's goal is translocation to establish new PPM populations, and thereby to help recover the species from the brink of extinction. No one should interpret our intent as translocation to mitigate proposed take of PPM or PPM habitat by development projects.

TCA FUNDED TASKS

This section reviews our recommendations for continued funding by the TCA through the year 2001. For completeness, we list all tasks undertaken to date, including discontinued tasks and tasks we do not recommend continuing at this time.

Task 1 — Evaluate the Feasibility of Translocating Pacific Pocket Mice

This task was completed during Phase I with a conclusion that translocations were not feasible, pending results of Phase II and III studies. We now recommend updating the feasibility report based on all new information collected over the past three years. Specifically, the findings summarized in the Phase I report would be comprehensively updated to reflect findings of Tasks 5 through 8 (Phases II and III), including the genetics results prepared by Dr. James Patton and the shrub thinning experiment carried out by Dodd and Montgomery. We would also update the literature review with findings and recommendations of other species translocations and reintroduction studies (e.g., Haight et al. 2000). The updated analysis and literature review would serve as the foundation for the translocation protocol developed in Task 4.

Task 2 — Evaluate Argentine Ant Invasions into Existing and Potential Habitat

This task was discontinued during Phase I, because information suggested it was a relatively low priority. We do not recommend refunding this task at this time, but recommend continued communication with experts in exotic species invasions, their effects, and control measures. We also recommend that ~~some~~ PPM presence/absence surveys and monitoring studies should document presence or absence of Argentine ants or other exotic species in potential PPM habitat.

Task 3 — Determine Habitat Area Requirements and Dispersal Distances

This task also was discontinued during Phase I, and we do not recommend funding at this time. However, genetic differences (using both mitochondrial and nuclear microsatellite DNA) should be evaluated for evidence of recent dispersal of individuals between extant sites (such as between San Mateo North and South).

Task 4 — Develop a Translocation Protocol for PPM

replace w/ insert B

This task is a very high priority. It was put on hold after Phase I, pending results of Phase II and III studies. Based on the significant new information that we have accrued over the past three years, we now recommend completing Task 4 as originally scoped. We believe we now have sufficient information to develop at least a framework protocol that addresses many pertinent aspects of a translocation effort, including host site selection, habitat manipulation and management, selection and capture of individuals, genetic considerations, timing of translocations, and methods for releasing and monitoring animals. The framework plan will also identify any remaining information gaps or details that need to be worked out prior to an actual translocation attempt. The framework will thus serve as a foundation for developing a translocation implementation plan in the near future (one to three years) as the remaining information gaps are filled. Phase IV tasks recommended herein are designed to fill many of these gaps. We therefore also believe it important to ~~initiate population modeling to investigate, for example, the optimal~~ allocation of translocated individuals among sex-age classes to (1) maximize growth potential in the new population, while (2) minimizing adverse effects on the donor population. ~~We endorse bringing in additional population modeling expertise from universities to assist with this effort.~~

consider

Task 5 — Continued Evaluation of Potential Translocation Receiver Sites

This task remains a very high priority. During 2001, the wildlife agencies are providing sufficient funding (using Section 6 monies to Dodd and Montgomery) to complete the detailed field evaluation of potential translocation receiver sites. We propose to continue providing scientific overview, coordination, and reporting of these efforts.

Task 6 — Laboratory Surrogate Studies

This task has become a low priority now that (1) a preferred PPM marking technique (toe clipping) has been recommended, and (2) captive breeding is considered an unlikely PPM recovery tool. We therefore recommend terminating this task. However, in the event that funding is found to develop a miniaturized PIT tag, the laboratory population of *P. l. longimembris* could be used to test the devices. In the meantime, this population is being used for taxonomic studies at the San Diego Natural History Museum, funded by USFWS.

Task 7 — Field Surrogate Studies

This task has basically been completed and has become low priority for refunding. Data collected to date at the Snow Creek study site have helped us refine field methods and have provided insights on the biology of little pocket mice; however, it is unclear how well the biological data apply to PPM. We therefore recommend not continuing the field marking and demographic studies on this surrogate population, except perhaps as part of a surrogate translocation experiment, as described in Task 9, below.

Task 8 — Meetings and Continued Coordination with Other Studies

Continued coordination between other pertinent studies, the TCA, and the wildlife agencies remains a high priority. We recommend continuing this task at a similar level as during Phases II and III. The study team will continue coordinating with studies being performed on PPM genetics (Patton), habitat management (Dodd and Montgomery), and population monitoring and habitat relationships (USFWS, Marine Corp Base Camp Pendleton, various consultants). We also recommend

intensifying coordination with those having land use authority over the high-potential translocation receiver sites (e.g., Center for Natural Lands Management, California State Parks Department, National Park Service, U.S. Navy, and U.S. Marine Corps).

Task 9 — Perform a Translocation Experiment

This task is a very high priority, and is considered critical by the USFWS before a translocation protocol can be finalized (see Task 4). The team would design and implement a translocation experiment or trials, either using a surrogate subspecies (probably *P. l. bangsi* at the Snow Creek study site) or using PPM individuals salvaged prior to take of their habitat on Camp Pendleton. We would design the experiment for use on the surrogate, but also to apply for use on salvaged PPM if a salvage operation becomes necessary for reasons beyond our control.

The goal of the experiment would be to test and refine specific tools and techniques to be used for an actual PPM translocation, including the size, shape, and duration of enclosures and design of artificial burrows and supplemental feeders within the enclosures. J. Diffendorfer and W. Longland (two of the scientific peer reviewers) have drafted a protocol for a surrogate translocation experiment at Snow Creek (Appendix E). This design was to test, in a statistically rigorous manner, two sizes and shapes of enclosure, and two enclosure durations, over a two-year period. Unfortunately this design would be very expensive to implement as designed. We therefore suggest discussing ways to reduce these costs, such as testing only one size of enclosure, ~~reducing the duration or intensity of follow-up monitoring, or reducing the number of replicates (and thereby statistical rigor).~~

ASSOCIATED TASKS NOT FUNDED BY TCA

One of the advantages that the PPM studies program has enjoyed to date is open communication and coordination with other agencies and researchers with related goals. Results of studies being performed by the USFWS and academic researchers, as well as surveys being performed by biological consultants, have helped inform our work, and vice versa. In this spirit, we offer the following recommendations for other ongoing work.

Population Monitoring and Research at Extant PPM Sites

several peer reviewers stated strongly that detailed demographic monitoring was an extremely high priority and perhaps the most worthwhile task for ~~the immediate~~ furthering PPM recovery efforts.

Oscar One/Edson Range — We recommend implementing a long-term population monitoring study at this largest of the extant populations, beginning in Spring 2001 – if possible, prior to emergence of young-of-the-year. At first, individuals should be toe clipped; however, PIT tagging should be instituted if and when a smaller PIT tag becomes available. The primary goal of the study should be to measure demographic parameters and build life tables necessary for assessing population viability and potential effects on the population of removing individuals from different sex-age classes (to serve as translocation donors). The study could also supplement existing information on PPM natural history, including habitat selection, space-use patterns, and food preferences.

San Mateo South — This site has been the least studied of the extant sites, and the current distribution and abundance of the population is poorly documented. This site also appears to have the greatest potential for natural expansion into adjacent habitat areas, perhaps aided by habitat management. We therefore recommend implementing an intensive trapping program, coupled with detailed analyses and mapping of soils and vegetation, in and near the occupied PPM area. Provided

that soils analyses substantiate our impression that suitable soils exist beyond the currently occupied area, experimental vegetation thinning, using either controlled burns or hand thinning, should be instituted to try to expand the population and improve its viability. The distribution and abundance of the population should also be monitored (again, marking individuals by toe clipping or with miniaturized PIT tags) before and after such experiments.

San Mateo North — Monitoring and controlled burning to expand this population are already being instituted by [redacted] Results of monitoring [redacted] should be used to determine whether additional thinning or controlled burning should be instituted to further increase the population, although this population is highly spatially constrained [redacted]

Dana Point — Monitoring and hand thinning to expand this population are already being instituted **using Section 6 funds**. Results of monitoring during 2001 should be used to determine whether additional thinning or controlled burns should be instituted to further increase the population onsite.

Population Modeling

The prospect of using translocations to help recover the PPM is appearing more likely. It is critical to design of a translocation program that we better understand the likely effects of translocating individuals on the viability of the donor population, as well as on the viability of any newly established populations. In our Phase I report we suggested that donor animals should be young-of-the-year, captured during late summer (during the peak dispersal season), to avoid undue harm to donor populations. However, scientific peer comments suggested that donors should include adults during peak reproduction, to maximize reproductive potential in the new population. These partially competing concerns (avoid harm to donor populations while maximizing successful establishment of receiver populations) suggest that a population modeling approach is necessary to determine the optimal allocation of donor individuals by sex and age class and by season. The goal should be to allocate translocated individuals to maximize the probability of successfully establishing new populations, while minimizing adverse effects on the donor population(s). We therefore recommend involving persons with population modeling expertise to assist in this effort. ~~Preliminary design of the modeling effort could begin immediately, although~~ However, designing and parameterizing the models ~~must~~ should await at least second-year results of demographic studies at extant PPM sites (see above).

Expanded Habitat Management Experiments

Preliminary results of the Dana Point habitat thinning experiment are very promising. As a part of species recovery efforts it is imperative that extant PPM populations be increased and expanded, if possible. This would serve to increase viability of the extant populations and grow them to where they can afford to donate individuals to establish new populations. A controlled burn (about 3-4 acres) was recently (January 2001) instituted by **Marine Corps Base Camp Pendleton (in cooperation with California State Parks and other cooperators)** at the San Mateo North site, in dense scrub adjacent to the more open, occupied, habitat area. Effects are to be monitored at least through 2001. We recommend continuing the monitoring at least through 2002, and, as discussed above, we recommend similar habitat management and monitoring efforts at the Dana Point and San Mateo South sites.

Continued Genetics Studies

Results of the genetics work to date have been extremely informative. We recommend expanding the samples for the Oscar One and San Mateo populations, to permit better estimates of within-population genetic diversity and gene flow between extant sites (e.g., between San Mateo North and San Mateo South sites). Increased samples were made available during summer 2000, and are currently being analyzed. Genomic microsatellite libraries and primers are currently being constructed to facilitate more precise analyses of population structure within and between extant PPM populations, and to serve as monitoring tools. Unfortunately, Dr. James Patton is retiring during this year, and may no longer be available to assist the PPM studies team.

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APPENDIX A
SOIL TYPES IN ORANGE AND SAN DIEGO COUNTIES, RATED FOR POTENTIAL TO SUPPORT PACIFIC POCKET MICE

SAN DIEGO COUNTY SOILS

DESCRIPTION	COMMENTS	ACRES	RANK
Bonsall sandy loam, 2 to 9 percent slopes		35.31	HIGH
Bonsall sandy loam, 2 to 9 percent slopes, eroded		194.37	HIGH
Bonsall sandy loam, 9 to 15 percent slopes, eroded		26.3	HIGH
Chesterton fine sandy loam, 2 to 5 percent slopes	Deep w/ Marina & Hueruero inclusions	3,461.00	VERY HIGH
Chesterton fine sandy loam, 5 to 9 percent slopes	Deep w/ Marina & Hueruero inclusions	1,986.07	VERY HIGH
Chesterton fine sandy loam, 9 to 15 percent slopes, eroded		615.51	HIGH
Chesterton-Urban land complex, 2 to 9 percent slopes		4,772.10	NONE
Fallbrook rocky sandy loam, 9 to 30 percent slopes, eroded		113.91	LOW
Fallbrook sandy loam, 5 to 9 percent slopes, eroded		21.29	LOW
Greenfield sandy loam, 0 to 2 percent slopes	Sands not fine enough for very high?	403.62	HIGH
Greenfield sandy loam, 2 to 5 percent slopes	Sands not fine enough for very high?	194.77	HIGH
Greenfield sandy loam, 5 to 9 percent slopes	Sands not fine enough for very high?	48.4	HIGH
Huerhuero loam, 15 to 30 percent slopes, eroded		6,077.35	LOW
Huerhuero loam, 2 to 9 percent slopes		9,017.03	LOW
Huerhuero loam, 5 to 9 percent slopes, eroded		2,301.19	LOW
Huerhuero loam, 9 to 15 percent slopes		1,708.40	LOW
Huerhuero loam, 9 to 15 percent slopes, eroded		1,662.48	LOW
Huerhuero-Urban land complex, 2 to 9 percent slopes		12,294.72	NONE
Huerhuero-Urban land complex, 9 to 30 percent slopes		2,825.42	NONE
Las Flores loamy fine sand, 15 to 30 percent slopes	Weathered sandstone; SMNorth PPM site	3,286.45	VERY HIGH
Las Flores loamy fine sand, 15 to 30 percent slopes, eroded	Weathered sandstone; SMNorth PPM site	2,502.61	VERY HIGH
Las Flores loamy fine sand, 2 to 9 percent slopes	Weathered sandstone; SMNorth PPM site	1,629.50	VERY HIGH
Las Flores loamy fine sand, 5 to 9 percent slopes	Weathered sandstone; SMNorth PPM site	2,101.97	VERY HIGH
Las Flores loamy fine sand, 9 to 15 percent slopes	Weathered sandstone; SMNorth PPM site	1,611.71	VERY HIGH
Las Flores loamy fine sand, 9 to 15 percent slopes, eroded	Weathered sandstone; SMNorth PPM site	2,649.88	VERY HIGH
Las Flores loamy fine sand, 9 to 30 percent slopes, severely eroded		1,555.44	HIGH
Las Flores-Urban land complex, 2 to 9 percent slopes		680.4	NONE
Las Flores-Urban land complex, 9 to 30 percent slopes		564.07	NONE
Las Posas fine sandy loam, 5 to 9 percent slopes		33.27	LOW
Las Posas stony fine sandy loam, 30 to 65 percent slopes	Stoney	55.11	LOW
Las Posas stony fine sandy loam, 9 to 15 percent slopes	Stoney	21.73	LOW
Loamy alluvial land-Huerhuero complex, 9 to 50 percent slopes, severely eroded		6,157.22	LOW

Olivenhain cobbly loam, 2 to 9 percent slopes	Cobbly	1,814.05	LOW
Olivenhain cobbly loam, 30 to 50 percent slopes	Cobbly	3,469.01	LOW
Olivenhain cobbly loam, 9 to 30 percent slopes	Cobbly	3,851.91	LOW
Olivenhain-Urban land complex, 2 to 9 percent slopes		1,102.13	NONE
Olivenhain-Urban land complex, 9 to 30 percent slopes		1,282.54	NONE
Placentia sandy loam, thick surface, 2 to 9 percent slopes	Sandy clay subsoil	95.74	HIGH
Ramona gravelly sandy loam, 15 to 30 percent slopes	Gravelly	44.42	HIGH
Ramona sandy loam, 2 to 5 percent slopes	deep A horizon; 15-20% gravel; includes sandy loams	306.87	HIGH
Ramona sandy loam, 5 to 9 percent slopes		69.17	HIGH
Ramona sandy loam, 9 to 15 percent slopes, eroded		17.41	HIGH
Redding cobbly loam, 9 to 30 percent slopes		719.51	LOW
Redding cobbly loam, dissected, 15 to 30 percent slopes		323.49	LOW
Redding gravelly loam, 2 to 9 percent slopes		2,211.88	LOW
Redding-Urban land complex, 2 to 9 percent slopes		1,932.91	NONE
Redding-Urban land complex, 9 to 30 percent slopes		126.45	NONE
San Miguel rocky silt loam, 9 to 30 percent slopes		302.63	LOW
San Miguel-Exchequer rocky silt loams, 9 to 70 percent slopes		706.11	LOW
Anderson very gravelly sandy loam, 9 to 45 percent slopes		19.83	NONE
Cieneba coarse sandy loam, 15 to 30 percent slopes, eroded		260.29	HIGH
Cieneba coarse sandy loam, 30 to 65 percent slopes, eroded		204.15	HIGH
Cieneba coarse sandy loam, 5 to 15 percent slopes, eroded		298.82	HIGH
Cieneba rocky coarse sandy loam, 9 to 30 percent slopes, eroded		40.73	HIGH
Cieneba very rocky coarse sandy loam, 30 to 75 percent slopes		131.62	HIGH
Cieneba-Fallbrook rocky sandy loam,9 to 30 percent slope,eroded		438.37	HIGH
Cieneba-Fallbrook rocky sandy loams, 30 to 65 percent slopes, eroded		147.7	HIGH
Corralitos loamy sand, 0 to 5 percent slopes	Very deep alluvium derived from sandstone; Manchester	1,550.95	VERY HIGH
Corralitos loamy sand, 5 to 9 percent slopes	Very deep alluvium derived from sandstone; Manchester	2,752.65	VERY HIGH
Corralitos loamy sand, 9 to 15 percent slopes	Very deep alluvium derived from sandstone; Manchester	1,955.97	VERY HIGH
Exchequer rocky silt loam, 30 to 70 percent slopes		383.27	HIGH
Exchequer rocky silt loam, 9 to 30 percent slopes	A = 10 in.; includes silt and fine sandy loams	677.74	HIGH
Gaviota fine sandy loam, 30 to 50 percent slopes	SMNorth, SMSouth, Oscar One	12,026.48	VERY HIGH
Gaviota fine sandy loam, 9 to 30 percent slopes	SMNorth, SMSouth, Oscar One	1,596.74	VERY HIGH
Marina loamy coarse sand, 2 to 9 percent slopes	Sands too coarse for very high?	13,172.82	HIGH
Marina loamy coarse sand, 9 to 30 percent slopes	Sands too coarse for very high?	2,019.33	HIGH
Reiff fine sandy loam, 0 to 2 percent slopes	Alluvial, tends to sandy loam/loam	162.78	HIGH

Reiff fine sandy loam, 2 to 5 percent slopes	Alluvial, tends to sandy loam/loam	625.63	HIGH
Reiff fine sandy loam, 5 to 9 percent slopes	Alluvial, tends to sandy loam/loam	388.61	HIGH
Tujunga sand, 0 to 5 percent slopes		5,558.44	HIGH
Carlsbad gravelly loamy sand, 15 to 30 percent slopes		427.97	HIGH
Carlsbad gravelly loamy sand, 2 to 5 percent slopes		1,568.27	HIGH
Carlsbad gravelly loamy sand, 5 to 9 percent slopes		2,511.02	HIGH
Carlsbad gravelly loamy sand, 9 to 15 percent slopes		801.57	HIGH
Carlsbad-Urban land complex, 2 to 9 percent slopes		1,344.84	NONE
Carlsbad-Urban land complex, 9 to 30 percent slopes		573.4	NONE
Escondido very fine sandy loam, 15 to 30 percent slopes, eroded		15.74	HIGH
Vista coarse sandy loam, 30 to 65 percent slopes	Too coarse for very high?	4.22	HIGH
Vista coarse sandy loam, 5 to 9 percent slopes	Too coarse for very high?	84.35	HIGH
Vista coarse sandy loam, 9 to 15 percent slopes	Too coarse for very high?	49.56	HIGH
Vista coarse sandy loam, 9 to 15 percent slopes, eroded	Too coarse for very high?	0.3	HIGH
Chino fine sandy loam, 0 to 2 percent slopes	Hard below 7 inches.	190.58	HIGH
Chino silt loam, saline, 0 to 2 percent slopes	includes sandy loams	3,859.74	HIGH
Elder shaly fine sandy loam, 2 to 9 percent slopes		1,330.40	HIGH
Friant rocky fine sandy loam, 30 to 70 percent slopes	Rocky, shallow mountain soils	11.66	HIGH
Friant rocky fine sandy loam, 9 to 30 percent slopes	Rocky, shallow mountain soils	330.43	HIGH
Grangeville fine sandy loam, 0 to 2 percent slopes		1,449.37	HIGH
Hambright gravelly clay loam, 30 to 75 percent slopes		9,906.12	NONE
La Posta rocky loamy coarse sand, 5 to 30 percent slopes, eroded		283.74	HIGH
Linne clay loam, 30 to 50 percent slopes		2,956.61	NONE
Linne clay loam, 9 to 30 percent slopes		1,483.92	NONE
Salinas clay loam, 0 to 2 percent slopes		1,030.13	NONE
Salinas clay loam, 2 to 9 percent slopes		5,282.15	NONE
Salinas clay, 0 to 2 percent slopes		900.47	NONE
Salinas clay, 2 to 5 percent slopes		784.63	NONE
Visalia gravelly sandy loam, 2 to 5 percent slopes		449.43	HIGH
Visalia gravelly sandy loam, 5 to 9 percent slopes		193.47	HIGH
Visalia sandy loam, 0 to 2 percent slopes	Too coarse for very high?	1,298.57	HIGH
Visalia sandy loam, 2 to 5 percent slopes	Too coarse for very high?	1,600.04	HIGH
Visalia sandy loam, 5 to 9 percent slopes	Too coarse for very high?	309.8	HIGH
Visalia sandy loam, 9 to 15 percent slopes	Too coarse for very high?	98.35	HIGH
Coastal beaches		3,367.75	NONE
GRAVEL PIT		2,385.07	NONE
Made land		896	NONE
Mine and quarry		5,451.12	NONE
Riverwash		276.43	NONE
		3,235.00	LOW

Rough broken land		1,965.87	LOW
Steep gullied land		646.43	LOW
Stony land	consists of many stones, cobbles, and boulders	690.73	NONE
Terrace escarpments		14,046.02	LOW
Tidal flats		3,155.81	NONE
Unclassified area due to both yearly or perennial water accumulation		74.11	NONE
Urban land		18,788.10	NONE
Altamont clay, 15 to 30 percent slopes		1,876.21	NONE
Altamont clay, 15 to 30 percent slopes, eroded		1,063.89	NONE
Altamont clay, 30 to 50 percent slopes		3,897.32	NONE
Altamont clay, 5 to 9 percent slopes		1,328.17	NONE
Altamont clay, 9 to 15 percent slopes		1,313.03	NONE
Altamont clay, 9 to 15 percent slopes, eroded		300.67	NONE
Auld clay, 5 to 9 percent slopes		36.14	NONE
Auld clay, 9 to 15 percent slopes		5.92	NONE
Diablo clay, 15 to 30 percent slopes		1,060.27	NONE
Diablo clay, 15 to 30 percent slopes		1,633.56	NONE
Diablo clay, 2 to 9 percent slopes		860.4	NONE
Diablo clay, 30 to 50 percent slopes		1,384.99	NONE
Diablo clay, 9 to 15 percent slopes		1,660.63	NONE
Diablo-Olivenhain complex, 9 to 30 percent slopes		121.19	NONE
Diablo-Urban land complex, 15 to 50 percent slopes		471.44	NONE
Diablo-Urban land complex, 5 to 15 percent slopes		926.84	NONE
WATER		787.13	NONE

ORANGE COUNTY SOILS

MAP UNIT NAME	COMMENTS	ACRES	RANK
ALO CLAY, 15 TO 30 PERCENT SLOPES		4,458.41	NONE
ALO CLAY, 30 TO 50 PERCENT SLOPES		5,707.02	NONE
ALO CLAY, 9 TO 15 PERCENT SLOPES		2,085.01	NONE
ALO VARIANT CLAY, 15 TO 30 PERCENT SLOPES		8.86	NONE
ALO VARIANT CLAY, 30 TO 50 PERCENT SLOPES		39.08	NONE
ALO VARIANT CLAY, 9 TO 15 PERCENT SLOPES		40.18	NONE
ANAHEIM CLAY LOAM, 15 TO 30 PERCENT SLOPES		281.52	NONE
ANAHEIM CLAY LOAM, 30 TO 50 PERCENT SLOPES		820.12	NONE
ANAHEIM CLAY LOAM, 50 TO 75 PERCENT SLOPES		510.11	NONE
ANAHEIM LOAM, 15 TO 30 PERCENT SLOPES		552.86	LOW
ANAHEIM LOAM, 30 TO 50 PERCENT SLOPES		831.29	LOW
BALCOM CLAY LOAM, 15 TO 30 PERCENT SLOPES		481.47	NONE
BALCOM CLAY LOAM, 30 TO 50 PERCENT SLOPES		765.39	NONE
BALCOM CLAY LOAM, 9 TO 15 PERCENT SLOPES		57.28	NONE
BALCOM-ROCK OUTCROP COMPLEX, 15 TO 50 PERCENT SLOPES		214.43	NONE
BEACHES		4,533.75	NONE
BLASINGAME STONY LOAM, 30 TO 65 PERCENT SLOPES	A = 5"; clay subsoil	55.79	NONE
BOLSA SILT LOAM		944.22	LOW
BOLSA SILT LOAM, DRAINED		9,875.66	LOW
BOLSA SILTY CLAY LOAM		925.88	NONE
BOLSA SILTY CLAY LOAM, DRAINED		4,711.85	NONE
BOSANKO CLAY, 15 TO 30 PERCENT SLOPES		2,084.08	NONE
BOSANKO CLAY, 30 TO 50 PERCENT SLOPES		1,492.97	NONE
BOSANKO CLAY, 9 TO 15 PERCENT SLOPES		918.12	NONE
BOSANKO-BALCOM COMPLEX, 15 TO 30 PERCENT SLOPES		507.79	NONE
BOSANKO-BALCOM COMPLEX, 30 TO 50 PERCENT SLOPES		316.03	NONE
BOTELLA CLAY LOAM, 2 TO 9 PERCENT SLOPES		593.94	NONE
BOTELLA CLAY LOAM, 9 TO 15 PERCENT SLOPES		673.73	NONE
BOTELLA LOAM, 2 TO 9 PERCENT SLOPES		378.87	LOW
CALLEGUAS CLAY LOAM, 50 TO 75 PERCENT SLOPES, ERODED		10,431.56	NONE
CAPISTRANO SANDY LOAM, 2 TO 9 PERCENT SLOPES		1,082.18	HIGH
CAPISTRANO SANDY LOAM, 9 TO 15 PERCENT SLOPES		412.07	HIGH
CHESTERTON LOAM SAND, 15 TO 30 PERCENT SLOPES		99.4	HIGH

CHESTERTON LOAMY SAND, 2 TO 15 PERCENT SLOPES		320.9	HIGH
CHINO SILTY CLAY LOAM		270.05	NONE
CHINO SILTY CLAY LOAM, DRAINED		90.18	NONE
CIENEBA SANDY LOAM, 15 TO 30 PERCENT SLOPES		751.64	HIGH
CIENEBA SANDY LOAM, 30 TO 75 PERCENT SLOPES, ERODED		3,341.07	HIGH
CIENEBA-BLASINGAME-ROCK OUTCROP COMPLEX, 9 TO 30 PERCENT SLOPES		2.32	HIGH
CIENEBA-ROCK OUTCROP COMPLEX, 30 TO 75 PERCENT SLOPES		6,583.70	HIGH
CORRALITOS LOAMY SAND		356.49	VERY HIGH
CORRALITOS LOAMY SAND, MODERATELY FINE SUBSTRATUM		239.33	VERY HIGH
CROPLEY CLAY, 0 TO 2 PERCENT SLOPES		67.22	NONE
CROPLEY CLAY, 2 TO 9 PERCENT SLOPES		2,986.71	NONE
GABINO GRAVELLY CLAY LOAM, 15 TO 50 PERCENT SLOPES		24.53	NONE
HUENEME FINE SANDY LOAM	ALLUVIAL FANS, VALLEYS	493.24	VERY HIGH
HUENEME FINE SANDY LOAM, DRAINED	ALLUVIAL FANS, VALLEYS	6,647.57	VERY HIGH
MARINA LOAMY SAND, 0 TO 2 PERCENT SLOPES	DANA PT, EOLIAN	554	VERY HIGH
MARINA LOAMY SAND, 2 TO 9 PERCENT SLOPES	DANA PT, EOLIAN	4,371.95	VERY HIGH
METZ LOAMY SAND	FINE ALLUVIUM	707.99	VERY HIGH
METZ LOAMY SAND, MODERATELY FINE SUBSTRATUM	FINE ALLUVIUM	751.02	VERY HIGH
MOCHO LOAM, 0 TO 2 PERCENT SLOPES		266.55	LOW
MOCHO LOAM, 2 TO 9 PERCENT SLOPES		70.88	LOW
MOCHO SANDY LOAM, 0 TO 2 PERCENT SLOPES		44.8	HIGH
MODJESKA GRAVELLY LOAM, 15 TO 30 PERCENT SLOPES		169.43	LOW
MODJESKA GRAVELLY LOAM, 9 TO 15 PERCENT SLOPES		265.43	LOW
MYFORD SANDY LOAM, 0 TO 2 PERCENT SLOPES	CLAY IN B HORIZON	2,852.58	HIGH
MYFORD SANDY LOAM, 15 TO 30 PERCENT SLOPES	CLAY IN B HORIZON	509.19	HIGH
MYFORD SANDY LOAM, 2 TO 9 PERCENT SLOPES	CLAY IN B HORIZON	6,117.56	HIGH
MYFORD SANDY LOAM, 2 TO 9 PERCENT SLOPES, ERODED	CLAY IN B HORIZON	1,213.70	HIGH
MYFORD SANDY LOAM, 9 TO 15 PERCENT SLOPES	CLAY IN B HORIZON	2,123.07	HIGH
MYFORD SANDY LOAM, 9 TO 30 PERCENT SLOPES, ERODED	CLAY IN B HORIZON	1,779.36	HIGH
MYFORD SANDY LOAM, THICK SURFACE, 0 TO 2 PERCENT SLOPES	CLAY IN B HORIZON	1,884.76	HIGH
MYFORD SANDY LOAM, THICK SURFACE, 2 TO 9 PERCENT SLOPES	CLAY IN B HORIZON	1,162.61	HIGH
OMNI CLAY, DRAINED		1,318.91	NONE
OMNI SILT LOAM, DRAINED	Moist; poorly drained	308.32	NONE
PITS		377.83	NONE
RIVERWASH		881.95	LOW

ROCK OUTCROP-CIENEBA COMPLEX, 30 TO 75 PERCENT SLOPES		1,244.17	LOW
SAN ANDREAS SANDY LOAM, 15 TO 30 PERCENT SLOPES		443.09	HIGH
SAN EMIGDIO FINE SANDY LOAM, 0 TO 2 PERCENT SLOPES		78.31	HIGH
SAN EMIGDIO FINE SANDY LOAM, 2 TO 9 PERCENT SLOPES		14.23	HIGH
SAN EMIGDIO FINE SANDY LOAM, MODERATELY FINE SUBSTRATUM, 0 TO 2 PERCENT SLOPES		87.12	HIGH
SOBOBA COBBLY LOAMY SAND, 0 TO 15 PERCENT SLOPES		27.88	LOW
SOBOBA GRAVELLY LOAMY SAND, 0 TO 5 PERCENT SLOPES	A = 10" over very gravelly material	155.83	LOW
SOPER COBBLY LOAM, 15 TO 50 PERCENT SLOPES		17.72	LOW
SOPER GRAVELLY LOAM, 15 TO 30 PERCENT SLOPES		572.27	LOW
SOPER GRAVELLY LOAM, 30 TO 50 PERCENT SLOPES		1,828.21	LOW
SOPER LOAM, 15 TO 30 PERCENT SLOPES		9.08	LOW
SOPER LOAM, 30 TO 50 PERCENT SLOPES		10.29	LOW
SOPER-ROCK OUTCROP COMPLEX, 30 TO 75 PERCENT SLOPES	A = shallow	738.77	NONE
SORRENTO CLAY LOAM, 0 TO 2 PERCENT SLOPES		380.67	NONE
SORRENTO CLAY LOAM, 2 TO 9 PERCENT SLOPES		1,284.09	NONE
SORRENTO LOAM, 0 TO 2 PERCENT SLOPES		573.35	LOW
SORRENTO LOAM, 2 TO 9 PERCENT SLOPES		1,186.68	LOW
SORRENTO SANDY LOAM, 0 TO 2 PERCENT SLOPES		17.8	HIGH
THAPTO-HISTIC FLUVAQUENTS		92.34	NONE
TIDAL FLATS		3,043.04	NONE
WATER		2,301.80	NONE
XERALFIC ARENTS, LOAMY, 2 TO 9 PERCENT SLOPES		951.97	NONE
XERALFIC ARENTS, LOAMY, 9 TO 15 PERCENT SLOPES		203.39	NONE
XERORTHENTS LOAMY, CUT AND FILL AREAS, 15 TO 30 PERCENT SLOPES		331.78	NONE
XERORTHENTS LOAMY, CUT AND FILL AREAS, 9 TO 15 PERCENT SLOPES		230.71	NONE
YORBA COBBLY SANDY LOAM, 30 TO 50 PERCENT SLOPES		451.26	LOW
YORBA COBBLY SANDY LOAM, 9 TO 30 PERCENT SLOPES		120.07	LOW
YORBA COBBLY SANDY LOAM, 9 TO 30 PERCENT SLOPES, ERODED	A = 11"	310.26	LOW
YORBA GRAVELLY SANDY LOAM, 15 TO 30 PERCENT SLOPES		117.96	LOW
YORBA GRAVELLY SANDY LOAM, 2 TO 9 PERCENT SLOPES		168.65	LOW
YORBA GRAVELLY SANDY LOAM, 9 TO 15 PERCENT SLOPES	A = 11"	190.87	LOW

APPENDIX B
DATA SHEET FOR RAPID EVALUATION OF POTENTIAL PPM TRANSLOCATION RECEIVER SITES

Potential Receiver Site Data Sheet

Date _____ Observers _____ Page __1__ of _____

Site Location _____ County _____

Habitat

1) Location _____

Habitat Type _____

Shrub Layer (0-100% cover) 0 1 2 3 4 5 6 7 8 9 10 (| indicates overall ave.)

Dom. Species _____

Comments (exotics?)_____

Herb Layer (0-100% cover) 0 1 2 3 4 5 6 7 8 9 10 (| indicates overall ave.)

Dom. Species _____

Comments (exotics?)_____

Ground surface cover: Open Ground (0-100%) 0 1 2 3 4 5 6 7 8 9 10

Detritus (wood/leaf litter)0 1 2 3 4 5 6 7 8 9 10; Pebble/Cobble/Rock 0 1 2 3 4 5 6 7 8 9 10

Comments_____

Soil Conditions (sand/loam/clay) (compact/loosely packed) (depth?_____)

Comments_____

Slope, Topography _____

Surrounding Habitat and Land Use _____

Management Needs _____

Rating (prime/high/medium-high/medium-low/low)_____

Add'l Comments: (cats, ants?)_____

_____

APPENDIX C
SUMMARY RESULTS FOR POTENTIAL RECEIVER SITES NOT RATED IN THE TOP SEVEN

Appendix C. Summary Results for Potential Receiver Sites Not Rated Among the Top Seven

Areas/habitat rated	Rating	Comments
San Diego County		
	Calavera Heights	
1. CSS (eastern portion)	medium-low	dense vegetation, loamy (non-sandy) soils, far from coast
2. CSS, old burn, some Chaparral (western portion)	medium-low	dense vegetation, soils loose but not sandy
	Macario Canyon	
1. CSS & Chamise Chaparral	medium-low	good soils are very patchy, entire area is very patchy and disturbed by developments and migrant use
2. Ruderal, NNG (small patch)	medium-high to medium-low	small patch with loose/sandy soil, but lots of past and present disturbance
	Del Mar Mesa	
1. CSS	high to medium-low	high and medium-high patches small and interspersed with mostly medium-low areas; higher rating because of fine-grain sands present; dense vegetation
2. Chamise Chaparral and SMC	medium-low	soils are sandy in areas but the habitat is mostly dense chaparral (small burn areas looks better)
	Fieldstone/La Costa	
1. CSS to Chaparral	low	compact loam soil, moderate to steep topography, inappropriate habitat (little *Artemisia* and *Eriogonum*)
	Lawrence/Benet/Tuley Canyons	
1. CSS and Mule-fat scrub (SE I5 and Hwy 76)	medium-low	lots of substrate disturbance and high human activity, lots of trash and dumping, only small patches of sandy soils in bottom of canyon
2. CSS (Benet Cyn, W of Prince of Peace facility)	low	very steep, dense vegetation, no obvious sandy areas
3. CSS and NNG (N of river)	low	mostly loamy/clay compact soils, moderate to steep topography
	U. S. Navy Lands in Coronado	
1. Disturbed Grassland and Ruderal (N of antenna area)	medium-low	soil loose but entire area is dominated by exotics, disturbed ruderal lands
2. Dune habitat (W of antenna and north in State Park Beach)	medium-high to low	good sandy dune soil (too loose, salty?), some human disturbance, iceplant dominant, few sage scrub species
3. Wetland (SW of antenna and E side of strand road)	low	*Salicornia* sp. dominant species, compact clay soils, soils saturated
4. Disturbed Grassland (S of antenna)	low	soils loamy and compact, dense exotic herb ground cover
5. CSS and Disturbed Grassland (NW of Saturn Blvd/Palm Ave)	high to medium-high	loose loamy/sandy soils, sparse shrub cover, gopher diggings, imported soils?
6. Disturbed Grassland (E of strand, N of Coronado Cays)	medium-low	filled soils (from dredging SD Bay), variable in texture, exotic species dominant
	Dawson/Los Monos Reserve	
1. Chamise Chaparral and some SMC	medium-low	soils not sandy, mostly loams and decomposed granite, dense chaparral vegetation and woodland, poor access, large parcel to be developed?

No. of areas/types of habitat rated	Rating	Comments
Orange County		
	Bolsa Chica Ecological Reserve	
1. NNG and Ruderal (N of Lagoon)	low	loamy compact soils, dense exotic cover
	Crystal Cove State Park	
1. CSS and NNG (most of State Park), plus areas of *Carpobrotus*	medium-low to low	loamy/clay and compact soil, open to dense vegetation, evidence of old disturbances
2. CSS and NNG	medium-high	small patches of loose sandy/loamy soils, lots of squirrel and gopher activity
	Laguna Canyon Area	
1. CSS and NNG (broad ridge near N end of study area)	medium-high to medium-low	Dense herb cover, dense shrubs in areas, relatively good soil - could use more sand component
2. NNG (patch on Water Tank Rd)	medium-high to medium-low	Small area, sandier on north side of road, dense non-native herb cover
	San Joaquin Hills Area	
1. CSS and NNG (ridge south of Toll Road and patch in north)	medium-high patches medium-low overall	Better soils on sandstone caps, road berms, small patches, dense vegetation
2. NNG w/ sparse shrub cover (north of Toll Road)	Medium-high	Soils could be sandier, good open habitat, lots of non-natives
	Upper Newport Bay	
1. CSS patches, NNG, Ruderal (N side of bay)	low	loamy/clay soil, dense vegetation (scrub and exotic herbs), lots of human presence/disturbance
2. NNG (E of Hwy 73)	medium-low	sandy and loamy soils (not very loose), dense exotic herb layer, very disturbed

APPENDIX D
SUMMARY DATA ON *PEROGNATHUS LONGIMEMBRIS BANGSI* CAPTURES ON THE SNOW CREEK STUDY GRIDS, 1999

Summer 2000 Capture Data

GRID A							Morning	
Animal	Mark	Recap?	Age	Sex	1	2	3	4
1	T2100	NO	SA	F	A3	B3	A1	**
2	T4300	NO	SA	M	A5	**	**	A5
3	T3100	NO	SA	M	B7	**	A9	**
4	T4200	NO	SA	M	A7	A7	A7	B6
5	T3200	NO	SA	M	A14	**	A14	A14
6	T0004	99/00	A	F	A13	**	**	**
7	T3300	NO	SA	M	C10	**	**	**
8	T3400	NO	SA	F	C8	C9	C9	C8
9	T0330	99/00	A	F	D5	D5	D5	**
10	T4400	NO	A	F	C1	B1	C1	**
11	T0233	NO	SA	F	D2	D2	D2	**
12	T0111	NO	SA	M	E3	F4	E3	E4
13	T0112	NO	SA	M	F9	**	G8	H8
14	T0113	NO	SA/A	F	F9	F9	F9	E8
15	T0114	NO	SA	F	F13	F12	G12	G12
16	T0121	NO	J	?	G14	**	**	**
17	T0122	NO	SA/A	M	H13	H14	H14	H14
18	T0133	NO	SA	M	H12	**	**	I11
19	T0131	NO	SA	M	G10	G9	G9	G10
20	T0311	NO	SA	M	H4	**	**	**
21	T1011	NO	SA/A	M	G6	G4	**	**
22	T0031	2000	A	F	I1	**	**	**
23	T0123	NO	SA	M	J7	J7	J6	**
24	T1014	NO	SA/A	F	I8	I9	I9	I9
25	T0124	NO	SA	M	L12	L12	L12	L12
26	T0132	NO	SA	F	L9	K10	J10	**
27	T0100	YES	A	M	L7	**	**	**
					from Grid B or re-grown toe			
28	T1110	NO	SA/A	M	L2	N2	M2	**

GRID A						Morning		
Animal	Mark	Recap?	Age	Sex	1	2	3	4
29	T4011	NO	A	F	M1	**	N4	N3
30	T1012	NO	SA	M	N4	**	**	**
31	T4044	NO	J	F	M5	**	M5	**
32	T0321	NO	J	M	M9	**	**	**
33	T0134	NO	SA	M	N8	M12	N8	**
34	T0324	NO	SA	F	M11	**	**	**
35	T0322	NO	J	F	N13	**	**	N13
36	T1013	NO	SA	M	N14	N14	N14	**
37	T4032	NO	SA	M	**	A1	**	**
38	T4041	NO	SA	M	**	B2	A2	A3
39	T4021	NO	SA	M	**	B7	B7	**
40	T2042	NO	SA/A	M	**	A10	**	A10
41	T2023	NO	A	F	**	B12	B13	B11
42	T2031	NO	A	F	**	A13	A13	A11
43	T2012	NO	J	M	**	A14	**	**
44	T2013	NO	SA	F	**	C14	B14	B14
45	T2014	NO	SA	M	**	D12	**	D12
46	T4033	NO	J/SA	M	**	F1	E1	F2
47	T0002	NO?	A	F	**	F1	F2	F1
						natural mark, T2 all the way gone		
48	T4122	NO	?	?	**	E5	**	E6
49	T4034	NO	SA	F	**	F14	F7	G13
50	P03932 323	2000	A	F	**	G9	G10	G9
51	P039526 882	2000	A	F	**	H12	**	**
52	T4034	NO	SA	M	**	G6	**	**
53	T4042	NO	SA	M	**	G2	**	**
54	T0031	2000	A	F	**	J1	**	**
55	T4023	NO	A	M	**	I7	I7	**
56	T4042	NO	SA	M	**	I14	**	**
57	T4043	NO	SA	F	**	K14	**	J13

GRID A						Morning		
Animal	Mark	Recap?	Age	Sex	1	2	3	4
58	TOO34 to T2034	2000	A	F	**	L14 missed orig mark	L14	**
59	T2021	NO	SA	F	**	K12	**	**
60	T3024	NO	SA	F	**	L8	**	L9
61	T0142	NO	SA/A	M	**	K8	K7	**
62	T3011	NO	SA	M	**	L5	**	**
63	T2033	NO	SA/A	M	**	K6	L6	L5
64	T2024	NO	SA	F	**	L4	**	**
65	T3012	NO	SA	F	**	L4	L4	L4
66	T3043	NO	SA	M	**	K3	J2	**
67	T3042	NO	?	?	**	N1	**	**
68	T3041	NO	SA	F	**	N2	**	**
69	T3044	NO	SA	F	**	M5	**	**
70	P039553 278	2000	A	F	**	N5	**	**
71	T3034	NO	A	M	**	N6	**	**
72	T3033	NO	SA	F	**	N10	**	N10
73	T3032	NO	J/SA	M	**	N11	N13	**
74	T0023	2000	A	M	**	**	A9	B10
75	T0003 deformed t3	NO	SA	M	**	**	D14	**
76	T0421	NO	A	M	**	**	D11	B10
77	T4022	NO	?	?	**	**	E13	**
78	T0434	NO	SA	F	**	**	G14	**
79	T0442	NO	A	M	**	**	H14	**
80	P039526 882	2000	A	F	**	**	H11	J12
81	T0431	NO	J/SA	M	**	**	H1	I1
82	T0031	2000	A	F	**	**	J1	**
83	T0423	NO	A	M	**	**	I3	I3
84	T0443	NO	SA	M	**	**	J4	H4
85	T0432	NO	J	M	**	**	I11	**
86	T0413	NO	?	F	**	**	L7	**

GRID A							Morning	
Animal	Mark	Recap?	Age	Sex	1	2	3	4
87	T1010	99/00	A	M	**	**	K2	K2
88	T0343	NO	SA	M	**	**	K2	**
89	T0432	NO	A	M	**	**	M14	**
90	T1021	YES	SA	M	**	**	**	B4
							Moved from Grid B over 1 night	
91	T0320	1999	A	M	**	**	**	C3
92	T0232	NO	SA	M	**	**	**	F14
93	T2034	YES	SA/A	F	**	**	**	L14
							Moved from Grid B over 1 night	
94	T0244	NO	J	F	**	**	**	M5
95	T0242	NO	SA/A	F	**	**	**	M6
96	T0241	NO	SA	M	**	**	**	N7
97	T0234	NO	SA	M	**	**	**	N10

GRID B - Spring 2000 Capture Data

Animal #	Mark	99 Recap	Sex	Age	Morning 1	2	3	4	5
1	T1020	YES	M	A	A1	C2	A3	**	**
2	T0102	YES	F	A	B1	A1	**	**	**
3	P039283769	NO	M	A	B7	D7	C5	E6	C5
4	T0041	NO	M	A	A12	C14	**	**	**
5	T0042	NO	M	A	C8	B8	B8	F7	**
6	T0043	NO	F	A	E1	E1	F2	E1	C10
7	T0044	NO	M	A	F2	D2	A1	**	**
8	P039378628	NO	M	A	F2	**	F2	I3	G3
9	T1020	YES	F	A	F3	**	**	**	**
					ripped ear, no tail				
10	T4000	YES	F	A	F4	**	**	C5	D5
					ripped ear				
11	T0210	YES	M	A	G6	**	E6	**	**
12	T3000	YES	F	A	H9	D10	D10	E9	
13	T0201, E98	YES	M	A	J14	**	**	**	**
14	T0002	YES	M	A	K4	J5	**	**	**
15	T0$^{1}/_{3}$40	YES	M	A	L12	H14	**	H11	
					orig. 0100 or 0300?			3 toe swollen	
16	F7D31702F; T0C	YES	F	A	K12	K12	K12	K12	K12
	orig. T4010				front toe re-grown				
17	T0444	YES	M	A	N7	L10	M8	N5	M6
					orig. 0404				
18	T2020	YES	F	A	**	D8	**	C8	C8
19	T3002	YES	F	A	**	D1	**	**	E1
20	T4020	YES	F	A	**	F3	**	**	F3
						no tail			
21	P039513023	NO	M	A	**	N2	**	M5	**
22	T0204	NO	M	A	**	**	G13	D13	**
23	T1100	NO	F	A	**	**	J5	L3	**
24	T1300	NO	M	A	**	**	N12	N12	**
25	P039372100	NO	F	A	**	**	**	D4	I3
								orig. Grid A capture	
26	T2200	NO	M	A	**	**	**	G2	H1
									mangled front feet
27	T$^{2}/_{3}$200?	?	M	A	**	**	**	G10	**
								mangled left front foot	
28	T4100	NO	F	A	**	**	**	M4	**

GRID B - Spring 2000 Capture Data

Animal #	Mark	99 Recap	Sex	Age	Morning 1	2	3	4	5
29	T2000	YES	F	A	**	**	**	**	H9
30	P039317337	NO	F	A	**	**	**	**	N1
31	P039526805	NO	F	A	**	**	**	**	N8
32	P039516525	NO	M	A	**	**	**	**	M14

Summer 2000 Capture Data

GRID B					Morning			
Animal	Mark	Recap?	Age	Sex	1	2	3	4
1	T0141	NO	SA/A	M	A2	A3	A2	A3
2	T1020	99/00	A	M	B3	B2	**	
3	T1401	NO	SA	M	B4	half tail **	B5	
4	T0441	NO	J/SA	M	A12	**	**	A12
5	T0440	NO	SA/A	M	C13	C12	C12	
6	T1402	NO	SA	M	C9	C8	C8	
7	T0433	NO	SA	M	C4	D5	D6	
8	T0344	NO	J/SA	M	D3	**	**	
9	T2011	NO	SA	M	D1	**	C1	
10	T0411	NO	SA	?	E1	E3	E1	
11	T1042	NO	J	M	E3	**	**	
12	T0211	NO	SA	M	F2	D2	E3	E3
13	T4000	99/00	A	F	E5	**	**	
14	T4020	99/00	A	F	F4	F4	**	
15	T2044	NO	SA/A	F	E8	bobtail F6	E6	F7
16	T2041	NO	SA	F	F6	E6	**	
17	T1041	NO	SA	M	F10	**	**	
18	T1033	NO	SA	F	G9	**	**	
19	T1031	NO	J/SA	M	G8	**	**	
20	T1032	NO	A	F	G7	G7	G7	G7
21	T1021	NO	SA	M	G1	G2	G2	
22	T1022	NO	SA	M	I4	H4	I3	
23	T1023	NO	SA/A	M	N14	**	**	N12
24	T1024	NO	SA	F	M5	**	**	
25	T1034	NO	SA	F	L2	L2	N1	
26	T1043	NO	SA	M	L3	L3	**	
27	T1044	NO	SA/A	F	L12	**	M11	M14
28	T4031	NO	SA	M	L11	**	**	

GRID B						Morning		
Animal	Mark	Recap?	Age	Sex	1	2	3	4
29	T2022	NO	SA	F	J13	J13	**	K13
30	T4024	NO	SA	M	J7	H6	**	
31	T4014	NO	SA	M	I12	H10	H10	
32	T4012	NO	SA	F	H14	I13	H13	
33	T3014	NO	J	F	**	B1	**	
34	T3031	NO	SA	F	**	A9	A8	A8
35	T3023	NO	SA	M	**	B9	A9	A9
36	T3022	NO	SA	M	**	A13	A14	A14
37	T3021	NO	SA	F	**	C14	**	
38	T3013	NO	A	M	**	E12	E12	E12
39	T2034	NO	SA/A	F	**	F13	F12	
40	T2043	NO	SA/A	F	**	E13	E14	
41	T3000	99/00	A	F	**	G9	G9	G9
42	T1044 dup #	NO	J	F	**	H5	**	I5
43	T1404	NO	J	F	**	G5	**	
44	T0210	99/00	A	M	**	H4	G4	
45	T0143	NO	SA/A	M	**	G3	**	
46	T0144	NO	SA	M	**	J1	I1	
47	T0212	NO	SA/A	F	**	J8	J8	
48	T0213	NO	SA/A	F	**	I7	I8	H7
49	T0214	NO	SA	F	**	J12	**	
50	T0221	NO	SA	M	**	J14	**	J14
51	T0222	NO	SA	M	**	N2	N4	N1
52	T0223 to $T^2/_3 23$	NO	J/SA	M	**	M5	K6	
53	T0224	NO	SA	M	**	N4	**	
54	T0231	NO	A	F	**	M7	N7	M7
55	T0412	NO	SA	M	**	N9	N10	N11
56	T0424	NO	SA/A	M	**	M9	M9	M9
57	T0141	NO	J	M	**	M10	**	

GRID B							Morning	
Animal	Mark	Recap?	Age	Sex	1	2	3	4
58	T0331	NO	SA/A	F	**	**	N2	N2
59	T0332	NO	SA	M	**	**	K1	
60	P039372 100	2000	A	F	**	**	J2	
61	T1332	NO	J/SA	F	**	**	G10	F9
62	T1020	99/00	A	F	**	**	F4	
63	T3002	99/00	A	F	**	**	no tail B1	C1
64	T0333	NO	SA	F	**	**	B5	B5
65	TO334	NO	SA/A	F	**	**	B9	B9
66	T1222	NO	J	M	**	**	M2	M4
67	T0243	NO	A	F	**	**	**	B14
68	T0431	NO	A	F	**	**	**	K14
69	T0314	NO	J/SA	M	**	**	**	N7
70	T0312	NO	SA	?	**	**	**	N13
71	T0313	NO	SA	M	**	**	**	N14

APPENDIX E
DIFFENDORFER AND LONGLAND TRANSLOCATION STUDY DESIGN

Introduction

The USFWS Recovery Plan for the pacific pocket mouse (*Perognathus longimembris pacificus*, hereafter "PPM") considers the species recovered when 10 viable populations exist. Currently, 4 populations exist with perhaps only one being capable of sustaining individuals long-term. Thus, additional populations of PPM must be created. Given the highly fragmented landscapes of S. Ca relative to the dispersal ability of PPMs, natural dispersal will not result in the colonization of suitable areas. Instead, the recovery goal of ten populations will necessitate the translocation of animals to found new populations. The Phase 1 Report effectively outlines general considerations for translocation attempts. Here we describe an experiment that will help guide translocation efforts by testing three designs of onsite enclosures for temporarily holding translocated individuals.

Two requirements are critical for the establishment of a newly translocated population. First, animals must remain on site. Second, translocated animals must survive to the first, post-translocation, reproductive season and successfully reproduce. We believe that meeting these requirements is best achieved by the use of enclosures, which restrict immediate dispersal and protect animals from predators. In the absence of movement barriers, animals may attempt to home back to their original location. Restricting animals for a short period of time may reduce the motivation to home and allow animals to construct burrows, which are critical to creating site fidelity. Moreover, a newly arrived animal must construct a burrow and learn local habitat features in order to garner resources. During this time, they are probably subject to increased risk of predation. Enclosures create a safe haven during acclimation. In addition, when enclosures are opened, by cutting small holes in the fence, they will still act as an area where predators and most competitors cannot gain entrance.

Although the ultimate goal is the translocation of PPM, it may be wise to test the efficacy of translocation protocols with a non-threatened sister taxon. The management team has identified *P. longimembris bangsi* as a suitable surrogate subspecies for PPM. The following experimental design therefore focuses on *P. l. bangsi*. However, the design is also intended to guide translocation efforts should PPM individuals become available under extraordinary situations.

Perhaps the most effective approach for successful translocation would be to enclose and protect a sufficiently large area of habitat to allow a reproducing population to persist, long-term, inside. In reality, this method will not be used in translocation attempts because it is limited by logistics, including prohibitive expense and construction time requirements (it would also be difficult to predator proof). In addition, designing an experiment to test various methods within the framework of large enclosures would require large expanses of land, and extremely expensive logistics. We therefore have opted for an approach that uses small enclosures to temporarily contain individual animals. We specifically propose to systematically test two factors; the size of enclosures and the amount of time animals are held in the enclosures.

Experimental Design

Two sites must be established that are $\geq$ 1km apart. The goal is to create two areas in which translocated individuals are naïve, with no cognitive map of the new environment. The current Snow Creek site can probably be used for one of these sites.

The grids should be large enough to allow the capture of, at a minimum, 60 individuals. A reciprocal transplant experiment will take individuals captured off one grid and use them as founders on the other grid. It is of utmost importance that the vast majority of resident animals be removed from both plots. Initial PPM translocations will occur into areas that have no conspecific individuals (although later supplementation of a translocated population may be desirable), so the planned experiment should parallel this situation. Furthermore, the removal of unmarked, new individuals will have to occur throughout the experiment.

The experiment will primarily test the effects of enclosure size and duration of confinement on a number of response variables, and will also, but with less rigor, test the effects of sex and age. Response variables that can be measured include: persistence (which includes both death and dispersal off the grid) at different time intervals from moment of release. This includes, short-term persistence immediately after release, persistence between trapping sessions (depending on what they are), and longer-term, overwinter persistence. In addition, site fidelity (distance moved from release point), body mass, and reproductive condition can be measured and tested.

Enclosure design. We propose two enclosure designs. The first is a small, circular, 2.0-m diameter enclosure. The second is a large, 5 x 5-m square enclosure. The primary construction element should be quarter-inch hardware cloth supported by t-posts and a stronger material such as hog fencing. Enclosures should be buried 0.5 m below ground. Metal flashing should cover the top of fences to prevent climbing. Each enclosure will contain a small human-made "burrow" consisting of two, 1-inch diameter PVC tubes (30 cm long), that are buried at a 30-degree angle with ends meeting in an open chamber (or metal can with both ends removed) below ground. The inner surfaces of the tubes should have sand glued to them for a more natural surface. Enclosures should be covered with netting to deter avian predators.

Duration of containment in small enclosures will be either 5 days or 1 month. To release animals, small holes (approximately 1.5 cm) will be cut in the base of the fence to permit passage of small pocket mice, but not larger animals. Animals in all of the large enclosures will all be contained for one month. Thus, we do not have a fully replicated design (i.e., 5–day, large enclosure treatment). However, we felt large enclosures would not, in practice, be used for such brief containment periods.

We can test the utility of the different enclosures by testing the effects of the three enclosure designs on the above response variables using ANOVAs. The ANOVA models used should include planned orthogonal comparisons contrasting the two types of small enclosures (5-day vs. 1-month confinement) and the large enclosures versus the small, 1-month confinement enclosures. These contrasts systematically test for effects of confinement period and enclosure size, respectively, on persistence, site fidelity, and various fitness proxies of individual pocket mice. Sex and age of individual mice can also be included as class variables in these analyses to determine which sex/age categories might be the best candidates for successful translocation.

Methods. Capturing, translocating, and placing animals in the enclosures should take place in early spring. This date allows individuals in the 1-month enclosures enough time to establish seed caches critical to overwinter survival after being released. It may also

allow for the capture of pregnant females and some young, thus maximizing the ability to get sufficient representation across age categories and possibly obtain some pregnant females. Before trapping begins all enclosures should be in place. It is possible that some resident animals will be in the area of the newly created enclosures (particularly the 5 x 5 m enclosures). These animals should be trapped out of the enclosures, and held until the full-scale translocation takes place. A total of 120 enclosures should be made (20 large, 40 small for each grid) and randomly located across the two study grids. Despite a random placement, each enclosure should include some shrub cover if possible. In addition, the enclosures (particularly the 5 x5 m) should not include burrow systems as the tunnels may go under the fence. In general and if possible, equal numbers of males and females as well as juveniles and adults (we assume only two age classes can be identified in the spring), should be placed among each of the three enclosure treatments, with a single individual in each enclosure. Ideally, 5 individuals of each sex/age category should be in each of the three enclosure treatments.

The initial trapping effort will simultaneously remove animals from a grid and move them to their new site. As animals are captured, they should immediately be moved to the new site and placed in an enclosure. Animals should be placed in long duration enclosures first to avoid having to release animals from the short duration enclosures while the removal of resident animals continues.

Removal trapping should continue after animals are translocated to assure that the resident population has been greatly reduced. Since the grids are not closed, some number of new individuals will likely occur as they disperse onto the grid from adjoining habitat. However, the key is to create a *relatively* resident-free habitat to simulate the empty habitats targeted in PPM translocations. The initial removal trapping (first 5 –7 days) will give a rough estimate of the population size on a grid. Removal trapping should occur frequently enough after the initial trapping so that the number of new individuals captured is not more than 10-20% of the original population removed. This removal trapping should continue until the translocated animals become reproductive after overwintering. Translocated individuals should be uniquely marked before being placed in enclosures, so they are not confused with new migrants during the removal trapping. Removal trapping would not be necessary if the entire study grid was enclosed. However, as mentioned above, fencing the entire plots is not practical.

All enclosures should be supplemented with food while animals are above ground, including the time after release. This will take place until aboveground activity ceases for winter. We feel that PPM translocations will supplement animals to increase the chances of overwinter survival. Augmenting the enclosures with grain creates a ready supply of food that is only available to the smallest of granivores, such as pocket mice. A bird feeder may act as a good time-release device that only needs to be serviced monthly and can be retrofitted to discourage ant foraging (by hanging them just an inch off the ground from the top of the cage).

For high quality survivorship data, trapping should occur monthly following the release of animals, with trapping periods of at least 5 days. This regime may be too expensive for the current budget. Minimally, trapping must occur once in the winter soon after release and again in the spring to estimate both overwinter survival and reproduction. In this scenario, overwinter survival would be calculated as the proportion of animals that survived from those released. In this case, survival will include both true

mortality and dispersal off the grid. If just a minimal level of trapping takes place (before and after winter only), trapping on an adjacent control grid before and after winter to compare the overall rates of survival in experimentally translocated animals to a control may be worthwhile.

Limitations of the study to successful translocation of PPM. We believe it is important to place the current study design in the larger context of successful PPM translocation. The study proposed above only considers methods for enhancing site fidelity and survival of translocated animals. However, there are other critical factors that will determine the overall success of a translocation attempt. We feel we should touch on both the specific limitations of the proposed study as well as identify other areas of incomplete knowledge that may bear on the success of such translocations.

Site Quality. Regardless of the outcome of the proposed experiment, high quality sites must be found to increase the probability of successful translocation. This process is currently being implemented by the recovery team as describe in the phase I and II reports. Examining methods of improving site quality before translocations, such as brush removal, may be a worthwhile area of research. Hand-thinning experiments are currently underway at Dana Point, and controlled burning may also occur at the San Mateo North population. Trapping results on Dana Point indicate immediate, short-term, positive response of PPM to shrub removal: At last count, seven PPM were captured in thinned areas and only one in un-thinned control. These individuals were all over-wintered adults, indicating a behavioral response to habitat change.

Life history information. The current study may show some responses of sex and or age to translocation. However, the importance of high quality life history data for PPM cannot be over emphasized. If, for example, we knew that juvenile survival was low relative to adult survival, we may choose to translocate adults. Furthermore, second year females may no longer reproduce and hence be useless for translocation. Without this information, choosing what animals to use as founders for a new population is difficult. In addition, we are not confident that life history data from the surrogate species (*bangs*) will be instructive for PPM.

Genetics. We currently lack information on the genetic structure of PPM populations. As such, it is difficult to determine the appropriate mix of genotypes in a founding population. Consequently, we have not considered genetics in the current proposal. However, Dr. Patton, at UC Berkeley is currently working on genetic analyses of PPM and the new toe-clips he will get this year should greatly aid his analysis.

Temporal variability. Results of the experiment could change depending on variability in weather. Obviously, high levels of success in the experiment during a year of high rainfall may not be applicable to a translocation attempt during a drought (which we do not recommend).

Comparability of *bangsi* to *pacificus*. The assumption that responses found in enclosure experiments will be applicable to PPM translocation should viewed with caution. Given

both the taxonomic and habitat differences between these sister taxa, we simply cannot be sure that the results carry over between these organisms.

Cost/logistic considerations. The proposed experimental design, even with the most minimal statistical rigor, may exceed current funding levels or require excess labor. It may possible to drop large enclosures from the experimental design if the use of these in actual PPM translocations is deemed unlikely.

Removal trapping. It may be possible that removal trapping will still be occurring when it is time to release animals from the short duration enclosures (i.e. after 5 days). This should not be a problem if, as we expect, the vast majority of the resident population has been removed. To avoid this problem, animals designated for the short-duration enclosures could be placed in temporary captivity (using small cages) for 2 -3 days before introduction to the enclosures while removal trapping is taking place.

APPENDIX F
LETTER SUMMARY FROM JIM PATTON REGARDING *P. LONGIMEMBRIS* GENETICS ANALYSES

Summary of genetic analyses of populations of Perognathus longimembris pacificus
J. L. Patton -- 3 December 2000

Andrea Swei, an undergraduate student at the University of California at Berkeley, completed a senior honors thesis under my guidance in May 2000 that investigated aspects of the genetic diversity of samples of the long-tailed pocket mice (Perognathus longimembris) from southern California, including samples available at that time of the Pacific Pocket Mouse, P. l. pacificus. Her thesis built upon a dataset already available that I had completed in 1995-1996, one that stemmed from the sampling efforts of Philip Brylski and Shana Dodd. A copy of Andrea's thesis was sent to Wayne Spencer in July, 2000. I have added a few sequences from Dana Point and the Oscar One site at Camp Pendleton this fall, based on material collected during the summer/fall of 2000. A complete synopsis of available samples for the five subspecies of the long-tailed pocket mouse that occur in southern California is given in Table 1. A set of hair samples from the Oscar One site remain to be extracted and sequenced; this will be done during the coming Christmas holiday season.

Andrea's work, as was true for the data I had assembled earlier and more recently, utilized sequences from the mitochondrial cytochrome b gene to examine several important aspects of the population genetic structure of these pocket mice; namely: (1) the degree to which the Pacific Pocket Mouse is an independent evolutionary unit in comparison to those other subspecies in southern California; (2) the extent of gene exchange among populations of the Pacific Pocket Mouse, and between any of these and population samples of geographically adjacent subspecies (P. l. brevinasus, P. l.bangsi, and P. l. internationalis) in San Diego, Riverside, and Imperial counties; and (3) the amount of genetic diversity present within local populations as well as summed across separate population samples of the Pacific Pocket Mouse. The first issue addresses the genetic uniqueness of the Pacific Pocket Mouse, and thus whether it should be considered as an Evolutionary Significant Unit for management purposes. The second issue seeks to determine the degree to which known populations of the Pacific Pocket Mouse are genetically isolated. Finally, the third issue asks if there has been a significant loss of genetic diversity, within the subspecies as well as within the extant populations, in relation to unimpacted populations of the other subspecies. To address these issues, we were provided with tissue of 29 individuals (mostly hair samples from live-trapped individuals) of the Pacific Pocket Mouse from four different populations: Dana Point [Orange Co.] and Oscar One, San Mateo North, and San Mateo South [San Diego Co.]. These data were added to a set of 8 individuals from Dana Point sampled by Phil Brylski at the time that population was "rediscovered." While sample sizes remain limited (Table 1), sufficient data are available to estimate the population genetic parameters for each of the three measures cited above. We also examined a few additional individuals of the Coachella Valley subspecies (bangsi). Most importantly, however, Andrea expended considerable effort to obtain DNA sequence data from 12 museum specimens of the Pacific Pocket Mouse collected in the

early part of the 20th century and housed in the collections of the Museum of Vertebrate Zoology (Table 2). These samples permit us to assess whether the current pattern of genetic structure exhibited by the Pacific Pocket Mouse reflects historical (and, thus, "natural") processes or has resulted largely from the urbanization and habitat fragmentation of the recent 3-4 decades.

A complete description of laboratory and analytical methodologies and a presentation of the results is given in Andrea's senior thesis. With the addition of samples of the Pacific Pocket Mouse obtained during the late summer and early fall, and which are being analyzed now (see below), we will prepare these data in manuscript form to submit to a formal journal. I provide a synopsis of the general findings below.

In relation to each of the three study issues stated above, the salient features of Andrea's analyses are as follows, separated by extant and historic samples:

Extant samples:---

(1) With three exceptions, each separate haplotype is unique to a particular population. The exceptions are one haplotype shared between two populations of bangsi, one haplotype shared between a population of bangsi and brevinasus, and another shared between the San Mateo South and Dana Point samples of the Pacific Pocket Mouse. However, no subspecies, including the Pacific Pocket Mouse, is reciprocally monophyletic for their respective DNA sequences. This means that none of these taxa has been isolated genetically from neighboring ones for a sufficient length of time to allow for the development of an independent evolutionary trajectory. Each subspecies has exchanged genes within the relatively recent past (within what is termed the coalescence time [the time to the common ancestor] of the set haplotypes recovered for this gene). Importantly, therefore, the Pacific Pocket Mouse is not, by itself, an Evolutionary Significant Unit, but only part of such a unit that includes the other subspecies from southern California. Having said this, however, the data are also clear that all Pacific Pocket Mouse haplotypes are unique to that subspecies and are rather closely linked genealogically. Hence, while reciprocal monophyly is not complete, historically the Pacific Pocket Mouse has been diverging genetically from its geographic neighbors. There is no evidence on on-going gene flow between any population of the Pacific pocket mouse and those from neighboring subspecies.

(2) It is not surprising, therefore, that measures of gene flow (either historical or potentially current) are quite low in nearly all comparisons between populations belonging to the different subspecies. This is also true for the two populations of the Pacific Pocket Mouse for which reasonable samples are available (Dana Point and San Mateo). This means that genetic drift is, and has been, an important force in the genetic diversification of all of these populations, regardless of which subspecies each belongs to. Unless local populations are maintained at high densities, genetic drift through time is expected to generate both differentiation among populations and loss of genetic diversity within each.

(3) However, populations of the long-tailed pocket mouse in southern California have retained relatively high levels of genetic diversity, as measured by mitochondrial haplotype diversity. As is evident in Table 1, nearly every individual mouse sampled possesses a unique haplotype. The major exception to this pattern is the Pacific Pocket Mouse, for which overall haplotype diversity is less than half that found for the other four subspecies (all populations and individuals pooled). The apparent loss of diversity results solely from the Dana Point sample. There were only 9 unique haplotypes recovered from the 27 individuals sampled from this population, while 7 of the 8 individuals from San Mateo (North and South, combined) had unique haplotypes as did both individuals from Oscar One. Hence, of all samples of pocket mice from southern California, only the Dana Point population appears to have lowered genetic diversity. Whether this has resulted from the isolated and small population size of the Dana Point population remains to be determined.

Historic samples.--

Genetic data from the 12 historical individuals from which DNA was obtained are not as complete, as only half the number of bases could be determined. Nevertheless, these data, which come from three additional populations that spanned the historical range of the subspecies (Tijuana, Mexico, to El Segundo, Los Angeles Co.) offer important insights into understanding the present-day genetic structure of the Pacific Pocket Mouse.

(1) While sample sizes are limited, each of the historic samples are comprised on sets of unique haplotypes that are part of the same general genealogical grouping as present at Dana Point and San Mateo today. The pattern of haplotype differentiation suggests that each sample has been relatively separated from all others historically. Hence, the level of differentiation found today between Dana Point and San Mateo is likely due to a deeper history of limited genetic contact than the result of recent fragmentation and isolation.

(2) The amount of haplotype diversity contained within each historic sample is somewhat intermediate between that found today at Dana Point and San Mateo (3 of 5 individuals with unique haplotypes [Tijuana River] and 3 of 6 [Oceanside]). With the limited available samples, therefore, it is not possible to determine if the Dana Point population has suffered a loss of diversity in recent times or has been relatively isolated and of small size for a substantial period of time.

Conclusions and Recommendations

The addition of the remaining samples collected in 2000 are not expected to modify in any substantial manner the general conclusions to date, namely that the Pacific Pocket Mouse is not itself an Evolutionary Significant Genetic Unit, although its genetic contact with neighbors has been sufficiently far in the past to allow the subspecies to develop genealogically uniqueness. Moreover, the pattern of a high degree of genetic structure across the range of this subspecies appears to result from

historical (="natural") processes and not from recent urbanization leading to fragmentation and isolation. Although the Dana Point population has less genetic diversity than others, including the San Mateo and historic samples, it is not clear as yet if such a loss is a recent phenomenon; this population may have been historically relatively small and isolated. Of importance, however, is the acknowledgement that the haplotypes found within the Pacific Pocket Mouse, even if these are largely apportioned among separate populations, are genealogically closely related. While there is no yardstick available for explicit support to the following statement, this genealogical closeness would suggest that individuals from San Mateo or Oscar One, for example, could be used for transplantation purposes into Dana Point, should that population suffer an extreme decline. Certainly, transplantation would be genetically defensible.

Current studies:

Based on Andrea's analyses, I recommended that sample sizes be enlarged, especially for the San Mateo populations, and that samples be obtained from the Oscar One site, the third region where the Pacific Pocket Mouse is known to occur. Expanded samples will permit better estimates of within-population genetic diversity measures as well as those determining the degree of differentiation, and hence gene flow, between them. Shana Dodd provided me with these samples in October. I have completed extraction and sequencing for those individuals represented by whole tissues (7) and am about to begin work on the series of individuals for which only hair samples are available. Results will be forthcoming over the Christmas holidays.

I am also beginning to construct genomic libraries to recover highly variable microsatellite loci from the nuclear genome. Once microsatellites have been identified and primers constructed, I will determine genotypes at each locus for all available individuals. This work is being done under subcontract with a commercial genomics company, and should be completed by spring. Microsatellite loci can be used to assess parentage as well as to get measures of genetic diversity of the nuclear genome for comparison to the mitochondrial data currently available. The availability of these loci will permit other investigators to monitor genetic characteristics of these populations into the future.

Table 1. Number of individuals and number of distinct haplotypes for each pooled population sample of five subspecies of southern California long-tailed pocket mice (Perognathus longimembris).

taxon	$N_{individuals}$	$N_{haplotypes}$	locality	N_{pooled}
longimembris	11	9	Kern Co.	3

			San Bernardino Co.	8
brevinasus	9	6	San Bernardino Co.	2
			Riverside Co.	7
bangsi	24	19	Riverside Co.	21
			San Diego Co.	2
			Imperial Co.	1
internationalis	6	5	San Felipe Valley	3
			Earthquake Valley	3
pacificus	37	18	Dana Point	27
			San Mateo South	6
			San Mateo North	2
			Oscar One	2

Table 2. Historic samples of Perognathus longimembris pacificus from the collections of the Museum of Vertebrate Zoology for which mtDNA was extracted and sequenced.

Year of collection	County	Specific locality	$N_{individuals}$
1931	San Diego Co.	mouth of Tijuana River*	5
1931	Sam Diego Co.	Oceanside	6
1937	Orange Co.	0.5 mi W El Segundo	1

* near type locality

Conservation Genetics 4: 501–514, 2003.
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Hierarchical genetic structure in fragmented populations of the Little Pocket Mouse (*Perognathus longimembris*) in Southern California

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Received 1 May 2002; accepted 26 July 2002

Key words: cytochrome *b*, haplotype diversity, Little Pocket Mouse, mtDNA sequences, Pacific Pocket Mouse, *Perognathus longimembris*, phylogeography, Southern California

Abstract

The geographic genetic structure, based on sequence variation of an 810 base pair fragment of the mitochondrial cytochrome *b* gene, is described for populations of five subspecies of the Little Pocket Mouse, *Perognathus longimembris*, from Southern California. One of these, *P. l. pacificus* (Pacific Pocket Mouse), is listed as Endangered by the U.S. Federal Government. Sixty-two unique haplotypes were recovered from 99 individuals sampled. Phylogenetic analyses of these variants do not identify regionally reciprocally monophyletic lineages concordant with the current subspecies designations, but most haplotypes group by subspecies in networks generated by either statistical parsimony or molecular variance parsimony. Moreover, a substantial proportion of the total pool of haplotype variation is attributed to these subspecies, or to local populations within geographic segments of each, indicating their relative evolutionary independence. The pooled extant populations of the endangered Pacific Pocket Mouse exhibit the same levels of nucleotide and haplotype diversity as other, presumptively less-impacted populations of adjacent subspecies, although the sample from Dana Point, Orange County, has markedly low haplotype diversity in comparison to all others. These populations also show a genetic signature of population expansion rather than one of decline. Both pieces of evidence are at odds with current empirical population estimates, which reinforces the fact that present-day patterns of genetic diversity are the product of coalescent history and will not necessarily reflect recent anthropogenic, or other, perturbations. Comparison of haplotype variation within and among extant populations of the Pacific Pocket Mouse with those obtained from museum samples collected more than 70 years ago suggests that the pattern of population differentiation and diversity was in place before the post-World War II exponential urbanization of Southern California.

Introduction

Population genetics and phylogenetics intersect conservation biology in a number of salient, if different, ways. These range from measures of the loss of variability due to bottleneck effects following habitat fragmentation, to consequences of inbreeding, and to the development of management plans that promote out-crossing, among others (Crandall et al. 2000; Hedrick 2001; Hedrick and Kalinowski 2000). Genetic methodologies have also proven useful in determining how genetic variation is apportioned within and among populations, races, and species, with the lineage contribution to overall genetic diversity increasingly relevant to management decisions (Moritz 1994a, b, 1995). Finally, molecular markers have been used to confirm, or reject, an extant taxonomy with respect to the uniqueness of listed

taxa, or those proposed for special protection at state, federal, or international levels (e.g., Zink et al. 2000).

In this paper, we examine the patterns of genetic variation in mitochondrial DNA sequences for populations and races of *Perognathus longimembris* (the Little Pocket Mouse) in Southern California. We use the current subspecies designations and mapped distributions (e.g., Hall 1981; Williams et al. 1993) as a point of departure, but our analyses do not depend on the taxonomic validity of any of these forms. One subspecies, *P. l. pacificus* (the Pacific Pocket Mouse) is currently listed as Endangered under the U. S. Endangered Species Act, and three others are considered of conservation concern by the State of California and the IUCN Species Survival Commission (Patten et al. 1998). The ranges of both subspecies and populations in Southern California have been strongly influenced by habitat conversion, degradation, and fragmentation as a result of intensive development, especially within the past 50 years.

We use hierarchical phylogenetic and population genetic analyses to address the question of the uniqueness of extant populations of all recognized races of the Little Pocket Mouse in Southern California. We combine data from extant populations with those from historical, but now extirpated populations, of *pacificus* to help examine the relative importance of deeper history and recent habitat fragmentation through urbanization to the observed patterns of genetic diversity. We conclude that these types of molecular studies primarily yield information about that deeper history rather than more recent, anthropogenic population perturbations. This backward look into the genetic past must be combined with future projections based on current demography and the likelihood for population interconnections in the development of any management directives.

Perognathus longimembris *in Southern California*

For the purposes of this paper, we define Southern California to include the Los Angeles Basin and coastal plain south to San Diego, was well as the western margins of the Colorado Desert in Riverside, San Bernardino, San Diego, and Imperial counties (map, Figure 1). By current taxonomy (Williams et al. 1993), four subspecies of *P. longimembris* are recognized within this region (*P. l. bangs* [Palm Springs Pocket Mouse], *P. l. brevinasus* [Los Angeles Pocket Mouse], *P. l. internationalis* [International Pocket Mouse], and *P. l. pacificus* [Pacific Pocket Mouse]). Williams (1986) noted that the systematics of the entire *P. longimembris* group is in need of revision, especially the various subspecies in Southern California. For simplicity, we use the range designations given in Williams et al. (1993) for each subspecies, yet recognize that both the validity of these taxa and their explicit boundaries remain to be firmly established. The range of *bangsi* includes in the Coachella and Imperial valleys east of San Gorgonio Pass at least to the Mexican border, *brevinasus* inhabits the arid coastal basins to the immediate west, and *internationalis* is known from the quasi-isolated interior desert valleys in eastern San Diego Co. (Figure 1). Both *bangsi* and *brevinasus* have experienced considerable habitat loss from urban development in the Palm Springs and greater Los Angeles areas, respectively (Brylski et al. 1994). The historic range of *pacificus* extended down the coastal strip from approximately El Segundo, Los Angeles Co., to near Tijuana, Baja California. Today, this subspecies is limited to two small and isolated areas, one at Dana Point, Orange Co., and the other at three separate nearby sites on Marine Corps Base Camp Pendleton in San Diego Co. (Spencer et al. 2000a, b, 2001). It has apparently been extirpated from the remainder of its range. Two other subspecies are distributed to the adjacent north and east, in the Antelope Valley and Mojave River region (*P. l. longimembris*, Figure 1, inset) and along the Colorado River (*P. l. bombycinus*); we include data for the former but not the latter.

Perognathus longimembris is a diminutive (7–12 grams in adult body mass), nocturnal, solitary, and semi-fossorial (living in self-dug burrows) rodent in the family Heteromyidae. It is largely granivorous, specializing on grass and forb seeds that it caches. The species inhabits desert scrub and sparse sage scrub in the southwestern U.S. and northwestern Mexico, particularly in areas of fine, sandy soils. Average life expectancy in the field is approximately one year, with survival for as long as 3–5 years common (French et al. 1967, 1974) and one exceptional record of over 8 years in captivity (Edmonds 1972). The extended longevity for such a small-bodied mouse is presumably facilitated by seasonal heterothermy (winter hibernation and facultative summer aestivation) resulting from the environmental stresses of food shortage and/or low temperatures (Chew et al. 1965; Bartholomew and Cade 1957).

Few studies of these mice have been undertaken in Southern California. Anecdotal references (e.g., von Bloeker 1928, 1931) suggest that populations of *paci-*

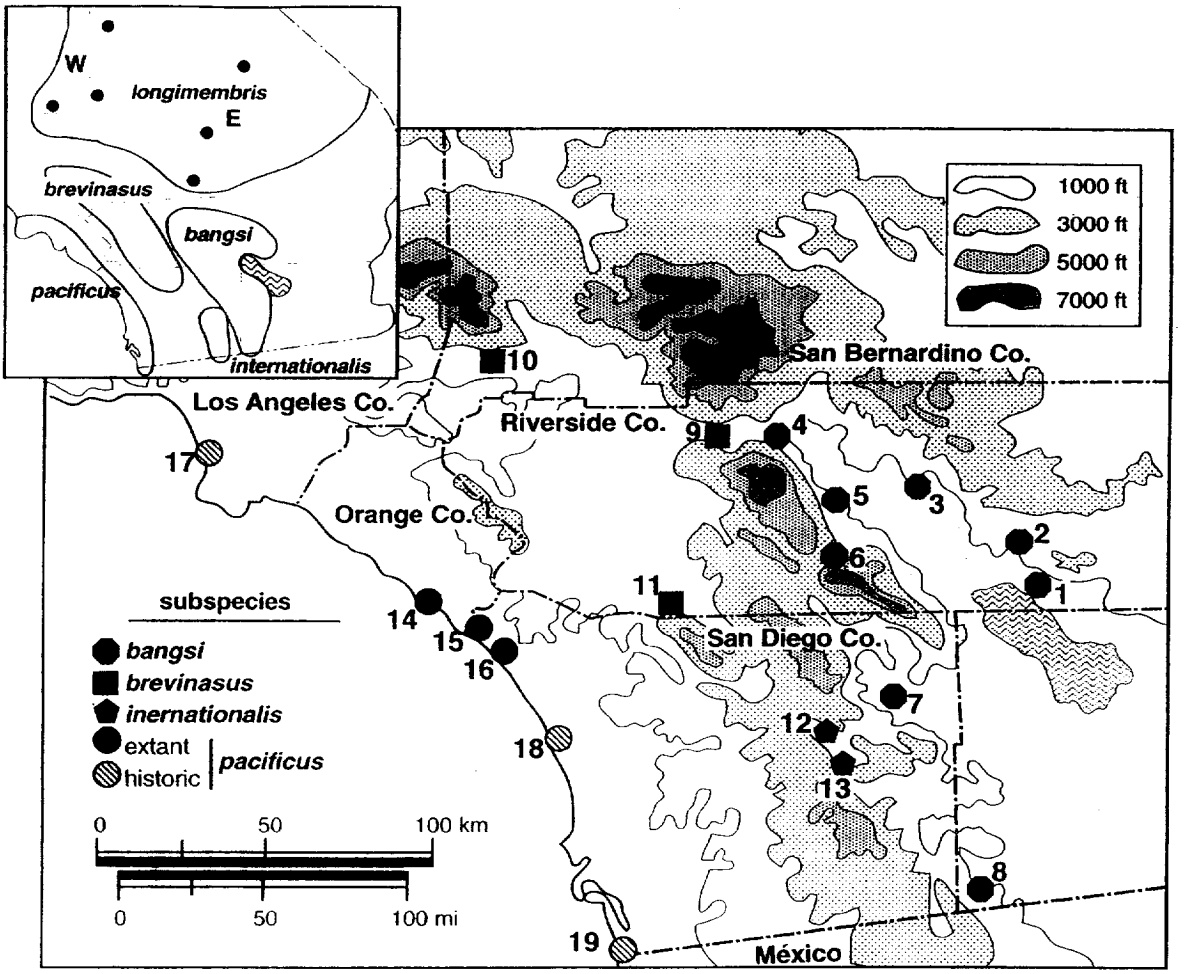

Figure 1. Map of southern California showing sample localities of four subspecies of the Little Pocket Mouse, *Perognathus longimembris*, from Southern California. Localities are numbered as listed in the Appendix. The inset map illustrates the generalized ranges of each of these subspecies as well as the range and sample sites for six localities of the nominate subspecies, *P. l. longimembris*, from the Mojave Desert north of Southern California, divided into western (W) and eastern (E) geographic units.

ficus were normally at low numbers punctuated by the occasional year with local irruptions in numbers. The only relatively long-term population studies have been at a site (Irvine Ranch, Orange Co. [M'Closkey 1972; Meserve 1976]) where pocket mice are now apparently extirpated (Brylski et al. 1994; Spencer et al. 2000a, b, 2001). Here, mice were rare and their occurrence unpredictable over a 15-month trapping study (M'Closkey 1972). Mark-and-release studies on the extant populations of *pacificus* at Dana Point and Marine Corps Base Camp Pendleton suggest current population sizes from less than 20 to about 1,000 individuals, respectively, with limited adult movement and juvenile dispersal distances (US Fish and Wildlife Service, unpublished data; Spencer et al. 2000a). Recent trapping studies of *bangsi* north of Palm Springs found it to be among the most abundant mammal species, reaching densities of about 60 to 200 individuals per hectare in creosote scrub habitat (Spencer et al. 2001).

Materials and methods

We examined variation within the first 810 base pairs of the mitochondrial cytochrome *b* (cyt-*b*) gene.

Sequence data are available for 99 specimens, including 12 of the nominate subspecies (*P. l. longimembris*) from the Mojave Desert, 24 *bangsi* from the Coachella and Imperial valleys, 9 *brevinasus* from the northern and eastern Los Angeles Basin, 6 *internationalis* from San Diego Co., and 48 *pacificus* from Dana Point, Orange Co., and three sites on Camp Pendleton in northern San Diego Co. (San Mateo North and South and Oscar One; see map, Figure 1, Table 1, and the Appendix for locality list). All preserved specimens are cataloged in the Museum of Vertebrate Zoology, and representative haplotypes are deposited in GenBank (accession numbers AY152409–AY152417).

We used liver or muscle tissue as the source of DNA for all specimens, except for most specimens of *pacificus* and a few *bangsi*, for which either hairs or a biopsied hind toe were removed from live-trapped individuals prior to their release. In addition to samples from extant populations, we also extracted DNA from 2 × 2 mm skin snips from 12 museum specimens of *pacificus* collected in the 1930s from three localities that span the historic range of this subspecies (Table 1; Appendix). We used a lysis-salt procedure (Medrano et al. 1990) or the DNAease kit (Quiagen, Inc.) for all extractions. Initially, we sequenced manually, following asymmetrical amplification and direct sequencing protocols given in earlier papers (Patton and Smith 1992; Patton et al. 1994; Smith and Patton 1993). We sequenced other specimens obtained since 1996, including all skin snips, on an ABI 377 (Applied BioSystems Inc.) automated sequencer following manufacturer protocols. For the DNA from recent specimens, we amplified the entire 810 bp fragment with primer pairs MVZ05/MVZ16 and sequenced in both directions by each primer along with the light-strand internal primer MVZ65. For DNA extracted from skin snips from museum specimens, we obtained a final 432 bp fragment by amplifying overlapping smaller fragments using primers MVZ05/MVZ06 and AS07/MVZ04. MVZ primer sequences can be found in Smith and Patton (1993); the sequence for AS07, which begins at position 14256 on the light strand of the *Mus* mitochondrial genome, is 5′-GGCTATGTCTCATTATCC-3′.

We aligned sequences either with Sequence Navigator (ABI Inc.) or Sequencher (Gene Codes Corporation) software, and identified redundant haplotypes by subjecting a file of all 99 individuals to MacClade 4.0 (Maddison and Maddison 2000). We examined the phylogenetic relationship among these unique haplotypes with PAUP 4.0b8 (Swofford 2001) using maximum parsimony. To address the question of the monophyly of the *P. longimembris* samples, we used sequences from the other two species of the "*longimembris*-group", *P. amplus* from Arizona and *P. inornatus* from the Central Valley of California (from two of the three recognized subspecies, *inornatus* and *neglectus*; see Appendix). Because of the large number of highly similar haplotypes, we limited phylogenetic analysis to a single heuristic search using TBR branch swapping. We assessed the strength of the major internal nodes by bootstrapping, with

Table 1. Sample sizes (N_i), number of separate populations sampled per pooled group (N_p), and number of haplotypes (N_h) of each subspecies of the Little Pocket Mouse, *Perognathus longimembris*. Localities are numbered as in the map, Figure 1, and as detailed in the Appendix. The date of collection of each historic sample is indicated

Subspecies: Geographic subdivision	N_i	N_p	N_h
longimembris			
(Little Pocket Mouse)			
west	9	4	7
east	3	3	3
brevinasus			
(Los Angeles Pocket Mouse)			
east (9)	6	1	4
west (10–11)	3	2	2
bangsi			
(Palm Springs Pocket Mouse)			
east (1–3)	9	3	9
west (4–8)	15	5	9
internationalis			
(International Pocket Mouse)			
north (12)	2	2	2
south (13)	4	2	2
pacificus			
(Pacific Pocket Mouse)			
Dana Point (14)	27	1	9
San Mateo North (15)	5	1	4
San Mateo South (15)	10	1	10
Oscar One (16)	6	1	6
El Segundo (1937) (17)	1	1	1
Oceanside (1931) (18)	6	1	3
Tijuana (1931) (19)	5	1	3

1000 replicates, on a random sample of 10,000 trees obtained from the heuristic search. Bremer support indices (Bremer 1988) were calculated using TreeRot (Sorenson 1996) on this same reduced set of trees.

We used Arlequin 2.0 (Schneider et al. 2000) for all measures of nucleotide and haplotype diversity, for hierarchical analysis of molecular variation (AMOVA), and to construct a minimum spanning network among haplotypes by the method of molecular variance partitioning. We also used TCS alpha, ver. 1.01 (Possada 2000) to construct a statistical parsimony network (Templeton et al. 1992). In both procedures, the number of mutational steps along the network branches measures the degree of evolutionary divergence between any two haplotypes in each network. To arrange the shorter museum sequences within the larger haplotype database, we truncated the 810 bp data set to the museum sequence length of 432 bp and analyzed these data separately. The AMOVA analysis used a matrix of mutation steps. We used the subspecies designation to define geographical regions, which sort taxa into those from the Mojave Desert (*longimembris*), Coachella-Imperial valleys (*bangsi*), upper Los Angeles Basin (*brevinasus*), intermontane desert valleys (*internationalis*), and coast (*pacificus*). We combined geographically adjacent localities within each subspecies to provide a measure of inter-population variation within each subspecies (see Table 1). Pooling in some cases is arbitrary but could not be helped given the difficulties in securing sufficient samples of these mice from all areas. Different pooling strategies yielded similar hierarchical patterns. For example, pooling the San Mateo samples of *pacificus* did not change the apportionment pattern obtained when each single locality of this subspecies was treated separately. We also combined historic and modern samples of *pacificus* in a separate set of hierarchical analyses for this subspecies.

We generated standard variance components at each of three hierarchical levels using the AMOVA subroutine in Arlequin: differences among the groups (subspecies or temporal samples) relative to the total haplotype pool, differences among populations within groups, and differences among individual haplotypes within populations. We used Φ_{ST} as an estimator of Wright's F_{ST} (Michalakis and Excoffier 1996) to infer levels of female gene flow (Nm), denoted as $\hat{M}$ (Slatkin 1993). Estimates of $\hat{M}$ provide a qualitative signal of past or recent gene flow, under assumptions of equilibrium, based on $Nm = 1/4(1/F_{ST} - 1)$ (from Slatkin 1994). Finally we used Fluctuate, version 1.3 (Kuhner 1998), to calculate the population exponential growth (or decline) parameter, g, from haplotype data for three single localities for which samples sizes were 10 or more (Dana Point and San Mateo, combined, of *pacificus*, and Snow Creek, of *bangsi*). This estimate can give insights into the genetic history of a population, such as the likelihood of expansion from a recent bottleneck wherein genetic diversity was reduced (Kuhner et al. 1998). Because the Markov Chain Monte Carlo simulation is based on the genealogy of haplotypes at each locality, which will necessarily be different among localities, we standardize the growth parameter by its standard deviation. Since each of these analytical procedures assumes that haplotype variants are not under selection, we used both Tajima's (1989) and Fu's (1997) tests of selective neutrality, as implemented in Arlequin.

Results and discussion

In what follows, we present the general trends among all sampled populations from Southern California and follow these by consideration, where appropriate, of the truncated dataset involving only the temporal and spatial samples of *pacificus*. Combining both sets of analyses, most (8 of 14) estimates of Tajima's D or Fu's F_S are negative and none are significantly different from zero (Table 2). These data thus support the assumption that observed haplotype variation has been governed by neutral processes. As a consequence, we can assume that selection has not significantly influenced the distribution of that variation during the history of the populations under study.

Haplotype and nucleotide diversity

There are 62 unique haplotypes among the 99 individuals for which the 810 bp cyt-*b* gene fragment was available (Table 1). These differ by a maximum of 20 mutational steps (2.5%, uncorrected), with a mean among all haplotypes of 11.4 steps. The truncated dataset of 432 bp for all 60 specimens of *pacificus* contained 19 haplotypes, 7 from the historic individuals and 12 from extant samples. These differed by a maximum of 12 mutational steps (2.8%, uncorrected). The pooled samples for each subspecies exhibit approximately the same haplotype and nucleotide diversities and contain similar average pairwise nucleotide differences among their included haplotypes (Table 2). The exception is the small sample of *internationalis*

Table 2. Estimates of haplotype and nucleotide diversity, average number of pairwise differences, and measures of the intensity of selection (Tajima's *D* and Fu's *Fs*) for pooled samples of each subspecies of *Perognathus longimembris*. Measures are means ± one standard deviation; ns = non-significant ($p >> 0.05$). The extant and historic samples of *pacificus* include 432 bp of sequence; all other measures are based on the complete set of 810 bp.

Subspecies	Haplotype diversity	Nucleotide diversity	Mean # pairwise differences	Tajima's *D*	Fu's *Fs*
longimembris	0.9636 ± 0.0510	0.00969 ± 0.00552	7.8545 ± 3.9609	0.00114^{ns}	-1.48109^{ns}
brevinasus	0.9167 ± 0.0725	0.01163 ± 0.00669	9.4767 ± 4.7775	-0.44353^{ns}	1.42422^{ns}
bangsi	0.9601 ± 0.0252	0.01972 ± 0.00582	8.8877 ± 4.2450	-0.09066^{ns}	-3.78438^{ns}
internationalis	0.7333 ± 0.1552	0.00263 ± 0.00196	2.1333 ± 1.3728	-0.14427^{ns}	1.14056^{ns}
pacificus	0.9521 ± 0.0152	0.00940 ± 0.00495	7.6117 ± 3.6134	-0.45731^{ns}	-6.43940^{ns}
extant	0.8511 ± 0.0324	0.00842 ± 0.00482	3.6374 ± 1.8755	0.46765^{ns}	-0.92524^{ns}
historic	0.8718 ± 0.0670	0.01229 ± 0.00713	5.3077 ± 2.7403	0.40958^{ns}	0.42399^{ns}

that is lower in all measures (Table 2); whether or not this difference is real or only results from the limited sample remains to be determined. Importantly, the endangered Pacific Pocket Mouse (*pacificus*) is not singularly different in any of these measures of diversity or inter-population differentiation in comparison to the other subspecies. For this subspecies, however, historic haplotypes were slightly more differentiated among themselves than were those from extant populations (means = 5.308 steps versus 3.637 steps, respectively, although this difference is not significant at $p = 0.05$; Table 2). This slight difference is also not surprising given the much larger portion of the original subspecies range represented by the historic samples (linear distance of approximately 120 versus 20 miles, respectively; Figure 1).

For the most part, it was not possible to calculate reliable measures of haplotype and nucleotide diversity for single population samples, as the number of individuals examined in each was limited. However, we did estimate these parameters for the five populations that had sample sizes between 6 and 27 (Dana Point, San Mateo, and Oscar [*pacificus*]; Cabazon [*brevinasus*]; and Snow Creek [*bangsi*]). Of these, the sample from Dana Point was notably low in haplotype diversity (0.8661 ± 0.0362) in comparison to this measure for the other four samples (range, 0.9333 [Snow Creek] to 1.0000 [San Mateo and Oscar]). Nucleotide diversities for all five samples, however, were similar, with that for Dana Point (0.00699 ± 0.00386) intermediate between those for the other samples (range, 0.00518 [Oscar] to 0.00946 [Cabazon]).

Phylogeny and phylogeography

The related species, *P. amplus* and *P. inornatus*, differ from *P. longimembris* by 103 and 61 steps, on average, respectively. Phylogenetic analyses strongly associate all sequences of *P. longimembris* into a monophyletic clade in relation to the two out-group species, with 100% bootstrap support and a Bremer index of 10 (Figure 2, inset). Within the *longimembris* clade, however, there is little phylogenetic structure among the 62 haplotypes. Although several distinct clusters are evident, only one has bootstrap support above 50% (Figure 2). This particular cluster includes haplotypes from western samples of *bangsi* (localities 4 through 8, Figure 1), those of *brevinasus* (localities 9 and 10), and two haplotypes of *pacificus* (both from Dana Point). Haplotypes of *longimembris* from the Mojave Desert (Figure 1, inset), eastern *bangsi* (localities 1–3), and *internationalis* (localities 12 and 13) form a weakly associated cluster (bootstrap < 50%) at the base of the tree. Importantly, haplotypes of *pacificus* are scattered throughout the tree, except among those of the basal cluster. The subspecies are not reciprocally monophyletic with regard to the genealogy of their respective haplotypes although, with the exception of *bangsi*, most haplotypes of single subspecies are closely united.

Haplotype networks generated by statistical parsimony and molecular variance parsimony were identical in the placement of individual haplotypes. Differences between the two methods were only in the identification of missing haplotypes in the network that are estimated by statistical parsimony. For simplicity, we illustrate the network without the placement of missing haplotypes (Figure 3). Four general

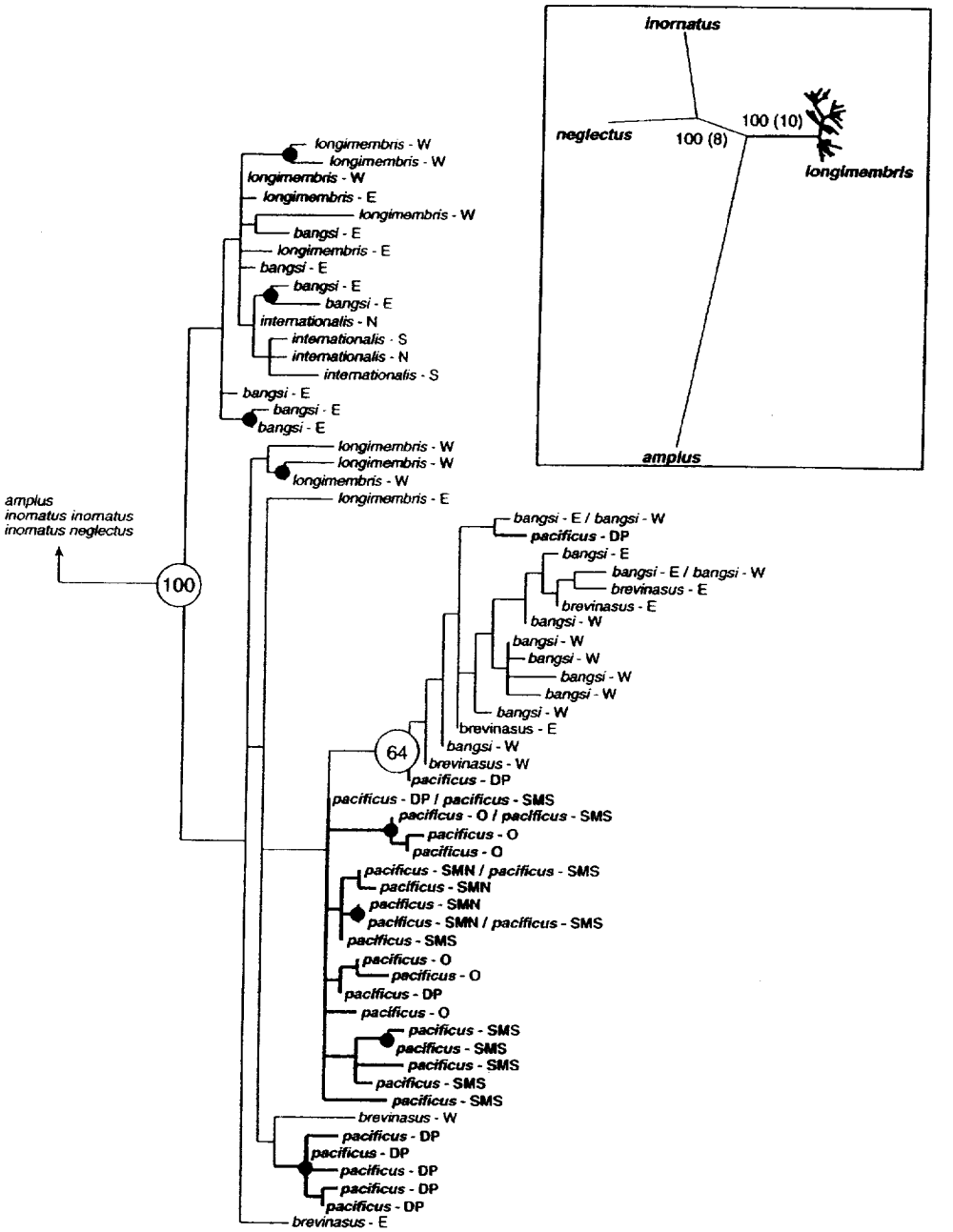

Figure 2. Strict consensus maximum parsimony tree illustrating the phylogenetic relationships of 62 unique cytochrome *b* haplotypes of *Perognathus longimembris* in Southern California and rooted by comparison to the other two species in the *longimembris*-group, *P. amplus* and *P. inornatus* (subspecies *inornatus* and *neglectus*) (of 138,395 trees, each 257 steps long; 810 total characters, 608 constant, 109 parsimony informative; consistency index = 0.665). Bootstrap values linking haplotype clusters > 50% are indicated at internal nodes. Inset illustrates the relationship of the outgroup taxa to *P. longimembris*; bootstrap and Bremer support values at nodes supporting the monophyly of the 62 haplotypes of *longimembris* are indicated.

haplotype clusters are apparent: one of these groups all *longimembris* from the Mojave Desert, *internationalis*, and eastern *bangsi* and a second groups western *bangsi*, most *brevinasus*, and one *pacificus* haplotype (from Dana Point). The remaining *pacificus* and one *brevinasus* haplotype (that from locality 11, Figure 1) belong to separate but united clusters that form the nexus between these other two groupings. Generally, each cluster of haplotypes in the network is coincident with geographic relationships of the respective samples, with one group to the north and east of the Salton Sea and a second that combines all interior and coastal Southern California samples. The exceptions are the haplotypes of *internationalis* from southeastern San Diego Co. that group with those to the east and north rather than to coastal forms (contra expectations, see Williams et al. 1993).

There is also limited haplotype sharing among the extant samples, as only one haplotype is shared between samples of the eastern and western groups of *bangsi* (between localities 3 and 4–5; Figures 1 and 3), and four haplotypes are shared among samples of *pacificus* (one between Dana Point and San Mateo South, one between San Mateo South and Oscar One, and two between the separate San Mateo samples). The Dana Point sample includes at least one haplotype positioned in each cluster in the network where *pacificus* haplotypes are found. In contrast, all haplotypes from Camp Pendleton group collectively into the single, larger cluster. Interestingly, the single haplotype of *brevinasus* from the Pauba Valley on the border of Riverside and San Diego counties, while relatively divergent from all others, groups with those of *pacificus* rather than with others of this subspecies. Thus, of the five subspecies examined, as their distributions are currently understood, *bangsi* clearly represents two historical units (eastern and western margins, respectively, of the Coachella and Imperial valleys) while *brevinasus* is the least inclusive and thus apparently the most polyphyletic. The remaining three subspecies exhibit cohesion in the network, even if they do not form reciprocal monophyletic groupings.

All historic haplotypes of *pacificus* (those with 432 bp) are tied to one of two common haplotypes among the extant samples (arrows, Figure 3). The single individual from El Segundo (locality 17) and all those from Oceanside (locality 18) group with a haplotype shared between Dana Point (locality 14) and San Mateo (locality 15) while all haplotypes from Tijuana (locality 19) stem from another Dana Point haplotype. Each of these differs by no more than 3 mutational steps (0.69%) from the closest haplotype among extant individuals.

Table 3. Hierarchical analysis of variance across population samples of *Perognathus longimembris* from Southern California. The percentage variance explained and probability estimated from permutation tests are given at each hierarchical level (see Excoffier et al. 1992)

Variance component	Subspecies		Temporal samples of *pacificus*	
	%	p	%	p
Among groups (Φ_{ST})	23.65	<0.001	6.49	>0.302
Among populations within groups (Φ_{PS})	30.83	<0.001	54.37	<0.001
Within populations (Φ_{IP})	45.52	<0.001	39.14	<0.001

Hierarchical apportionment

Only a limited amount (23.7%) of the total pool of haplotype variation is attributed to each subspecies in the AMOVA analysis (Table 3), as might be expected by visual examination of both the phylogenetic tree (Figure 2) and haplotype network (Figure 3). Rather, most variation is found within populations (45.5%) and an intermediate amount is distributed among populations within subspecies (30.8%). The structure present is significant, by permutation test, at each hierarchical level ($p < 0.001$ in all cases; Table 3). This same pattern of apportionment is present in other analyses (not shown) that placed samples into different hierarchical groupings (such as Mojave Desert, Colorado Desert, and coastal California). Hence, the patterns presented here are not merely an artifact of arbitrary grouping. The limited "subspecies effect" reflects the lack of reciprocal monophyly but is nevertheless significant and results from the general grouping of haplotypes belonging to single subspecies into unified clusters within the network. Similarly, individual populations within each subspecies or geographic group retain a substantial amount of the total pool of variation. In general, therefore, these samples do exhibit a degree of geographic structuring perhaps larger than might be expected, given the rather limited geographic scale over which our samples were collected. This grouping is evident in the haplotype network (Figure 3).

We employed a separate AMOVA analysis comparing the temporal samples of *pacificus* to determine if there has been any change in structure among

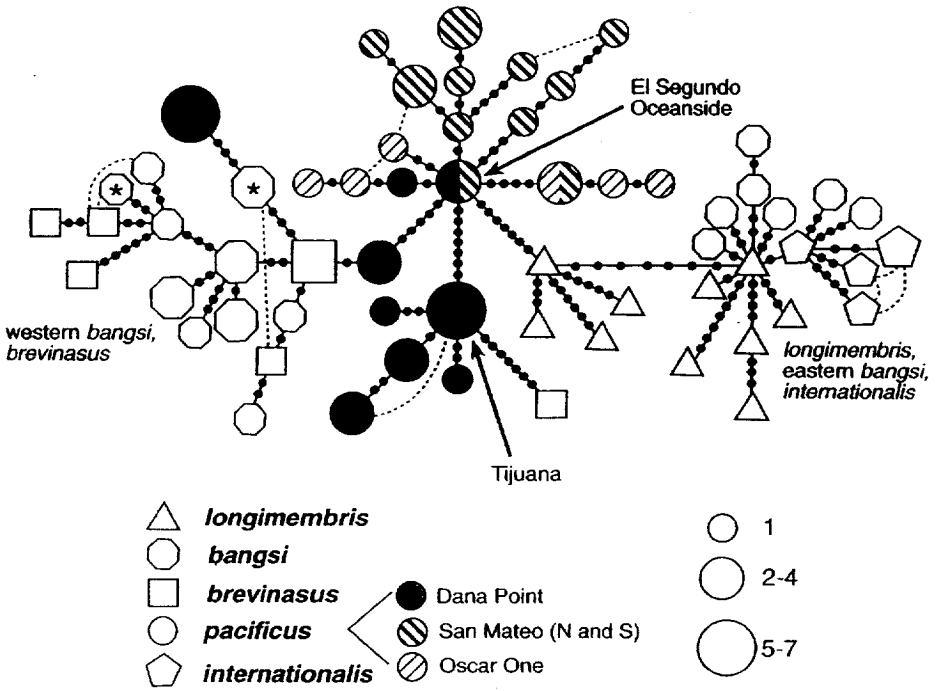

Figure 3. Parsimony network illustrating relationships of the 62 haplotypes (810 bp) of *Perognathus longimembris* samples from Southern California. Separate symbols are used for each subspecies, and for the three separate population samples of the endangered *P. l. pacificus* (Pacific Pocket Mouse); the size of the symbol indexes the number of individuals with that particular haplotype. Small solid circles along interconnecting lines are the number of mutational steps separating adjacent haplotypes in the network, and dotted lines identify alternative network connections. Arrows indicate the placement of the 432 bp haplotypes recovered from the historic samples of *pacificus* in the collection of the Museum of Vertebrate Zoology relative to the larger network.

populations over the past 70 years (Table 3). No demonstrable temporal effect is apparent, however, as only 6.5% of the total pool of haplotype variation can be attributed to comparisons between the historic and extant samples, an amount that is not significantly different from zero ($p = 0.302$). Most of the variation is again found among populations within each temporal period (54.4%) or is apportioned to individual differences within populations (39.1%).

Gene flow, past and present

As emphasized by Moritz (1994a), even with statistically adequate sample sizes it is difficult to obtain estimates of population size or migration rates that are accurate in the short term through the use of any set of genetic markers. This is particularly true for mtDNA genes, which are more prone to the stochastic effects of drift because of their smaller effective size relative to nuclear markers. Moreover, the maternal inheritance of mtDNA means that any gene flow estimates are those of females only, and are thus likely to be biased towards low levels in organisms, like mammals, where female philopatry and male dispersal are typical. Given these caveats, therefore, our data at best provide a qualitative perspective on the historical connectedness among samples of female pocket mice. Certainly, the exact numbers should be accepted with care, and Y-chromosome markers would be needed to obtain complementary measures for males.

For populations of *P. longimembris* of Southern California, pair-wise $\hat{M}$ values, Slatkin's (1993) estimate of Nm, range from 0.112 (between the Dana Point sample of *pacificus* [locality 14] and *internationalis* [locality 12]) to 10.999 (between *internationalis* and eastern *bangsi*), with a mean of 1.175 for the 78 comparisons. All samples of *P. longimembris* from the Mohave Desert north of our major sample area (Figure 1) are "connected" by relatively large $\hat{M}$ values (5.5 to 7.6) despite quite large straight-line distances among them (maximum approximate distance = 130 miles, average distance = 69.6 miles).

Clearly, populations of this species have the capacity to exchange genes, or at least be genealogically connected, over respectable distances. The relatively high connectedness among samples from the Mojave Desert contrasts sharply with data for samples from Southern California. In this focal sample area, the mean $\hat{M}$ value is 0.814, only 8 pairwise comparisons are above 1.0, and those that are range to a maximum of 2.71 (between western *bangsi* and eastern *brevinasus*, sample sites that are approximately 6 miles apart). For samples of *pacificus*, all $\hat{M}$ values are less than 1.0, with the exception of those between the two San Mateo samples ($\hat{M}$ = 4.1379) and between San Mateo North and Oscar One ($\hat{M}$ = 1.6588). The Dana Point sample exhibits uniformly low $\hat{M}$ values to other samples (0.4956 to 0.6069), suggesting that it has been relatively isolated from these for a period of time. Similarly, estimates of $\hat{M}$ among the historic samples are all below 1.0 (range, 0.1696 to 0.4170), indicting that the pattern of relative isolation between the extant samples at Dana Point and Camp Pendleton is qualitatively the same as that among population samples taken 70 years ago. Assuming that these estimates of $\hat{M}$ are accurate, then values among the sampled populations of *P. longimembris* throughout Southern California are, for the most part, below the threshold of 1.0 whereby populations are likely to diverge by genetic drift alone (Mills and Allendorf 1996).

Historical population demography

Estimates of g, the population growth parameter, for Dana Point (g = 664.5496, sd = 84.3272), San Mateo (g = 1206.3342, sd = 203.1894), and Snow Creek (g = 3359.2727, sd = 414.8081) are each positive and significantly different from zero (using a conservative estimate of $g > 3 \times$ standard deviation). This suggests that each population has experienced population expansion since the last coalescent event in their respective haplotype genealogies (Kuhner et al. 1998). This conclusion is consistent with the relatively large negative estimate of Fu's (1997) F_S, especially so for samples of *pacificus* (–6.4394; Table 2), which is nearly significant and also in the direction of expected population expansion (p = 0.024; statistical significance at the a = 0.05 level for Fu's test is a p-value of 0.02; see Schneider et al. 2000: 90). The standardized estimates of g are two to three times higher for the Snow Creek sample than for either sample of *pacificus* (7.182 versus 2.687 and 1.979, respectively).

The indication of exponential growth for samples of *pacificus* is at odds with actual estimates of population size based on current demographic studies. Spencer et al. (2000a) summarized trapping studies performed at Dana Point from 1993 to 1998 and estimated the total population at approximately 25 to 36 individuals. More recently, an intensive trapping effort during 2001 that was designed to obtain a complete population count captured only 4 individuals at Dana Point (U.S. Fish and Wildlife Service, unpublished data). Spencer et al. (2000a) also estimated the two San Mateo sites to support no more than 50 individuals each and the largest extant population (Oscar) to support in the neighborhood of 1,000. Clearly, growth estimates based on our genetic samples reflect a longer history than the likely demographic impacts of severely restricted habitat that characterize these populations today. Rogers and Harpending (1992), for example, have shown that the time scale for populations to reach genetic equilibrium after a decline is an evolutionary one, measured in units of hundreds or thousands of generations ($1/2\mu$, where μ is the mutation rate). Several empirical studies, including that of the endangered Stephens' Kangaroo Rat (*Dipodomys stephensi*; Metcalf et al. 2001) distributed over much of the same region in Southern California, and coconut crabs from the Pacific (e.g., Lavery et al. 1996), have documented genetic signatures of expansion even in severely declining populations of endangered species. Consequently, the genetic data we report here for *pacificus* should be taken in this light, and certainly do not suggest that the species is currently enjoying a population expansion or is unworthy of protection.

Conclusions and prospectus

The combination of (1) most samples with unique haplotypes that generally group into genealogical clusters (Figure 3); (2) lack of haplotype sharing among any subspecies or between most populations, even those geographically adjacent; (3) a substantial degree of apportionment at the level of geographic area (Table 3); and (4) low estimates of inter-population gene flow suggests that each subspecies of *P. longimembris* in Southern California and most of their member geographic units and/or populations have been genetically relatively independent for a reasonable period of time. Samples from the Mojave Desert where gene flow rates, as measured by $\hat{M}$ values, are uniformly high offer exceptions to this

general trend. Nevertheless, either local populations must have remained sufficiently large to prevent the loss of genetic variation, despite opportunities for drift, or these populations have remained of similar size regardless of the degree of habitat modification they have experienced. Indeed, historical population expansion is supported by the few available estimates of the genealogical growth parameter, *g*. Otherwise, with such low levels of gene flow among populations, both the different subspecies, if not many local populations, might be expected to exhibit a greater degree of reciprocal monophyly of haplotypes then they do. While it does seem clear from the network (Figure 3) that the subspecies are "moving" in the direction of reciprocal monophyly, none have reached this degree of differentiation. The anecdotal record of occasional population outbreaks (which would presumably lead to momentary increases in interpopulation "connectedness") interspersed temporally with more typically small-sized but persistent local populations (von Bloeker 1928) is fully consistent with these observations.

We offer two concluding comments on the utility of these types of data relative to the conservation of these mice, and other taxa. The first concerns whether or not any of these populations or subspecies of *P. longimembris* represent an Evolutionarily Significant Unit (ESU) as applied under the federal Endangered Species Act. Although each population is generally separable in the haplotype network (Figure 3), none is reciprocally monophyletic for their mtDNA genealogy, and hence none meet a strict definition of an ESU based purely on neutral genetic markers (e.g., Moritz 1994b). However, such a stringent criterion has been strongly debated and is being replaced by an emerging consensus that ESUs should be evaluated along two axes – molecular genetic diversity and adaptive diversity (Crandall et al. 2000; DeWeerdt 2002; Frazer and Bernatchez 2001; Moritz 2002). Neutral genetic markers (e.g., mtDNA) reflect the evolutionary history of a population and remain a primary method of measurement along the first axis. The second axis, adaptive diversity, can be measured either by investigating the genetic bases of adaptive traits (e.g., studying functional nuclear genes) or by investigating meaningful ecological differences between populations. The overall goal of defining ESUs thus becomes one that conserves both the products and the processes of evolution (Moritz 2002), a shift in focus from defining isolated products of evolution to investigating and protecting historical levels of gene flow between them (DeWeerdt 2002).

Based on such thinking, Frazer and Bernatchez (2001) argue that an ESU should be defined as a "lineage demonstrating highly restricted gene flow from other such lineages within the higher organization level (lineage) of the species" (Frazer and Bernatchez, 2001: 2742; see also Crandall et al. 2000 and Moritz 2002). By this definition, which emphasizes the degree of both ecological and genetic exchangeability (in the sense of Templeton 1989), the Federally listed Pacific Pocket Mouse (*P. l. pacificus*) is clearly an ESU. Indeed, a case could even be made for recognizing its separate populations as ESUs. An alternative interpretation of our results – based purely on the one axis of molecular genetic diversity – supports considering a combined grouping of *pacificus*, *brevinasus*, and western *bangsi* populations as one ESU, separate from eastern *bangsi*, *internationalis*, and Mohave populations of *longimembris*. This alternative nearly meets the strict definition of an ESU based on reciprocal monophyly. Nevertheless, we strongly suspect that the yet unstudied second axis – that of adaptive variation – would support defining *pacificus*, and perhaps other subspecies and populations of *P. longimembris* from Southern California, as separate ESUs, due to the extensive ecological differences each exhibits. The Pacific Pocket Mouse, for example, lives immediately along the Pacific coastline, which differs dramatically in climate, geology, vegetation, animal communities, and seasonal phenology from the interior deserts and valleys occupied by the other subspecies (Goudey and Smith 1994; Miles and Goudey 1998). Although detailed comparative studies of adaptive variation among these populations are not available, these environmental differences are so strong that the scientific peer committee overseeing recovery research for *pacificus* concluded that no other subspecies represented a valid research surrogate for investigating its biology (Spencer et al. 2001).

Finally, we simply reiterate that the genetic "signature" of extant populations is the result of the history of those populations, including their demographic characteristics and degree of genetic connection with others. It should not be a surprise, therefore, that extant populations of *pacificus* appear little different in their degree of molecular diversity or geographic structure and relative isolation than historical samples of this taxon taken more than 70 years earlier. It should also not be unexpected to record genetic characteristics indicative of exponential growth even in

populations, such as at Dana Point, where current estimates are of exceedingly low numbers of individuals. It takes time for the measured genetic characteristics of an extant population to reflect its immediate past history, and clearly the 40 years or so of increasing isolation and reduction in habitat and population numbers at Dana Point has been insufficient to override this deeper genetic history. What population genetic theory allows us to predict with some degree of confidence, however, is that if the current demographic conditions at Dana Point continue into the foreseeable future, loss of diversity must necessarily occur (Luikart et al. 1998). Indeed, Dana Point already exhibits the lowest haplotype diversity of any sample of *P. longimembris* from Southern California, including the other two extant populations of the Pacific Pocket Mouse at nearby Camp Pendleton.

Acknowledgements

Dr. Jesus Maldonado, in the laboratory of Professor Robert Wayne at UCLA, extracted the DNA from an initial set of six individuals of the Pacific Pocket Mouse; we thank both for their generosity in providing these extracts. Vouchered specimens were collected under auspices of the California Department of Fish and Game, hair samples from released Pacific Pocket Mice were collected by personnel of the PPM Recovery Team, and funding for the laboratory analyses was underwritten by grants from the National Science Foundation (to JLP) and US Fish and Wildlife Service and California Department of Fish and Game. We are grateful to Mark Pavelka, US F&WS, for logistic and other support, and to Marjorie Matocq and Fred Allendorf, plus two anonymous reviewers, for improving the contents and presentation of the manuscript.

Appendix

List of localities from which specimens were examined, grouped into pooled samples used in all analyses. Those for the four subspecies from southern California are numbered as in the map, Figure 1; all samples of *P. l. longimembris* come from the Mojave Desert of California (inset in Figure 1). Voucher specimens, when preserved, are identified by their Museum of Vertebrate Zoology (MVZ) catalog number.

Perognathus l. longimembris. **West** – Kern Co., 6 mi N and 5 mi E Rosamond (n = 3; MVZ 182710–182712); 7 mi N and 5.5 mi E Rosamond (n = 1; MVZ 182713); San Bernardino Co., 6 mi WSW Boron (n = 1; MVZ 182347); 2 mi E Searles Station (n = 4; MVZ 145699–145702). **East** – San Bernardino Co., 5 mi ENE Yucca Valley (n = 1; MVZ 195957); Pisgah lave flows (n = 1; MVZ 195191); Halloran Spring (n = 1; MVZ 195190).

Perognathus l. bangsi (Palm Springs Pocket Mouse). **East** – Riverside Co., [1] 0.2 mi W Rancho Dos Palmas (n = 1; MVZ 195955), [2] Shavers Valley, 9 mi E Cactus City (n = 5; MVZ 195954); [3] Indio Hills, Pushawalla Canyon (n = 3; MVZ 184650). **West** – Riverside Co., [4] Snow Creek (n = 10; MVZ 184653–184661); [5] 0.5 mi W and 0.1 mi S Palm Spring Station (n = 1; MVZ 184651); [6] 0.4 mi E Dos Palmas Spring (n = 1; MVZ 184652); San Diego Co., [7] 3.3 mi S Borrego Springs (n = 2; 184663–184664); Imperial Co., [8] Crucifixion Thorn Reserve (n = 1; MVZ 184644).

Perognathus. l. brevinasus (Los Angeles Pocket Mouse). **East** – Riverside Co., [9] 1 mi E Cabezon (n = 6; MVZ 184645–184649). **West** – [10] Etiwanda Wash (n = 2; MVZ 182968–182969); [11] Temecula Creek, Pauba Valley (n = 1; MVZ 182967).

Perognathus l. internationalis (International Pocket Mouse). **North** – San Diego Co., [12] west side San Felipe Creek, 2.5 mi N S2 on Hwy 78 (n = 2; MVZ 182970–182971), San Felipe Valley, 3.9 mi S San Felipe (n = 1; MVZ 182972). **South** – [13] 6.7 mi S Jct Hwy S2 and S22 (n = 2; MVZ 182973–182974), 7.2 mi S Jct Hwy S2 and S22 (n = 1; MVZ 182975).

Perognathus l. pacificus (Pacific Pocket Mouse). **Extant samples**: Orange Co., [14] Dana Point Reserve (n = 27; MVZ 195949); San Diego Co., [15] San Mateo North (n = 5; no vouchers) and San Mateo South (n = 10; no vouchers), Camp Pendleton Marine Corps Base; [16] Oscar One, Camp Pendleton Marine Corps Base (n = 6; MVZ 195951–195952). **Historic samples**: Orange Co., [17] 0.5 mi NW El Segundo (n = 1; MVZ 74750); San Diego Co., [18] Oceanside (n = 6; MVZ 47101–47106); [19] mouth Tiajuana River (n = 5; MVZ 47312–47316).

Outgroups used in phylogenetic analyses: *Perognathus amplus pergracilis* (MVZ 149946 – Arizona: Mohave Co.; 10.2 mi NE Oatman). *Perognathus inornatus inornatus* (MVZ 182713 – California: Tulare Co., Pixley National Wildlife Refuge). *Perognathus inornatus neglectus* (MVZ 182836 – California: Contra Costa Co., Horse Valley, 4 mi S Antioch).

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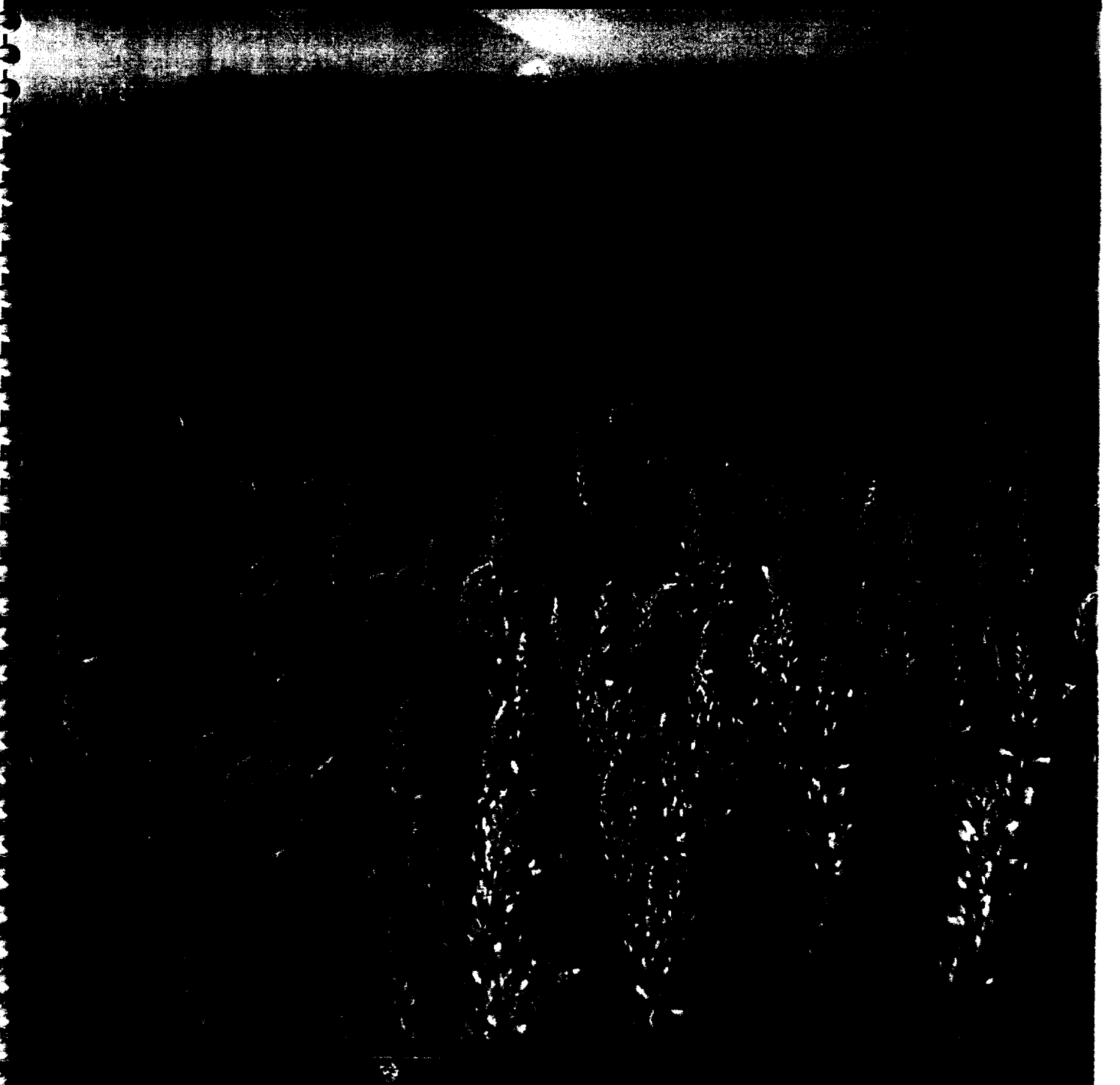
On The Global and Regional
Ecological Significance of Southern Orange County:

Conservation Priorities for a Biodiversity Hotspot



October 2001

CONSERVATION BIOLOGY INSTITUTE

On The Global and Regional Ecological Significance of Southern Orange County:

Conservation Priorities for a Biodiversity Hotspot

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October 2001

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TABLE OF CONTENTS

	Page
Table of Contents	i
List of Tables	i
List of Figures	ii
Acknowledgements	iii
Executive Summary	v
Introduction and Overview	1
Information Sources and Limitations	2
Biodiversity Hotspots	3
California's South Coastal Hotspot	4
Effects of Human Development and Gaps in Ecosystem Protection	7
Analyzing Conservation Priorities	10
Gaps in Protection for the Coastal Foothills and Terraces	11
Southern Orange County -- The Heart of a Hotspot	16
Vegetation Communities and Environmental Gradients	18
Profiles of Key Resources	20
Conservation Priorities in Southern Orange County	30
Principles of Conservation Planning	30
Core Biological Resource Units	31
Conclusions	37
References	38

LIST OF TABLES

		Page
Table 1	Characteristics of the largest remaining unprotected land areas in the Coastal Hills and Coastal Terraces Ecological Subsections	13
Table 2	Vegetation communities and land cover for the Southern Orange County NCCP Subregion	18
Table 3	Recorded locations of selected songbirds in the Southern Orange County NCCP Subregion	22
Table 4	Number of nesting locations recorded in the Southern Orange County NCCP Subregion for selected raptor species	23
Table 5	Recorded locations of selected amphibians, reptiles, and invertebrates in the Southern Orange County NCCP Subregion	25
Table 6	Rare plant species in the Southern Orange County NCCP Subregion	28

LIST OF FIGURES

		Page
Figure 1	The 25 global biodiversity hotspots	3
Figure 2	Biodiversity hotspots in the continental U.S. and Hawaii	5
Figure 3	California's South Coast Ecoregion showing ecological sections and subsections	6
Figure 4	Land protection status in the Coastal Hills and Coastal Terraces Ecological Subsections	12
Figure 5	Vegetation communities in the Southern Orange County NCCP Subregion	19
Figure 6	Distributions of key species in the NCCP Subregion outside of Cleveland National Forest	21
Figure 7	Core Biological Resource Units in the Southern Orange County NCCP Subregion	32

Acknowledgements

The following conservation scientists (listed in random order) reviewed and commented on earlier drafts of this report: Dr. Jonathan Atwood, Dr. Ted Case, Dr. Paul Beier, Dr. Tom Scott, Dr. Michael Allen, Dr. Paul Zedler, Dr. Michael O Connell, Dr. John Rotenberry, Dr. Hartmut Walter, Ms. Trish Smith, Dr. Jon Keeley, Dr. Michael Horn, Mr. Pete Bloom, Dr. James Strittholt, Dr. Robert Fisher, Mr. Fred Roberts, Dr. Jay Diffendorfer, Dr. Philip Behrends, and two anonymous reviewers. The comments of these individuals greatly strengthened the content of this report. We do not imply that peer review constitutes an endorsement of the report by these individuals or their institutions, although many of them voiced support for the findings and recommendations herein.

The Rancho Mission Viejo Corporation and Dudek & Associates provided maps and data for the Southern Orange County NCCP Subregion. Additional data were provided by Mr. Pete Bloom, Mr. David Bittner, and the U.S. Fish and Wildlife Service. Figure 1 was reprinted with permission of Conservation International, and Figure 2 with permission from The Nature Conservancy. Dr. James Strittholt of the Conservation Biology Institute prepared final report graphics and spatial analyses.

Executive Summary

This report summarizes available scientific information establishing the crucial role that Southern Orange County could play in efforts to conserve biodiversity at both global and regional scales. The report outlines a conservation framework for the area, using principles of conservation planning to delineate four core biological resource units. These four resource units must be conserved essentially intact, without further internal fragmentation by development, to continue supporting key species and ecosystem processes. We present this information in support of the Natural Community Conservation Planning (NCCP) program for the Southern Orange County NCCP subregion.

South-coastal California is a biodiversity hotspot of global importance. Hotspots are those areas harboring the greatest concentrations of living species, especially those species found nowhere else on Earth (endemics). Together, 25 global hotspots identified by leading conservation scientists support more than 60 percent of the Earth s total species diversity, on only 1.44 percent of its surface. Concentrating conservation efforts in these relatively small areas therefore gains the greatest biodiversity value from limited conservation funds.

Much of Southern California s unique biodiversity is concentrated in the foothills and terraces along the Pacific coast, from Orange County to the Mexican border. Having thus far escaped the urban sprawl that has reduced and fragmented natural habitats throughout southern California, southern Orange County supports a last best representation of this globally unique ecosystem. In concert with adjacent federal lands (Cleveland National Forest and Marine Corps Base Camp Pendleton), this large undeveloped block of natural habitat supports the broadest remaining array of natural environmental gradients and ecosystem processes in the south-coastal landscape. Southern Orange County and adjacent public lands support core populations of many imperiled wildlife species. The area's outstanding biological attributes include the following:

- Seven federally threatened or endangered species and critical habitat (areas designated by the U.S. Fish and Wildlife Service as essential to species survival and recovery) for three of these.
- Approximately 50 to 56 percent of the total remaining population of coastal cactus wrens—the single most important breeding area for this rare endemic bird.
- Approximately 15 to 25 percent of the California gnatcatchers in the U.S. the country's largest contiguous population of this threatened species.
- Portions of the last remaining undammed and undiverted major drainage in all of southern California San Mateo Creek is the most pristine coastal stream south of the Santa Monica Mountains and supports the southernmost population of the endangered steelhead trout.

- A tremendous diversity of nesting raptors (hawks, owls, eagles, and falcons) with over 330 recorded nest sites and 15 species including a critical foraging area for one of the last remaining golden eagle pairs in Orange County.
- Significant areas of native California grasslands, an imperiled vegetation community that exists here in natural mosaic with other diverse habitats as much of south-coastal California once appeared.
- Healthy populations of mountain lions and mule deer, which require large and intact wildlands to survive.
- Some of the largest remaining populations of certain rare plant species within some of the last and best examples of such rare ecological communities as southern alkali marshes and alkali grasslands.

Based on these biological facts, principles of conservation biology and planning, and guidance provided by the Southern Orange County NCCP Science Advisors, we mapped those areas most critical to retaining these resource values in the region. *Four core biological resource areas (Arroyo Trabuco, Chiquita, San Juan, and San Mateo) must be conserved essentially intact, without further internal fragmentation, significant reduction in size, or degradation by development, to retain these resources and the ecosystem processes they depend upon.* Conserving private lands within these four areas would consolidate a large ecosystem reserve in conjunction with adjacent existing protected areas, such as the San Mateo Canyon Wilderness Area, Cleveland National Forest, Caspers Wilderness Park, Rancho Mission Viejo Conservancy, and Audubon Starr Ranch Sanctuary.

The findings and recommendations of this report should help guide NCCP planning for the Southern Orange County NCCP subregion, which is the last best hope to conserve a large, ecologically intact representation of the globally unique coastal foothills and terraces ecosystem. This hope can be achieved through the NCCP process as long as society agrees that these resource values are irreplaceable.

Introduction and Overview

> "It has long been my opinion that this area [southern Orange County] stands in a class by itself as our ONLY opportunity to conserve a large, unfragmented, ecologically intact portion of southern California's coastal ecosystems. The regional and global significance of this area cannot be overstated."
>
> Dr. Paul Beier
> Northern Arizona University

Most Southern Californians remain unaware that a globally significant ecological jewel lies near the heart of their region—a relatively intact and functioning ecosystem that rates as a global "hotspot" of biological diversity and conservation value. Having so far escaped the urban sprawl enveloping much of south-coastal California, the undeveloped lands of southern Orange County represent one last large and relatively undisturbed block of what was once a more extensive and unique ecosystem—the southern coastal foothills of the California Floristic Province.

Little remains of the natural habitats that once covered the coastal foothills and terraces that drain toward the Pacific Ocean between Los Angeles and Tijuana. Over 85 percent of the coastal sage scrub habitat has been converted to houses, roads, and golf courses; the native grasslands are all but lost to development and weedy invasions; and all but one major stream has been dammed and diverted. But what remains of this unique ecosystem still supports an assemblage of plants and animals dazzling in its variety and unlike any other in the world. The information summarized in this report suggests that a remarkably intact representation of this remnant ecosystem lies in southern Orange County, in an area large enough to support core populations of key wildlife species and to allow for the continued action of natural ecological processes and cycles. Unfortunately, many of these species and ecological functions are threatened with extinction unless large, interconnected habitat areas are conserved essentially intact, without further fragmentation by roads or other development.

Objectives of This Report

- Summarize available information to educate decision-makers and the public about the unique biological resources of Southern California and the Southern Orange County NCCP subregion.
- Use principles of conservation planning to delineate core resource areas that must be conserved intact to retain these unique resource values.

Southern Orange County is a "subregion" under the State of California's Natural Community Conservation Planning (NCCP) program. The 1991 NCCP Act seeks to sustain multiple species on a landscape level, while accommodating economic development outside of preserve areas. The Southern California NCCP Conservation General Process Guidelines (California Department of Fish and Game 1998) require "conservation of habitat on an ecosystem level...based on recognized principles of conservation biology."

NCCP planning was recently reinitiated in the Southern Orange County Subregion after several years of hiatus. Unfortunately, development plans have proceeded piecemeal in the interim, precluding some opportunities for comprehensive ecosystem planning. In 1996 a panel of scientific experts was convened to ensure that NCCP planning efforts for the

subregion were informed by the best available science, as required by law. This report supplements the Science Advisors' guidance by translating pertinent biological data, guidelines, and principles into a conservation framework for the region that would provide for the continued viability of this unique, remnant ecosystem and its imperiled species.

We delineated four core biological resource units in southern Orange County using widely accepted principles of conservation planning and specific guidance provided by the Science Advisors. These areas support a diverse mosaic of native habitats over broad environmental gradients, including coastal sage scrub, vernal pools, alkali marshes, native grasslands, oak woodlands, and pristine riparian and aquatic communities. Together with adjacent wilderness reserves and federal lands, these four areas allow such wide-ranging species as the golden eagle, mule deer, and mountain lion to persist in south-coastal California. These four areas are also crucial to the continued viability and recovery of such rare species as the southern steelhead, California gnatcatcher, coastal cactus wren, arroyo toad and numerous other rare and endemic species. To maintain these species and the natural ecological processes that define this unique coastal ecosystem, these four areas must be conserved without further internal fragmentation or substantial reduction in size.

Data Sources

Digital Map Information

Multi-resolution Land Characterization Consortium, US EPA/USGS, 1999, National Land Cover

California Gap Analysis Project, UC Santa Barbara Biogeography Lab, 1998, Land Status and Ownership

Bureau of Land Management, 1999, Land Ownership

GreenInfo Network, 2001, California Protected Areas

USGS digital elevation model (30 and 90 meter)

Teale Data Center, 1997, Transportation Digital Line Graph, 1:100,000

US Forest Service, 2000, Ecological Subsections

Conservation International, 2000, Global Biodiversity Hotspots

California Department of Conservation, Farmland and Mapping Monitoring Program (FMMP), 1996, Urban Areas

Paper Maps

Dudek & Associates, 1998b, Vegetation, 1:48,000 and 1:24,000

Dudek & Associates, 1998c, Species Locations, Selected Plants and Animals, 1:24,000

U.S. Army Corps of Engineers, 2000, Wetland Resources, Regulated Aquatic Resources, Riparian Vegetation, and Hydrogeomorphic Surfaces, ≈1:36,432

Information Sources and Limitations

We collected no new data for this report. Rather, we compiled and analyzed available scientific information from published and unpublished works, existing geographic data, data collected by field biologists, and expert opinion recorded by the Science Advisors and others.

This report does not analyze all species or issues that an NCCP plan document or environmental assessment must cover. Instead, we present information on selected resources and issues that we believe deserve high priority in designing a viable preserve for the subregion.

Biodiversity Hotspots

Since the British ecologist Norman Myers conceived the hotspot concept in the late 1980s, it has become an essential tool for setting conservation priorities throughout the world. Hotspots are those areas harboring the greatest concentrations of living species, especially those species found nowhere else on Earth (endemics). By concentrating conservation efforts in these relatively small samples of the Earth's surface, we theoretically gain the greatest "bang for the buck" from limited conservation funds.

Key Terms and Concepts

Biodiversity: The array of life on Earth, including all its different organisms, their genetic codes, and their interconnections within ecosystems and communities.

Biodiversity Hotspots: Those spatially limited areas of Earth supporting the greatest concentrations of living species, especially those endemic to a region.

Ecosystem: A dynamic complex of plants, animals, and other organisms that interact with one another and their non-living environment as a unit.

Endemic Species (Endemism): Species restricted in distribution, occurring nowhere outside a defined geographic area, such as a particular ecoregion.

Leading conservation scientists have identified 25 global biodiversity hotspots (Figure 1). The naturally vegetated portions of these 25 hotspots comprise only 1.44 percent of the Earth's land surface, but support about 70 percent or more of all vascular plant species. Moreover, as measured by species endemic to only a single hotspot, these 25 hotspots account for 44 percent of all plant diversity, 35 percent of all terrestrial vertebrate species, and 75 percent of all terrestrial animal species listed as threatened by the IUCN-World Conservation Union.

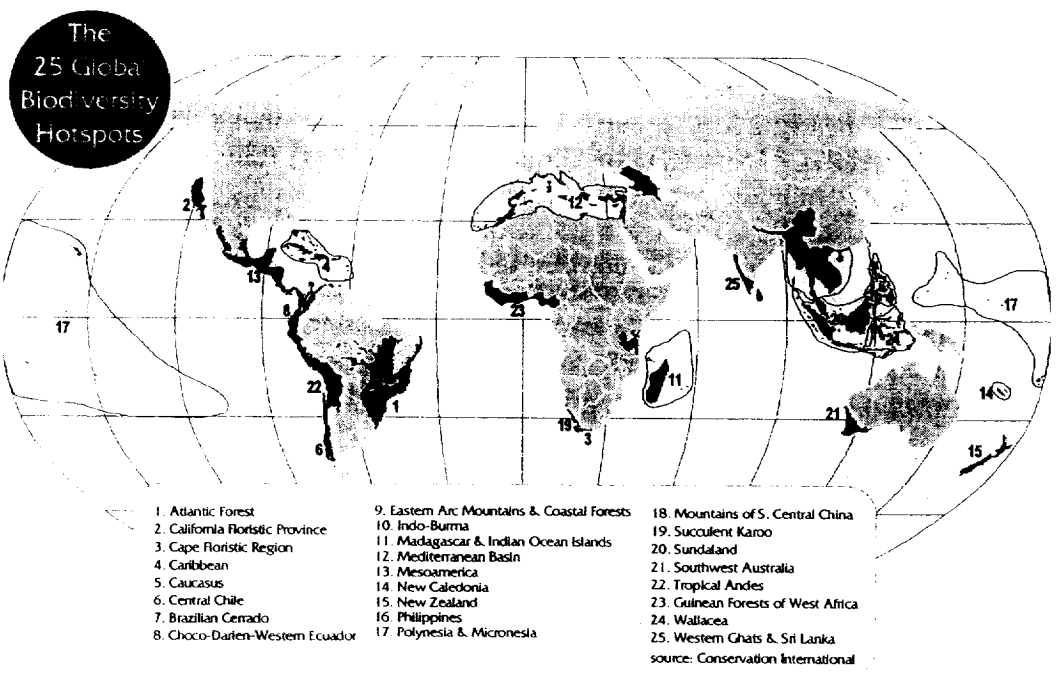

Figure 1 – The 25 global biodiversity hotspots (Mittermeier et al. 1999).

Overall, this 1.44 percent of the Earth's surface appears to account for roughly 60 percent or more of the remaining diversity of life on Earth, considering all groups of species (Mittermeier et al. 1999, Mittermeier et al. 1998). Although we cannot discount the species and habitats outside of these hotspots as unworthy of conservation, the hotspots clearly represent areas of concentrated biodiversity and high conservation priority.

California's South Coastal Hotspot

> "We always tend to equate biodiversity only with places like Brazil or Indonesia. But as you look more deeply, you begin to realize that it's as if North Americans have won the biological lottery, but forgot to look at the ticket."
>
> Dr. Eric Dinerstein
> Chief Scientist, World Wildlife Fund

The hotspot concept has been studied and applied by numerous biologists to identify conservation priority areas using different groups of species, different spatial and temporal scales, and different analytical techniques (for example, by mapping plant diversity, the number of endemic species, or the number of threatened and endangered species across the globe, or across the United States). Regardless of the techniques, scales, or species used, these analyses invariably identify south-coastal California as a hotspot for species diversity, endemism, endangerment, and conservation priority (Myers 1988, Myers 1990, Kiester et al. 1996, Dobson et al. 1997, Flather et al. 1998, Mittermeier et al. 1998, Wilcove et al. 1998, Mittermeier et al. 1999, Griffin 1999, Rickets 1999, Myers et al. 2000, Stein et al. 2000, Rutledge et al. 2001).

For example, Wilcove et al. (1998) identified hotspots within the United States for all federally listed threatened and endangered species. They found south-coastal California to be a hotspot for nearly every group of species, including plants, invertebrates, birds, mammals, and reptiles. Most recently, Rutledge et al. (2001) tested how this endangered species hotspot pattern holds within the United States when examined across different time spans—beginning in 1967 when the government started listing species. Unlike other hotspots that were added or subtracted from the hotspot list over time (due, for example, to changing priorities in species listing), the southern California hotspot endured throughout the entire study period.

Figure 2 shows one recent hotspot map for the continental United States and Hawaii. The map indicates major concentrations of imperiled species (as listed by the country's state Natural Heritage Programs), weighted by the rarity of each species (those with the smallest geographic ranges count most). This weighting scheme assumes increased conservation significance for areas supporting large numbers of rare species that occur nowhere else. Hence, these hotspots represent "irreplaceable" places for preventing species extinctions (Stein et al. 2000). By this method, south-coastal California stands out as one of the six greatest hotspots for imperiled species in the U.S. Of these six hotspots, Southern California supports the second greatest number of federally threatened and endangered species after Hawaii (U.S. Fish and Wildlife Service 2001).

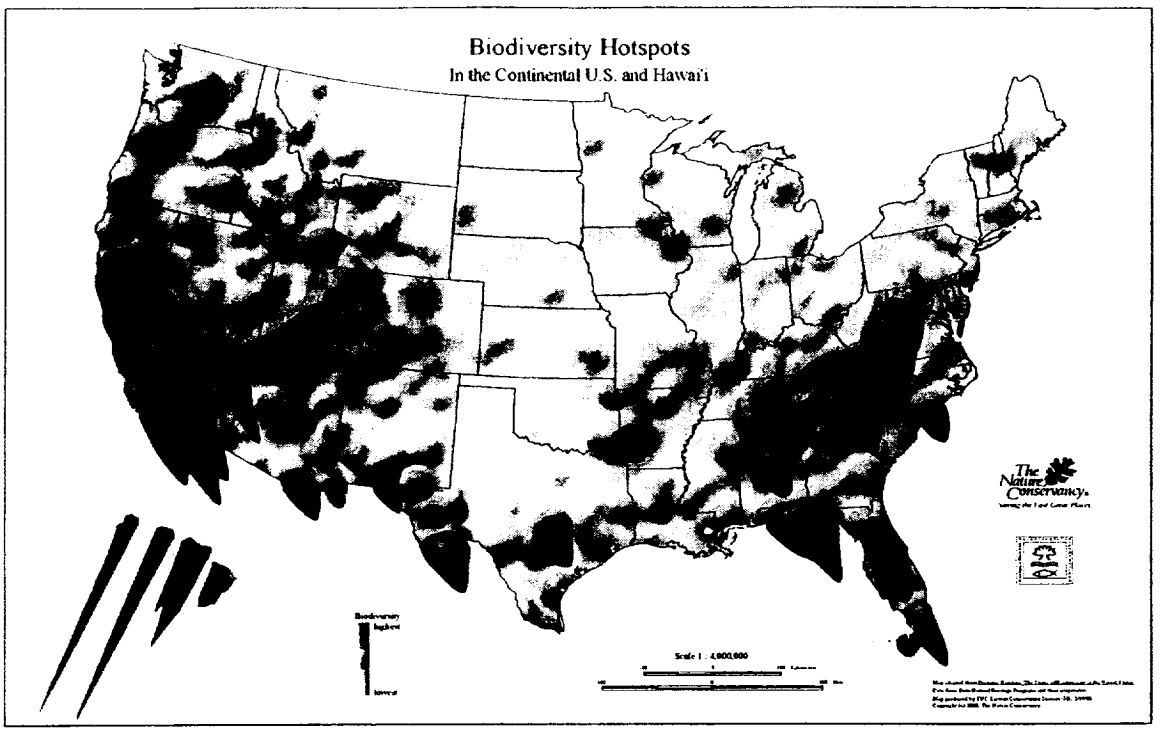

Figure 2 – Biodiversity hotspots in the continental U.S. and Hawaii (map courtesy of The Nature Conservancy, Stein et al. 2000).

Looking successively closer at biogeographic patterns shows south-coastal California to be a "hotspot within a hotspot," and southern Orange County to lie at its heart.

The Global Scale: The California Floristic Province—At a global scale, southern California lies within the California Floristic Province, which extends from southern Oregon to northern Baja and includes most of California west of the interior deserts and the Sierran Crest. It includes essentially all of the Pacific coast hotspots in Figure 2. This floristic province supports one of the richest plant assemblages in the world, supporting about 25 percent of all plant species occurring north of Mexico—and about half of these species are endemic to the province (Mittermeier et al. 1999, Raven and Axelrod 1978). Only five floristic provinces in the world are defined by Mediterranean climatic conditions (hot, dry summers and cool, moist winters, mediated by proximity to oceans). All five of these provinces are global hotspots, each with an exceptionally high proportion of endemic plants. Of the five, the California Floristic Province has the greatest diversity of soil types and moisture regimes (Stebbins and Major 1965), which further contributes to its wide array of plant communities and associated species—from Mediterranean shrublands (such as coastal sage scrub and maritime chaparral) to coniferous forests—and from perennial grasslands to alkali marshes, riparian forests, oak woodlands, and vernal pools.

The Continental Scale: The South Coast Ecoregion—Within the California Floristic Province, that portion lying generally south and west of the Transverse and Peninsular

mountain ranges along the Pacific coast comprises the South Coast Ecoregion (Figure 3). This ecoregion—bounded as it is by the Pacific Ocean and a dramatic series of mountain ranges—mixes a complex array of geological substrates, topographic features, climatic regimes, soil types, and other physical factors. The mountains also serve as barriers to plant and animal dispersal, thus isolating this area somewhat from other ecological communities and species. The result is a natural laboratory of speciation and ecological innovation that has made the South Coast Ecoregion a "hotspot within a hotspot." It supports more endemic plant and animal species (at least 138) and more imperiled species (158 and counting) than any other ecoregion in the U.S. (Stein et al. 2000). According to the California Department of Fish and Game (1996), this ecoregion supports more than one-third of California's native plant species on only 8 percent of the land area.

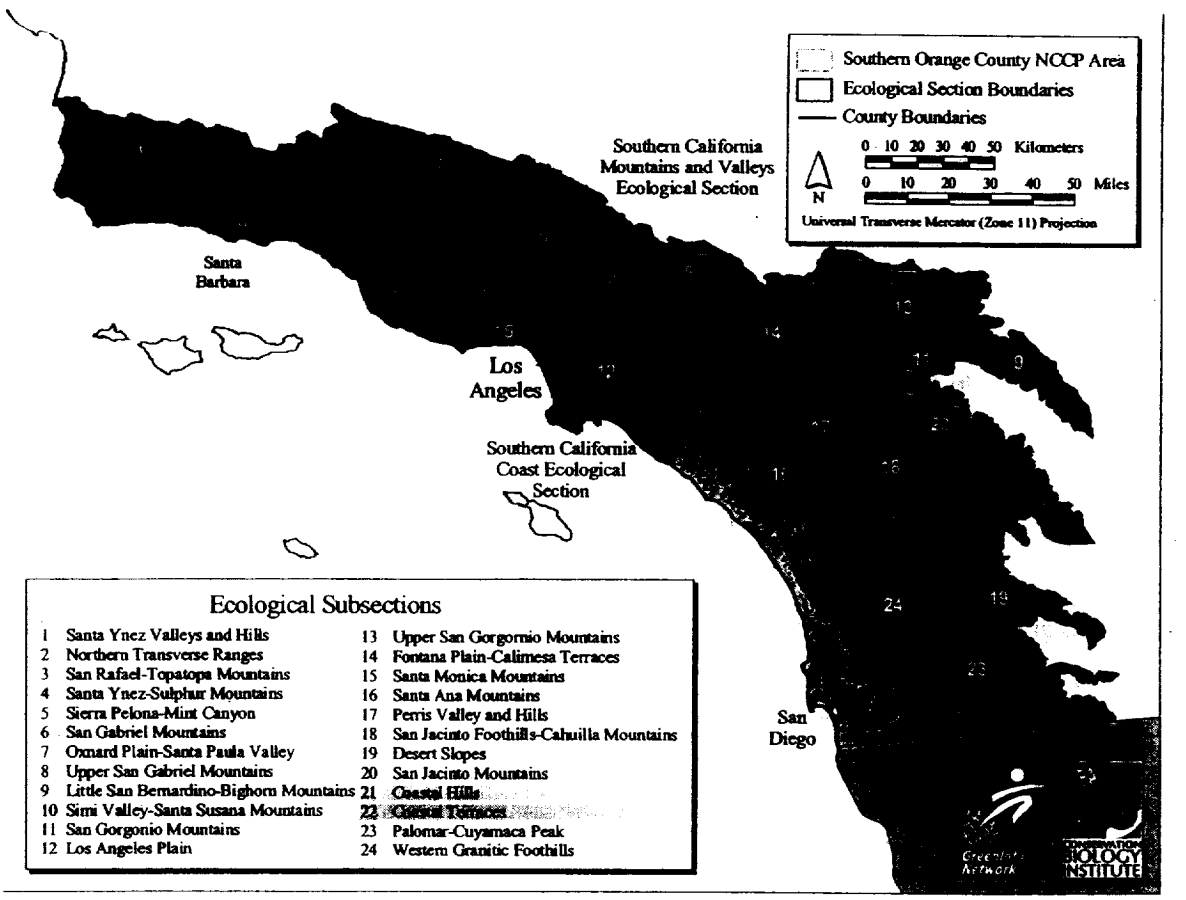

Figure 3 – California's South Coast Ecoregion showing ecological sections and subsections (Goudey and Smith 1994).

The Regional Scale: The Coastal Hills and Coastal Terraces Ecological Subsections—Much of the diversity and endangerment in the South Coast Ecoregion is concentrated in those areas closest to the coast, within two ecological subsections highlighted in Figure 3—the Coastal Hills and Coastal Terraces Ecological Subsections (as mapped by

the ECOMAP program: Bailey et al. 1994, Goudey and Smith 1994, McNab and Avers 1994). These gentle slopes draining to the Pacific are covered by coastal sage scrub and other associated vegetation communities whose distributions are limited by a unique combination of physical conditions, especially the Pacific Ocean's strong moderating effect on climate (Westman 1981, 1983; Miles and Goudey 1998). More than 100 threatened or endangered species are associated with coastal sage scrub vegetation (Atwood 1993, California Department of Fish and Game 1996), and the coastal foothills and terraces are widely considered to support among the greatest diversity of endemic plant species in North America (Stebbins and Major 1965, Stein et al. 2000).

The coastal foothills and terraces landscape is also favored by humans, which have developed most of it for their own uses. The resultant removal and fragmentation of the region's natural communities threatens many endemic species with extinction.

The Subregional Scale: Southern Orange County—Nearly all of the Southern Orange County NCCP Subregion falls within the Coastal Hills Ecological Subsection (excluding Cleveland National Forest lands, which lie in the higher elevation Santa Ana Mountains Ecological Subsection). Together with large adjacent habitat blocks in the Santa Ana Mountains and Camp Pendleton, this NCCP subregion supports a tremendous diversity of imperiled species within a globally unique ecosystem. As discussed in more detail below, southern Orange County and adjacent natural areas represent a last best example of the coastal foothills ecosystem. Thus, southern Orange County lies at the heart of a global biodiversity hotspot.

Effects of Human Development and Gaps in Ecosystem Protection

The principal causes of species endangerment are the direct removal or degradation of habitat and fragmentation of remaining habitat areas into smaller and more isolated blocks (Ehrlich and Ehrlich 1981, Diamond 1984, Wilcox and Murphy 1985, Noss and Cooperrider 1994, Noss et al. 1997, Flather et al. 1998, Stein et al. 2000, Czech et al. 2000). A review by Stein et al. (2000) found that about 85 percent of imperiled species in the U.S. are affected by habitat loss and fragmentation, 49 percent by alien species, 24 percent by pollution, 17 percent by overexploitation, and 3 percent by disease. In Southern California, the principal

Key Terms and Concepts

Edge Effects: Habitat degradation concentrated near the interface between natural and disturbed areas, such as increases in weedy species, pollutants, soil erosion and compaction, and predation by house pets.

Habitat Degradation: Human-induced changes in the physical, chemical, or biological properties of natural habitats that reduce their ability to support native species and ecological processes.

Habitat Fragmentation: The reduction of remnant habitats into smaller and more isolated blocks, each of which may be too small to continue supporting viable populations of species or ecosystem processes that operate over large landscapes, such as fire and hydrological cycles.

Internal Fragmentation: Fragmentation within otherwise contiguous habitat areas, thus creating "donut holes" in the habitat matrix.

causes of species endangerment are residential and industrial development (56 percent of endangered species), exotic species (52 percent), agricultural development (45 percent), heavy equipment, including military training (44 percent), and livestock grazing (36 percent) (Flather et al. 1998).

Considered in a slightly different way, the leading cause of species endangerment in California is urban sprawl—low-density, automobile-dependent development that sprawls into natural areas outside existing cities and towns. Sprawl is estimated to imperil 66 percent of the listed species in California (Czech et al. 2001). In addition to directly removing habitats required by native species, sprawl also fragments remaining habitat areas into small or isolated blocks, each of which may be too small to sustain natural ecological functions or populations of certain species. Fragmentation also increases adverse edge effects, such as incursions by exotic, weedy species, trampling by humans, predation by house pets, and changes in fire frequency or intensity. The following major factors of habitat degradation are of particular importance in southern Orange County.

Internal Fragmentation—All else being equal, habitat removal from the interior of a habitat area is more deleterious than habitat removal around the edges. Simple geometry dictates that internal fragmentation by development "bubbles" or "donut holes" within natural landscapes causes greater edge effects than an equal area of development at the habitat edge. Moreover, the adverse effects of these internal edges occur where they generally do the most harm to native species and ecological processes. "Leap-frog" development patterns that create internal fragmentation also require new roads, utility lines, and other infrastructure across the intervening habitat, thus further compounding adverse effects on native species and ecological processes. For example, the Wildlife Research Institute reports that 67 percent of all golden eagle deaths in Southern California since 1987 have been caused by collisions with electrical distribution and transmission lines, which is considered a leading cause in the species' decline here (D. Bittner and P. Bloom personal communication).

Roads—Roads, in particular, cause increased edge effects, direct mortality via road kill, disruption of natural migration or movement patterns, interference with species communication, changes in water runoff and flow patterns, and air, water, and soil pollution (Trombulak and Frissell 2000, Forman and Deblinger 2000, Jones et al. 2000, Reijnen et al. 1997). During Beier's (1993, 1995) study of mountain lions in the Santa Ana Mountains, vehicles killed 33 percent of the population, including four lions killed at one road crossing during a 2-year period. Horn et al. (1993) predicted that planned roads in Orange County would help to complete the already partial isolation of existing reserves, leading to further species extinctions in the region.

Changes in Fire Regimes—Southern California vegetation communities have evolved with fire, which typically burned Mediterranean shrub communities at intervals of 20 to 50 years (Keeley 1986). Overly frequent fires may "type-convert" shrublands to grasslands. The establishment of exotic annual grasses provides a fuel load that decreases the return interval between fires, creating a positive feedback loop that favors non-native grasses over native species even more (Minnich and Dezzani 1998). On the other hand, fire suppression by man

leads to ecological stagnation and increased fuel loads—with larger, hotter, catastrophic fires as the eventual result. Maintaining natural fire cycles is therefore essential to retaining natural ecosystems and native species in Southern California. Achieving this goal requires large native landscapes of many thousands of acres to allow for natural fire and successional patterns to persist away from areas of human habitation.

Changes in Hydrology—Many southern California habitats and species also depend on the natural flood-scour-deposition cycles in watersheds unaltered by dams, diversions, irrigation, or vegetation removal. These natural hydrological cycles are necessary to replenish nutrients, create openings, refresh riparian vegetation communities, replenish sands in coastal estuaries and on beaches, and open coastal lagoon mouths. Exotic plants, fishes, and amphibians are also far more common in drainages with altered hydrology, and are primary causes of endangerment for numerous aquatic and riparian species (Swift et al. 1993, Jennings and Hayes 1994, Stephenson and Calcarone 1999). Thus, maintaining natural watershed areas and their hydrological processes is essential for retaining many imperiled species.

Pollution—Air and water pollution, especially coupled with changes in natural fire regimes and hydrological processes, have significantly degraded habitats throughout much of Southern California (Zedler et al. 1983, Zedler 1995, Minnich and Dezzani 1998, Allen et al. 1996, Stephenson and Calcarone 1999). Increased nitrogen input into soils from automobile exhaust greatly favors weedy annual species over native perennial species (Allen et al. 1996). When this effect is combined with invasion of exotic grasses and unnaturally frequent fires, coastal sage scrub and other native communities are rapidly converted to non-native grasslands or weedy fields (Minnich and Dezzani 1998). This process is likely to accelerate under global climate change, as discussed below (Field et al. 1999, M. Allen personal communication).

Climate Change—Climate models suggest that Southern California will experience increased winter precipitation, hotter and drier summers, and more severe El Niño events (Field et al. 1999). One effect of these changes will likely be a general shift in the distribution of vegetation communities and individual species to higher elevations and latitudes (Field et al. 1999). Simulation models suggest that this ecological migration will occur at an average rate of about 0.1 to 1 kilometer per year (Malcolm et al. 2001). The availability of broad elevational and other ecological gradients within contiguous habitat areas is critical to accommodate such changes in ecological conditions and species distributions. The primary effect of climate change on Southern California's vegetation will likely be further expansion of non-native grasslands into areas currently dominated by coastal scrub and chaparral, especially in areas suffering from altered fire regimes and air pollution (Field et al. 1999). Southern Orange County may be less susceptible to this exotic encroachment than other areas in Southern California due to its relatively clean air and natural fire regimes (M. Allen personal communication).

Conclusion—Maintaining functional ecosystems requires large, unfragmented natural areas over which natural environmental and ecological processes operate. The loss and

fragmentation of natural areas result in a variety of anthropogenic effects that degrade ecological integrity and lead to extirpation of species. Southern Orange County possesses several attributes favoring its ability to maintain natural processes and the species that depend on them: clean air, large area, broad ecological gradients, intact watersheds and hydrological cycles, and good connections to existing reserves and other public lands.

Analyzing Conservation Priorities

Conservation scientists use variants of three general methods to establish conservation priorities: (1) *special element analysis*, (2) *representation* (or *gap*) *analysis*, and (3) *focal species analysis*. Special elements are species, places, or biological occurrences of high conservation value (Noss et al. 1999), such as biodiversity hotspots or unique habitat types like vernal pools or alkali marshes. Representation approaches select samples of habitat types or environmental gradients that "capture" the full range of environmental attributes necessary to maintain biodiversity and ecosystem processes (Hummel 1989, Scott et al. 1993, Soulé and Sanjayan 1998). A variant of representation analysis, *gap analysis* uses geographic information systems (GIS) and geographic data to identify aspects of biodiversity that are under-represented within existing reserves and therefore are "gaps" in protection of particular ecological communities, habitats, or species. Focal species approaches select key species that, if adequately conserved, help ensure adequate reserve size, configuration, and connectivity to maintain most or all of the other species and processes comprising a functional ecosystem (Miller et al. 1998/99). Focal species are often those requiring large areas for survival, such as mountain lions or eagles, or that are most sensitive to human activities, such as amphibians or fishes that cannot tolerate pollution (Lambeck 1997).

Key Terms and Concepts

Ecological Integrity: The degree to which an ecosystem retains its naturally functioning parts and processes, without adverse modifications by man.

Focal Species: Species selected for conservation analyses because they serve as surrogates for larger groups of species or ecosystem functions, such as species requiring large areas or that are especially sensitive to habitat degradation.

Gap Analysis: An assessment of existing protection levels for aspects of biodiversity (species, ecosystems) to identify "gaps" in protection offered by existing reserve networks.

Representation Analysis: An assessment of the range of environmental attributes present in an ecosystem or region of interest, and the proportion of this range that is captured within existing or proposed reserves.

Special Elements Analysis: An assessment of how well a reserve system conserves particular species, places, or biological occurrences of high conservation value, such as biodiversity hotspots or rare community types.

Combining these three approaches results in the most complete evaluation of natural variability and therefore the most robust and defensible reserve designs (Kirkpatrick and Brown 1994, Noss et al. 1999). Given the global conservation importance of the Coastal Hills and Coastal Terraces Ecological Subsections, we recommend a combined approach for analyzing conservation priorities. A reserve system for the region should capture the full range of environmental conditions, ecological communities, and species within these subsections; and a reserve design for southern Orange County should capture all its special elements (including vernal pools, alkali marshes, seeps, cliffs, and core breeding habitats)

and the full representation of environmental variability in the subregion (including all vegetation communities, elevations, slopes, aspects, and distances from the coast). Moreover, the reserve should ensure continued persistence of wide-ranging and highly sensitive focal species by maintaining large core habitat areas that are sufficiently linked to maintain natural movement patterns and ecosystem functions that operate at the landscape scale. This report only touches on certain aspects of this approach. More complete analyses that address all sensitive species occurring in the subregion should be conducted as part of the NCCP process.

Gaps in Protection for the Coastal Foothills and Terraces

Figure 4 maps current land protection status within the Coastal Hills and Coastal Terraces Ecological Subsections. It portrays the pattern of urban and agricultural development in the area, as well as existing and proposed conserved lands. Unprotected lands that still support native habitats represent potential gaps in protection. Thus, this map helps illustrate those areas most worthy of conservation attention, especially the larger, more intact private lands that are adjacent to existing reserve areas.

Figure 4 shows military lands distinct from other public and private lands, due to their unique land use and legal issues. The military does not set aside or "conserve" land. Rather, it attempts to manage land areas consistent with federal resource protection laws, while pursuing its primary mission of national security. The military is exempt from state and local regulations (Boice 1996).

Marine Corps Base Camp Pendleton supports many threatened and endangered species and outstanding examples of southern California vegetation communities (M. Allen personal communication) and is a significant component of regional biodiversity and ecosystem function. In combination with southern Orange County and habitats in the Santa Ana Mountains, the open spaces of Camp Pendleton contribute greatly to maintaining ecological functions and values in the region.

Outside of military lands, five large areas of unprotected private lands remain within the Coastal Hills and Coastal Terraces Ecological Subsections (Figure 4, Table 1). These areas are described below, from north to south, in terms of their current conservation status, support of important biological resources, and connections to conserved habitats. Because each area comprises a unique set of ecological conditions and species—and together represent the full north to south and coastal to inland gradients of the coastal foothills and terraces landscape—they represent a complementary set of natural areas, and each is worthy of substantial protection.

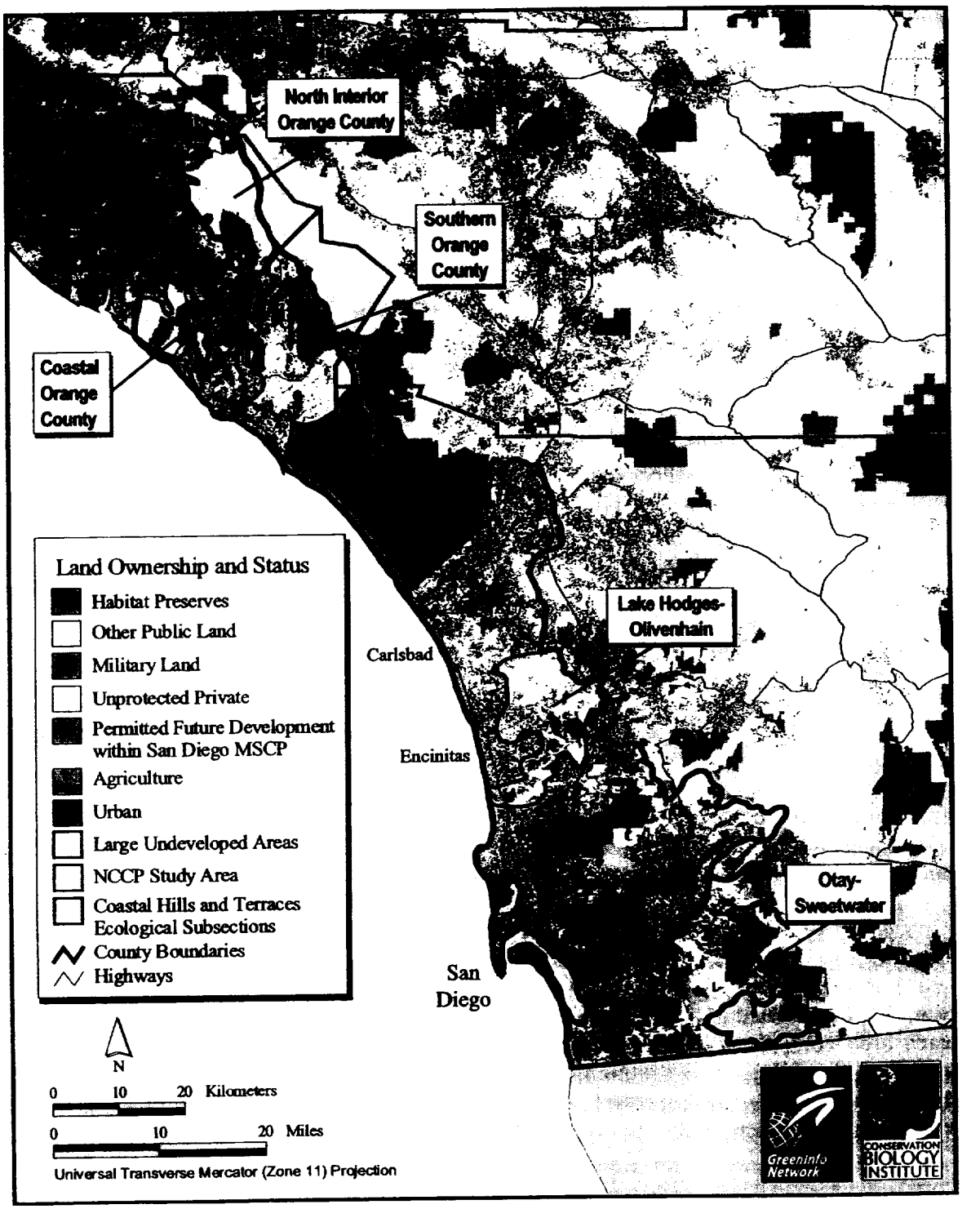

Figure 4 — Land protection status in the Coastal Hills and Coastal Terraces Ecological Subsections.

Table 1. Characteristics of the largest remaining unprotected land areas in the Coastal Hills and Coastal Terraces Ecological Subsections (excluding military lands).

Area	Gross Acreage	Acres of Natural Habitat	Dominant Vegetation Communities[1]	Physiography	Status/Comments
North Interior Orange County	43,651	43,085	Chaparral, coastal sage scrub, grasslands (non-native and native), riparian woodland	15 to 25 miles from coast; 900 to 2,000 feet elevation	Adjacent to Cleveland National Forest, but otherwise somewhat isolated from other habitat areas by urban development. NCCP plan protects about 20,000 acres.
Coastal Orange County	23,252	22,398	Coastal sage scrub, grasslands (non-native and native), chaparral	0 to 5 miles from coast; 0 to 1,200 feet elevation	Isolated from other large habitat areas by urban development. Approved NCCP plan protects about 18,000 acres.
Southern Orange County	64,092	46,835	Coastal sage scrub, grassland (native and non-native), chaparral, riparian woodlands and forests	0 to 15 miles from coast; 0 to 1,625 feet elevation	Not yet planned under NCCP; relatively little fragmentation. Well connected to existing large wilderness areas and other habitat reserves.
Lake Hodges-Olivenhain Area, San Diego County	60,137	[2]52,480 (40,861)	Chaparral, coastal sage scrub	0 to 15 miles from coast; 0 to 1,700 feet elevation	Existing NCCP agreement for south half allows substantial development and fragmentation; largely isolated from other large habitat areas. North half currently being planned under NCCP (North San Diego County MSCP Subarea Plan).
Otay-Sweetwater Area, San Diego County	98,498	[3]87,032 (59,645)	Coastal sage scrub, chaparral, non-native grasslands, riparian scrub	5 to 25 miles from coast; 250 to 2,000 feet elevation	Existing NCCP agreement and independent state and federal acquisitions are conserving significant habitats, but in a more fragmented configuration than current conditions.

[1]Aggregated vegetation communities listed in order from greatest to least acreage (source: California Gap Program)
[2]Approved MSCP plan permits about 11,619 acres of habitat removal, which will reduce natural habitat acres to about 40,861, not accounting for potential permitted development under the North County Subarea MSCP Plan.
[3]Approved MSCP plan permits about 27,387 acres of habitat removal here, which will reduce natural habitat acres to about 59,645.

North Interior Orange County

This area is adjacent to Cleveland National Forest on the steep hills rising above urbanized Orange County. It represents the northernmost inland extension of the Coastal Hills Ecological Subsection. The NCCP preserve for this area includes a large block of habitat in Limestone Canyon (chaparral, native grasslands, and riparian woodlands), with remnant lower-elevation coastal sage scrub on southern slopes. Other portions of the preserve are relatively small and fragmented by highways and housing developments. This area also includes the Irvine Company's North Ranch, which is intact but unprotected habitat adjacent

to Cleveland National Forest that is considered essential to persistence of wide-ranging species like mountain lions and golden eagles in the Santa Ana Mountains (T. Smith personal communication). It is well connected to other portions of the Coastal Hills and Coastal Terraces Ecological Subsections as well as the Santa Ana Mountain subsection via Cleveland National Forest, but lower elevation connections are threatened with development.

Coastal Orange County

This habitat block in the San Joaquin Hills represents the northernmost portion of the Coastal Hills and Coastal Terraces Ecological Subsections along the immediate coast. Although it is valuable habitat for numerous species, it is smaller and more isolated than other habitat blocks in the Coastal Hills and Coastal Terraces Ecological Subsections, and thus is no longer capable of supporting such wide–ranging species as mountain lions or nesting eagles.

Southern Orange County

This is the least fragmented portion of the Coastal Hills Ecological Subsection (after accounting for permitted habitat removal in San Diego's NCCP, the Multiple Species Conservation Program or MSCP; Table 1 and Figure 4). Together with large protected areas in the adjacent Santa Ana Mountains Subsection, this area still supports mountain lions and golden eagles. Southern Orange County supports a great diversity of vegetation communities in a natural mosaic. The native grasslands here are more extensive and in better condition than in any other portion of the county (F. Roberts personal communication).

Coastal sage scrub in this area is notable in that it includes large areas on gently sloping, lower elevation hills and valleys that are strongly influenced by a maritime climate. This rich form of coastal sage scrub has become exceedingly rare in the South Coast Ecoregion, because it typifies those areas that were most rapidly converted to urban and suburban development since the 1930s. Most other large, extant blocks of coastal sage scrub are on steeper slopes and in more interior climate zones that were not readily removed by development. Prevailing oceanic wind patterns bring cleaner air to southern Orange County than found in most of Southern California, making it more resistant to conversions to non-native grasslands and the effects of global warming (Field et al. 1999, Allen et al. 1996, M. Allen personal communication).

As the focus of this report, the resources of south coastal Orange County are more fully described in the next section.

Lake Hodges-Olivenhain

This island of natural open space is almost entirely surrounded by urban development in San Diego County, although it remains somewhat connected to more inland areas via the San Pasqual Valley. The southern half of the area is within the permitted San Diego MSCP plan area (about 11,619 acres is permitted for removal, leaving about 40,861 acres of natural

habitat potential for conservation). The County of San Diego is currently planning the northern portion through the North San Diego County MSCP.

The Lake Hodges-Olivenhain area is an important core habitat for coastal sage scrub and chaparral species—as part of a series of landscape "stepping stones" (Amec and Conservation Biology Institute 2001). It extends from near the coast, at sea level, to about 15 miles inland; however, the more coastal areas are highly fragmented, such that the bulk of conserved habitats will be 5 to 10 miles from the coast.

Otay-Sweetwater

This is the largest of the five areas in gross acreage and supports large and well-connected blocks of native habitat. The Otay-Sweetwater area lies about 5 to 25 miles from the coast, but the bulk of habitat conservation is and will occur more than 10 miles from the coast, where habitats reflect more inland climatic conditions. San Diego's MSCP plan, in conjunction with acquisitions for the San Diego National Wildlife Refuge and the Rancho Jamul State Ecological Reserve, have made important progress in securing large and valuable habitat areas, including some topographically gentle locations. It is well connected to more interior ecological subsections. Currently, the area supports roughly 87,052 acres of natural vegetation, but about 27,387 of these are outside of approved MSCP preserve planning boundaries and therefore subject to development.

Summary: Status of Remaining Habitat Areas in the Coastal Foothills and Terraces

The five unprotected, large habitat blocks remaining within the coastal foothills and terraces landscape are all important to maintaining regional biodiversity and precluding further species extinctions. Each area exhibits unique aspects of biodiversity not represented in other areas (for example, some narrow endemic plant species are restricted to only one or two of these five areas).

Of the five areas, the Otay-Sweetwater area and Southern Orange County are the two largest, most intact, and best connected to adjoining ecological subsections, and have the greatest potential to sustain viable populations of key species and relatively natural ecosystem processes. Of these two areas, Southern Orange County has less overall fragmentation, assuming that development proceeds as currently permitted in the Otay-Sweetwater area of San Diego County. It may also be more resistant than other areas to exotic invasions and ecological shifts influenced by air pollution and global climate change. Southern Orange County therefore seems the last best opportunity to conserve an intact portion of the coastal foothills ecosystem.

Southern Orange County — The Heart of a Hotspot

This section describes those attributes of the Southern Orange County NCCP Subregion that make it the last best opportunity to conserve the unique coastal foothills ecosystem—the heart of a biodiversity hotspot.

- It supports viable populations of at least seven federally listed threatened or endangered species and contains critical habitat (areas officially designated by the U.S. Fish and Wildlife Service as essential to the survival and recovery of the species) for at least three species—the California gnatcatcher, Riverside fairy shrimp, and arroyo toad.

- It supports approximately 50 to 56 percent of the total remaining population of coastal cactus wrens, representing the largest remaining core area for this endemic form and its rare cactus-dominated sage scrub habitat (Harper and Salata 1991, Ogden 1992, Garrett 1992, Rea and Weaver 1990, Dudek & Associates 1998a).

- It supports approximately 15 to 25 percent of the remaining U.S. population of the endemic California gnatcatcher, representing the largest contiguous population of this threatened songbird in the country (Dudek & Associates 1998a, Atwood 1990, 1992; U.S. Fish and Wildlife Service 1993).

- It supports a great diversity of nesting raptors (hawks, owls, eagles, and falcons)—with 15 nesting species and over 330 recorded nest sites for 11 of these (Dudek & Associates 1998a, P. Bloom unpublished data).

- It is a critical foraging area for one of the few remaining golden eagle pairs in Orange County and has potential to support other nesting pairs of eagles as well as peregrine falcons (Bittner 2001, P. Bloom personal communication).

- It supports a significant (though yet unquantified) acreage of native grasslands, which have been extirpated from the vast majority of Southern California. These occur in a natural mosaic with coastal sage scrub, chaparral, and oak woodlands, a semblance of how most of the south coastal foothills and terraces once appeared (P. Behrends, P. Bloom, and F. Roberts personal communication).

- It supports portions of relatively intact and high-quality watersheds for two major drainages: San Juan Creek and San Mateo Creek—the last remaining undammed and undiverted major drainage in coastal Southern California south of Ventura. San Mateo Creek is "...probably the most pristine coastal stream south of the Santa Monica Mountains" (Stephenson and Calcarone 1999).

- San Mateo Creek supports the southernmost population of the endangered southern steelhead, the only population recorded south of Malibu Creek. Protecting this watershed is therefore essential to recovering this species with the fullest range of genetic diversity (National Marine Fisheries Service 2000, Hunter unpublished 2000).

- Both San Mateo Creek and San Juan Creek support a variety of sensitive aquatic and amphibian species (including substantial populations of the arroyo chub, threespine stickleback, and endangered arroyo toad), which depend on the clean waters and natural flood-scour-deposition cycles that are possible only in such natural watersheds (Swift et al. 1993, Griffin et al. 1999, Stephenson and Calcarone 1999).

- In combination with adjacent Cleveland National Forest and Marine Corps Base Camp Pendleton, it supports populations of mountain lions and mule deer. This reflects the ecological integrity of the area, because these species require large and intact wildlands to survive (Beier 1993, 1995). Habitat fragmentation has all but extirpated them from coastal California south of Camp Pendleton.

- It supports one of the largest known complexes of several rare or endangered plant species, including southern tarplant, many-stemmed dudleya, and intermediate mariposa lily (F. Roberts personal communication).

- It supports some the largest concentrations of alkali grassland and alkali wetlands in southern California, which are of considerable importance because they support rare plants that are in serious decline in Southern California (F. Roberts personal communication).

The following sections describe these attributes in more detail, highlighting those considered most critical to defining conservation priorities for the southern Orange County NCCP Subregion.

Vegetation Communities and Environmental Gradients

The Southern Orange County NCCP planning area is about 91,800 total acres (excluding Cleveland National Forest). Of this, about 54,800 acres (60 percent) remain in natural habitat (Figure 5, Table 2). The planning area ranges from sea level to 2,700 feet. Of particular note are over 21,300 acres of coastal sage scrub vegetation—habitat for a large number of endemic and listed species of plants and wildlife (California Department of Fish and Game 1996, Stephenson and Calcarone 1999). Coastal sage scrub in this area is distinctive for the diversity of environmental gradients it covers, from gentle slopes and valleys to steep ridges, from near the coast to more inland areas, and from sea level to the highest elevations that support sage scrub species (over 2,400 feet). This is unlike most conserved areas of coastal sage scrub communities, which cover a more limited range of environmental gradients and especially steeper canyon slopes and more inland areas. Nowhere else in the U.S. is this full range of coastal sage scrub environmental gradients so fully expressed within a single, contiguous area as in the Southern Orange County NCCP Subregion. Not only does this help support a diverse array of species—each requiring slightly different combinations of ecological conditions—these gradients also provide an environmental hedge against global climate changes.

Table 2. Vegetation Communities and Land Cover for the Southern Orange County NCCP Planning Area (Dudek & Associates 1998a).

Coastal sage scrub	21,352
Grassland[1]	16,742
Chaparral	8,490
Riparian	5,645
Oak woodland	1,582
Forest	444
Lakes and reservoirs	423
Stream courses	81
Freshwater marsh	28
Cliff and rock	10
Vernal pools	8
Subtotal Natural Habitats	**54,805**
Developed	30,211
Agriculture	4,287
Disturbed land	2,330
Subtotal Non-habitat	**36,828**
Grand Total	**91,633**

[1] Approximately 20-30% of this is estimated to be California native grasslands (Behrends personal communication).

Diverse arrays of other habitat types occur in mosaic with the dominant sage scrub vegetation, including native, perennial California grasslands, annual grasslands, chaparral, riparian woodlands and scrub, oak woodlands, and a variety of wetland vegetation types. Together, this natural mosaic of communities supports a tremendous diversity and density of wildlife and allows for nearly the full range of ecological processes and cycles to continue with minimal human intervention. This is quite different from more fragmented reserve areas being established elsewhere in the ecoregion, where intensive, active habitat management (such as controlled burning, exotic species control, and artificial sediment transport) are considered essential to maintaining the species these reserves are intended to protect (Amec and Conservation Biology Institute 2001, Scott and Sullivan 2000, Sullivan and Scott 2000).

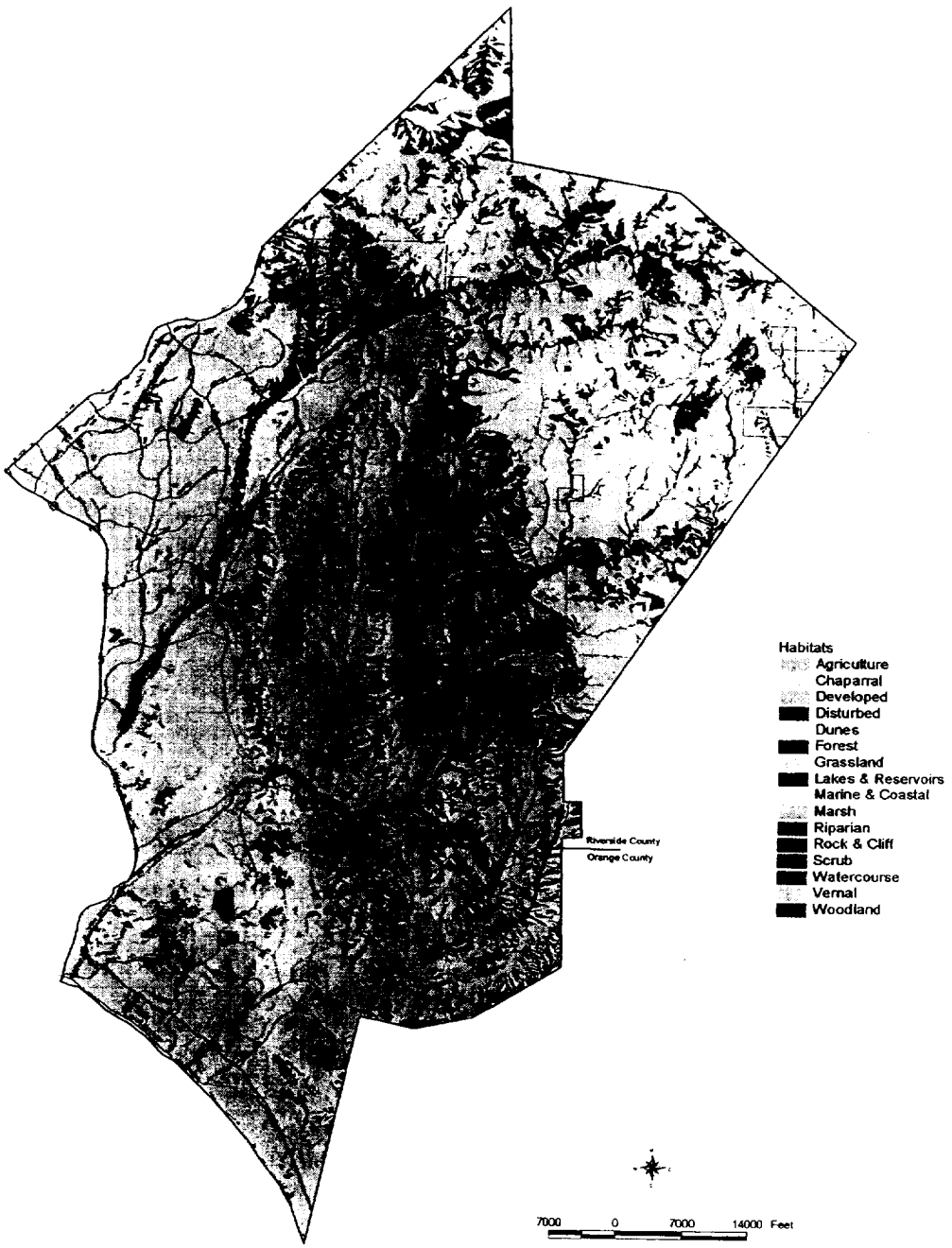

Figure 5 — Vegetation communities in the Southern Orange County NCCP subregion (Dudek & Associates 1998b).

Profiles of Key Resources

This section describes some key species and other resources we believe should help define conservation priorities for southern Orange County. It is not intended to cover all aspects of biodiversity in the study area, but to highlight a few that deserve high priority in preserve design and for which we have good distribution data.

Figures 6a through 6d show the distributions of selected species in the study area based on surveys covering most portions of the NCCP subregion except the Cleveland National Forest (see text box). We defined core and secondary concentrations of each species from mapped observation points using species-specific criteria. Core concentrations include at least 10 independent location points (3 points for raptor nests) at close spacing (less than 2,000 feet between points for California gnatcatcher and coastal cactus wren; less than 1 mile for raptor nests). For the arroyo toad, core areas include stream segments having over 100 adults during spring surveys. Secondary or buffer areas include lesser concentrations of points or less contiguous habitat areas that nevertheless have high habitat value and support significant populations of these key species.

Survey Data

Dudek & Associates (1998a, 1998b, 1998c) provided the vegetation map for the NCCP subregion and maps and tables summarizing results of species surveys in the planning area. These species surveys covered the largest private property and some public lands in the NCCP subregion, but excluded Cleveland National Forest. This should be considered when inspecting the range maps in this report (Figure 6).

For the California gnatcatcher, coastal cactus wren, and arroyo toad, the surveys covered essentially all potential habitat in the planning area and provide a reasonable estimate of adult population size during the survey year(s) (P. Behrends and P. Bloom personal communication). For many other species (especially plants and invertebrates) surveys covered more limited samples of available habitat, and additional populations are likely to be found in the future (P. Behrends and F. Roberts personal communication).

Coastal Cactus Wren—The cactus wren is a large, non-migratory species of wren found primarily in desert areas of southwestern North America. Although the species is fairly widespread, a unique form of cactus wren is restricted to coastal sage scrub habitats on the coastal foothills and terraces of south-coastal California and extreme northwestern Baja California (Rea and Weaver 1990, Harper and Salata 1991, Solek and Szijj 1999). This coastal population has been proposed as a unique subspecies (Rea 1986), and although this taxonomic distinction remains in dispute (U.S. Fish and Wildlife Service 1994), there is no question that the coastal form occupies a unique ecological niche and represents an important component of the south-coastal ecosystem.

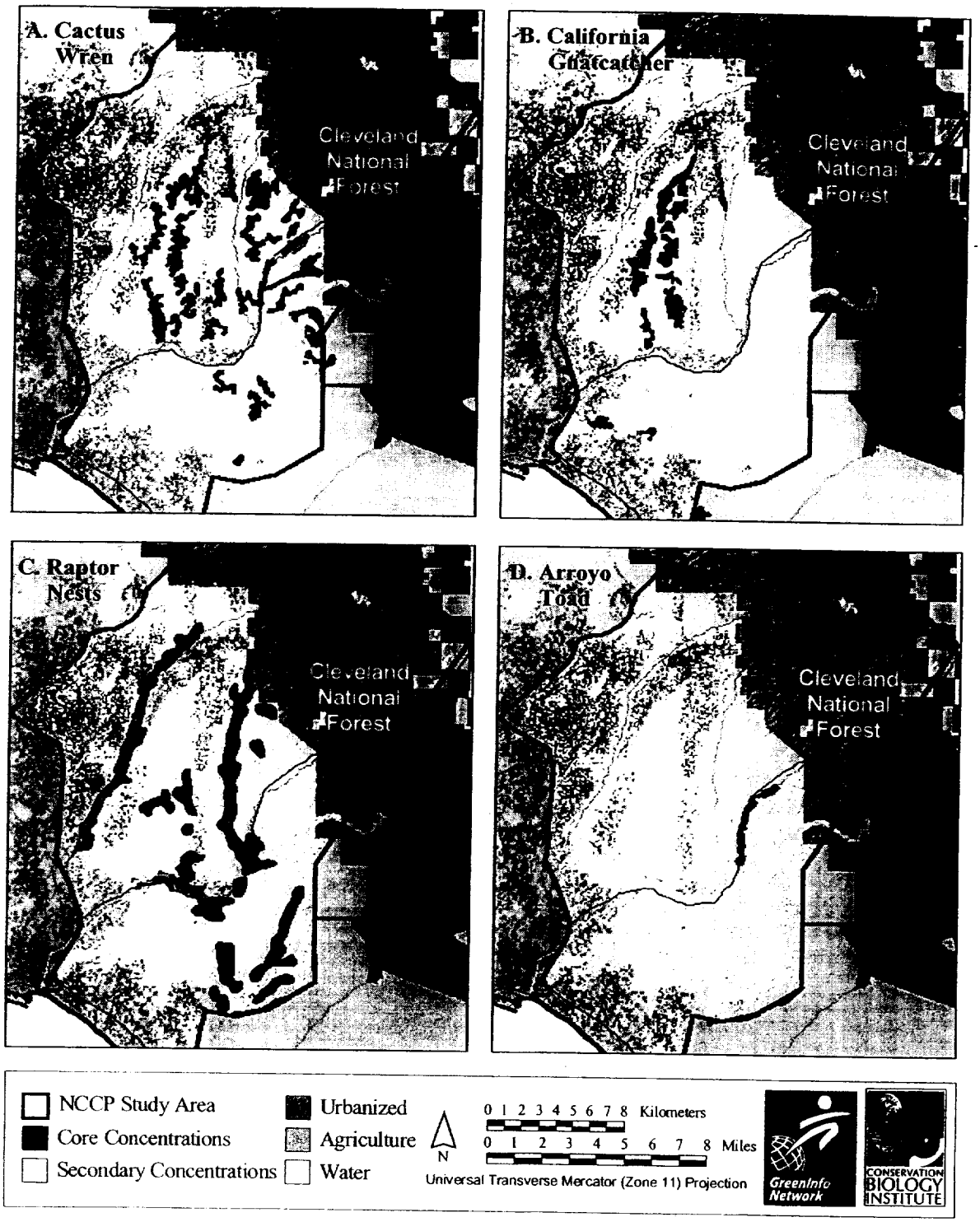

Figure 6 — Distributions of key species in the NCCP Subregion outside of Cleveland National Forest.

The coastal cactus wren requires coastal sage scrub with patches of tall cactus, and its distribution reflects the patchy distribution of this habitat. Degradation of cactus wren habitat by unnaturally high fire frequencies has greatly reduced wren populations on Marine Corps Base Camp Pendleton and other areas (Rea and Weaver 1990, Harper and Salata 1991, Bontrager et al. 1995). Orange County supports the majority of the remaining population, probably in the range of 65 to 85 percent of the remaining nesting pairs (estimated at 2,450 to 2,732 pairs based on data in Harper and Salata 1991; Ogden 1992, Garrett 1992, Rea and Weaver 1990, Dudek 1998a, and P. Behrends personal communication). The Southern Orange County NCCP Subregion has 1,378 recorded locations (Table 3). This represents about 50 to 56 percent of the total estimated nesting pairs and is the largest and most contiguous remaining population. Central coastal Orange County supports the second largest population, with 777 recorded locations (P. Behrends, personal communication). Most other populations have been isolated by urban development and support much smaller numbers. Figure 6a maps concentrations of nesting coastal cactus wrens in the southern Orange County planning area.

California Gnatcatcher—The coastal California gnatcatcher is a small songbird endemic to coastal sage scrub vegetation communities in the South Coast Ecoregion, especially within the Coastal Hills and Coastal Terraces Ecological Subsections. The greatest population densities occur near the coast (Amec and Conservation Biology Institute 2001), perhaps due to higher winter survivorship and richer food sources (Mock 1998). A victim of widespread habitat loss and fragmentation, the gnatcatcher was listed as threatened in 1993.

Total population size is difficult to measure, but has been estimated at 1,811 to 2,562 pairs in the U.S., with the single largest concentration in southern Orange County (Atwood 1990, 1992; U.S. Fish and Wildlife Service 1993). The total number of recorded locations in the U.S. is about 5,200—which includes pairs, single individuals, some redundant locations, and some locations recently lost to development. The Southern Orange County NCCP Subregion database includes 627 non-redundant locations (Table 3), probably representing roughly 500 to 600 breeding pairs in most years. Thus, the subregion supports *at least* 12 percent

Table 3. Recorded locations of selected songbirds in the Southern Orange County NCCP Subregion (Dudek & Associates 1998a, 1998c).

Common Name	Scientific Name	Federal/State Status*	Locations
coastal cactus wren	*Campylorhynchus brunneicapillus*	FSC/CSC	1,378
California gnatcatcher	*Polioptila californica californica*	FT/CSC	627
grasshopper sparrow	*Ammodramus savannarum*		619
least Bell's vireo	*Vireo bellii pusillus*	FE/CE	29
southwestern willow flycatcher	*Empidonax traillii extimus*	FE/CE	1
tricolored blackbird	*Agelaius tricolor*	FSC/CSC	104

*FT = Federally Threatened; FE = Federally Endangered; FSC = Federal Species of Concern.
CE = California Endangered; CSC = California Species of Concern

(627/5,200), and probably more than 20 percent (500/2,562) but fewer than 33 percent (600/1,811) of the U.S. population. Factoring in various uncertainties in these estimates, including the fact that the Atwood (1990, 1992) and U.S. Fish and Wildlife Service (1993) estimates were based on data collected during drought years, we conclude that the southern Orange County subregion supports roughly 15 to 25 percent of the U.S. population of gnatcatchers.

This core breeding area—concentrated on the gentle hills around Chiquita Canyon and Cañada Gobernadora (Figure 6b)—is unique not only in size (about 4,000 acres of occupied habitat scattered over about 8,500 total acres) and gnatcatcher density, but also in its physical and ecological setting. It lies relatively close to the coast (6 to 12 miles) on gently rolling hills having a relatively low incidence of exotic plant species. Other large gnatcatcher habitat areas are generally farther inland (11 to 25 miles) and mostly on steeper, higher elevation scrub communities that support lower densities of gnatcatchers. Moreover, the southern Orange County population could likely be increased by restoring coastal sage scrub to portions of Chiquita Canyon, where sage scrub was historically removed by discing for dry farming and pasture.

Nesting Raptors—Pete Bloom, a field biologist who grew up studying wildlife in southern Orange County, has for over 20 years recorded nest locations of raptors (eagles, hawks, falcons and owls) using the area. Bloom's data, supplemented by data from Dudek & Associates (1998a, 1998c), show this area to support a rich and stable raptor community (Table 4; Figure 6c). Fifteen species of raptors are known to nest in the subregion, and another five species use the area seasonally (P. Bloom personal communication). Two important raptor species—the golden eagle and peregrine falcon—may no longer nest in the subregion, but do forage here and have a high likelihood of returning to nest in the near future. Peregrine falcon once nested on at least two of the many sandstone cliffs that jut from canyon walls throughout the study area; but these aeries along San Juan Creek and Gabino Canyon were abandoned sometime during the mid-twentieth century when the species was in steep decline. The North American population of the state-endangered peregrine responded positively to conservation and management efforts throughout its range (enough, in fact, to permit its delisting by the U.S. Fish and Wildlife Service in 1999). Bloom believes that the increasing population of peregrines in California

Table 4. Number of nesting locations recorded in the Southern Orange County NCCP Subregion for selected raptor species (Bloom unpublished data; Dudek & Associates 1998a, 1998c).

Common Name	Scientific Name	Nest Locations
peregrine falcon	*Falco peregrinus*	2*
golden eagle	*Aquila chrysaetos*	2*
barn owl	*Tyto alba*	51
great horned owl	*Bubo virginianus*	29
long-eared owl	*Asio otus*	10
northern harrier	*Circus cyaneus*	1
Cooper's hawk	*Accipiter cooperii*	38
red-tailed hawk	*Buteo jamaicensis*	110
red-shouldered hawk	*Buteo lineatus*	68
turkey vulture	*Cathartes aura*	3
white-tailed kite	*Elanus caeruleus*	30

*Historic aeries not currently occupied.

will eventually result in this magnificent species returning to nest on cliffs in southern Orange County.

The golden eagle also once nested in the area and could again in the future. Orange County supported about seven eagle territories during the twentieth century, but at least four of these were extirpated by encroaching development from 1925 to 1985 (P. Bloom unpublished data). One aerie along the Arroyo Trabuco was abandoned in 1985 due to human disturbance near the nest and conversion of foraging habitat to housing (P. Bloom personal communication).

This story echoes many similar tales throughout Southern California. David Bittner and colleagues at the Wildlife Research Institute have been monitoring golden eagle pairs throughout Southern California since 1987 (over 200 pairs to date), building on research and records collected by many other biologists as far back as 1895 (records kept by Western Foundation of Vertebrate Zoology). These studies show that over 50 percent of Southern California's breeding golden eagles have been extirpated since the 1970s, due most significantly to destruction of habitat. In the words of Bittner: "Preservation of foraging habitat is as critical as protecting the nest sites of golden eagles. Without both nesting and foraging habitat golden eagles will continue to decline in Orange County and the rest of Southern California" (Bittner 2001).

Nevertheless, golden eagles still nest in the ecoregion, with several territories in or near southern Orange County, although the nest sites themselves are mostly in the Cleveland National Forest. One pair nesting along San Mateo Canyon depends on the Southern Orange County NCCP Subregion for survival. Bittner and colleagues estimate that about 7 of every 10 foraging trips are to the extensive mosaic of grasslands and scrub habitats of Talega, Gabino, La Paz, Blind, and Cristianitos canyons in southern Orange County. In the opinion of Bittner and the eagle research staff at Wildlife Research Institute, further loss of this hunting area in southern Orange County "would affect [this pair's] ability to successfully fledge young and will eventually lead to the loss of this golden eagle breeding pair altogether" (Bittner 2001).

Bloom and Bittner believe that golden eagles could nest again in the Southern Orange County NCCP Subregion outside of Cleveland National Forest, unless new housing developments further fragment the remaining habitat. Offspring from the current pair on San Mateo Creek may help fulfill this prediction.

Arroyo toad—The arroyo toad is a federally endangered, endemic amphibian of south-coastal California. It occupies streams and adjacent uplands within the Coastal Hills and Coastal Terraces Ecological Subsections, and to a lesser degree higher mountain sections below the headwaters (Jennings and Hayes 1994, U.S. Fish and Wildlife Service 1999b). Most populations have been extirpated, and many remaining populations are adversely affected by combined effects of wetland and upland habitat loss, reservoirs, water diversions, introduced predators (such as bullfrogs, mosquito fish, and largemouth bass), mining activities, road kill, and changes in river flows and sedimentation patterns (Griffin et al. 1999). South of Los

Angeles, only three watersheds still support the species through the full range of stream gradients, from the headwaters to the coast: San Mateo, San Onofre, and Santa Margarita (Griffin et al. 1999). Of these, only the San Mateo watershed remains undammed and hence lacks many of the associated threats to the species (Stephenson and Calcarone 1999). In addition, preliminary genetics work (Shanahan 1998) has shown the San Mateo population to have the highest known genetic diversity in the species and suggests that this population may be genetically distinct from others in the range. Hence, maintaining the San Mateo watershed in its current pristine condition is essential to the persistence and recovery of the species and may be critical to retaining its full genetic diversity.

Table 5. Recorded locations of selected amphibians, reptiles, and invertebrates in the Southern Orange County NCCP subregion (Dudek & Associates 1998a, 1998c).

Common Name	Scientific Name	Federal/State Status*	Locations
arroyo toad	*Bufo californicus* [*Bufo microscaphus californicus*]	FE/CSC	2,626 acres >550 adults
arboreal salamander	*Aneides lugubris*		12
coast range newt	*Taricha torosa torosa*	/CSC	
western spadefoot toad	*Scaphiopus hammondii*	FSC/CSC	16
orange-throated whiptail	*Cnemidophorus hyperythrus beldingi*	FSC/CSC	179
red-diamond rattlesnake	*Crotalus ruber ruber*	FSC/CSC	15
rosy boa	*Charina trivirgata*	FSC/	4
San Diego ringneck snake	*Diadophis punctatus similis*		10
San Diego horned lizard	*Phrynosoma coronatum blainvillei*	FSC/CSC	47
southwestern pond turtle	*Clemmys marmorata pallida*	FSC/CSC	23
Riverside fairy shrimp	*Streptocephalus woottoni*	FE/	6
San Diego fairy shrimp	*Branchinecta sandiegonensis*	FE/	2

*FT = Federally Threatened; FE = Federally Endangered; FSC = Federal Species of Concern.
CE = California Endangered; CSC = California Species of Concern

Within southern Orange County, Bloom surveyed populations of adult arroyo toads during the 1998 breeding season to identify major breeding concentrations downstream from Cleveland National Forest, as shown on Figure 6d and quantified in Table 5. He found abundant populations along upper San Juan Creek and Bell Creek (a tributary of San Juan Creek) and along Talega Creek (a tributary of San Mateo Creek). He also found lesser concentrations on Gabino Creek (another tributary of San Mateo Creek) and along lower San Juan Creek. Construction of new roads may have contributed to population declines and recent extirpation of arroyo toads in these lower reaches of San Juan Creek (P. Bloom personal communication). Note that Figure 6d does not show other known populations on Cleveland National Forest and Camp Pendleton.

Southern Steelhead and Other Native Fishes—Steelhead are the anadromous (sea-running) form of rainbow trout, and southern steelhead are winter-run populations that occur south of the Santa Maria River in Santa Barbara County. The southern steelhead is federally listed as

endangered, but the listing and subsequent designation of critical habitat initially failed to recognize that a population existed farther south than Malibu Creek (Los Angeles County). In fact, the southernmost population exists in San Mateo Creek and its tributaries.

Historically, southern steelhead ranged south to Baja California (Swift et al. 1993) and occurred in both San Juan and San Mateo creeks. Research on historic population sizes in various southern California coastal streams suggests that San Mateo Creek may have been one of the most important steelhead streams in the region (U.S. Fish and Wildlife Service 1998b). Individuals in San Mateo Creek regularly ranged up to 30 inches in length and 20 pounds in weight—substantially larger than fish recorded from Malibu Creek during the same time period.

Southern steelhead were considered to be extirpated from streams south of Malibu Creek until 1999, when an individual was caught in San Mateo Creek (A. Vejar, California Department of Fish and Game, personal communication). Since then, surveys have documented juvenile and adult steelhead in San Mateo Creek and tributaries on federal lands. Genetic analyses have confirmed that these are wild, reproducing, anadromous southern steelhead, and not the result of trout planting (California Department of Fish and Game 2000, National Marine Fisheries Service 2000). As a result of this new information, the National Marine Fisheries Service (2000) has proposed extending the southern steelhead's designated Evolutionarily Significant Unit and critical habitat to include the San Mateo Creek watershed. Recent surveys of habitat suitability have not been conducted in San Juan Creek, but headwater streams are also likely to support suitable habitat. According to Hunter (unpublished 2000), the San Mateo watershed is a "Core Watershed" (critical to persistence and recovery of the species), and the San Juan watershed is a "Recovery Watershed" (critical to recovery with some restoration to allow recolonization).

San Juan and San Mateo creeks support two other native fish species that have been extirpated from most streams in their original range: arroyo chub and threespine stickleback. The native fish fauna in coastal Southern California is a unique assemblage of six extant (and one extinct) species that are adapted to streams having highly variable conditions (Swift et al. 1993). Unlike most streams in Southern California, San Mateo and San Juan creeks appear to still support all of their historically occurring species. The threespine stickleback, in particular, is widespread in the subregion, including the Arroyo Trabuco, upper San Juan Creek, Hot Spring and Cold Spring canyons, and Bell Canyon. Control of exotic fishes, crayfish, and frogs and maintenance of natural hydrological processes and water quality are key to conserving this rare species within the NCCP subregion (Atwood et al. 1996).

Mule Deer and Mountain Lion—Mule deer and mountain lion are linked in a primary predator-prey system that serves as an indicator of ecological integrity. Both species are adversely affected by habitat fragmentation and have been largely extirpated from coastal habitats south of Marine Corps Base Camp Pendleton. As part of the larger Santa Ana Mountains landscape, the undeveloped habitat areas of southern Orange County support both lions and deer in healthy populations. Intensive studies using radio-telemetry have documented the natural movements of lions throughout the area (Padley 1991; Beier 1993,

1995). Beier (1993) studied the population viability of mountain lions in the Santa Ana Mountains and Palomar Range and concluded that further loss of habitat or of critical habitat linkages would likely extirpate lions from the region. Based on this research and a mountain lion habitat suitability model that was peer reviewed by experts (including Drs. Paul Beier, Kevin Crooks, and Michael Soulé), Hunter (unpublished 2000) identified the San Mateo and San Juan watersheds of this subregion as a "Key Conservation Area" for maintaining a viable population of mountain lions in the region.

Fairy Shrimp—The NCCP subregion supports two federally endangered invertebrates: Riverside and San Diego fairy shrimp. These small crustaceans inhabit temporary ponds called vernal pools and are adapted to the variable conditions of these ecosystems—forming encysted embryos that lie dormant in dry soils and emerge once the pools fill with winter rains. Different species have adapted to pools with different physical and chemical conditions. Riverside fairy shrimp occupy deep, cool vernal pools, whereas San Diego fairy shrimp occupy smaller, shallower pools.

Surveys by Dudek and Associates and PCR during 2001 documented Riverside fairy shrimp in pools on Chiquita Ridge, an area south of Ortega Highway known as Radio Tower Road, and at Saddleback Meadows in the northwest portion of the planning area (P. Behrends personal communication). The Saddleback Meadows population represents a geographically distinct complex within the species' range (U.S. Fish and Wildlife Service 1998a). Some of these pools are already protected. According to Fred Roberts (personal communication), additional locations may exist in the planning area.

San Diego fairy shrimp have been recorded in vernal pools on Chiquita Ridge and along Radio Tower Road (U.S. Fish and Wildlife Service 1998a, P. Behrends personal communication). These locations represent a distinct complex within the species' range (U.S. Fish and Wildlife Service 1998a). Preserving these pools and surrounding watersheds is essential to recovering San Diego fairy shrimp due to the potential genetic uniqueness of these populations. The U.S. Fish and Wildlife Service considers the San Diego fairy shrimp to have a high degree of threat but a high potential for recovery.

Rare Vegetation Communities and Plants—The Southern Orange County NCCP Subregion supports a diverse assemblage of rare plant species that are associated with unique habitat types (Table 6). It supports the largest known populations of southern tarplant, many-stemmed dudleya, and intermediate mariposa lily (F. Roberts personal communication), which are listed as rare or endangered in California and elsewhere by the California Native Plant Society (CNPS List 1B). Major populations of other CNPS List 1B plants in the subregion include Coulter's saltbush, sticky-leaved dudleya, and thread-leaved brodiaea. Thread-leaved brodiaea is also federally listed as Threatened and state listed as Endangered. Over 2,750 individuals of this species have been observed in the south-central portion of the subregion, in association with native, purple needlegrass grassland, and new populations are continuing to be discovered in other portions of the subregion (F. Roberts personal communication).

Table 6. Rare plant species in the Southern Orange County NCCP subregion (Roberts personal communication).

Common Name	Scientific Name	CNPS List[1]	Population Status[2]
Alkali wetlands and grasslands			
Southern tarplant	*Centromadia parryi* ssp. *australis*	1B	C
Coulter's saltbush	*Atriplex coulteri*	1B	M
Salt spring checkerbloom	*Sidalcea neomexicana*	2	P
Coastal sage scrub and chaparral			
Intermediate mariposa lily	*Calochortus weedii* var. *intermedius*	1B	C
Western dichondra	*Dichondra occidentalis*	4	M
California juniper	*Juniperus californica*	LR	M
Many-stemmed dudleya	*Dudleya multicaulis*	1B	C
Ashy spikemoss	*Selaginella cinerascens*	LR	P
Native and clay soil grasslands			
Small-flowered morning-glory	*Convolvulus simulans*	4	P
Paniculate tarplant	*Deinandra paniculata*	4	M
Prostrate spineflower	*Chorizanthe procumbens*		P
Thread-leaved brodiaea	*Brodiaea filifolia*	FT, CE, 1B	M
Chocolate lily	*Fritillaria biflora*	LR	M
Palmer's grappling hook	*Harpagonella palmeri*	4	M
Catalina mariposa lily	*Calochortus catalinae*		M
Oak woodlands			
Engelmann's oak	*Quercus engelmannii*	4	P
Rock outcrops			
Sticky-leaved dudleya	*Dudleya viscida*	1B	M
Vernal pools			
Water pygmy stonecrop	*Crassula aquatica*	LR	M
Hairy pepperwort	*Marselia vestita*	LR	M
Mesa brodiaea	*Brodiaea joloensis*	LR	P
Mud nama	*Nama stenocarpum*	2	M
Virginia rockcress	*Sibara virginica*	LR	P
Washes			
Coulter's matilija poppy	*Romneya coulteri*	4	M

[1] California Native Plant Society Status
- 1B = Rare or endangered in California and elsewhere
- 2 = Rare or endangered in California, more common elsewhere
- 3 = Plants about which more information is needed
- 4 = Plants of limited distribution

FT = Federally threatened
CE = California endangered
LR = Locally rare (Roberts, personal communication)

[2] Population status in the study area
- C = Critical populations
- M = Populations important but not critical
- P = Species present but in low numbers

Many of these rare plant species depend on unique vegetation communities or habitat types that are especially noteworthy in southern Orange County. Large expanses of alkali grasslands and wetlands are located in Cañada Chiquita and Cañada Gobernadora, which Roberts (personal communication) believes are the largest remaining alkali wetlands in Southern California. Significant areas of clay soils, native grasslands, vernal pools, oak woodlands, and riparian habitats also occur in the planning area, in addition to the large, intact patches of coastal sage scrub discussed previously. The native grasslands, in particular, are considered to be amongst the largest and best remaining examples of this community in Southern California (F. Roberts personal communication). California's native, perennial grasslands have been reduced to about 0.1 percent of their original range (Barry 1972, as cited in Keeley 1990).

Special Microhabitat Features—Habitat consists of more than just the vegetation associations that biologists often use to describe species-habitat relationships. Habitat includes all of the physical and biological features required by a species to survive and reproduce, such as cliffs for nesting eagles and falcons or large hollow trees for roosting bats. In addition, certain very rare habitats or microhabitat features, such as vernal pools, springs, and seeps, need special consideration in conservation planning to ensure that they are adequately protected and buffered from adverse effects to the species they support.

The Southern Orange County NCCP Subregion includes a variety of such features, some of which are mapped and others that are not. Sandstone cliffs are scattered throughout the canyons, where they are used as traditional nesting aeries by several of the resident raptor species. Vernal pools in the area support the endangered Riverside fairy shrimp and San Diego fairy shrimp and other rare species. Groves of large sycamore trees along streams support populations of the uncommonly observed arboreal salamander, and large oaks and sycamores are used for roosting by insectivorous bats, as nesting sites by raptors, bluebirds, and other species, and as granary trees by acorn woodpeckers (where the woodpeckers store acorns in thousands of small holes they drill in the trunks). Upland springs and seeps, which have yet to be fully mapped, create unique microhabitats for plants and animals along the ridges and canyon walls. Water bodies scattered throughout the area also providing drinking water for wildlife and are used as nesting, roosting, or foraging habitat by a diversity of water birds. Chiquita Canyon holds some of the last alkali marshes in the region, and hundreds of tri-colored blackbirds—a species of concern—nest in these and other marshes in the area.

Conservation Priorities In Southern Orange County

Southern Orange County supports significant remnants of a once extensive and still globally unique ecosystem. In this section, we present conservation measures to maintain this portion of the South Coast Ecoregion as a viable and functioning ecosystem. Due to limitations in data availability and the complex nature of conservation planning, this should be considered a framework for further refinement as part of the NCCP process. The NCCP process should also address the full range of species and expected impacts from proposed development, which are beyond the scope of this report.

The approach we take recognizes southern Orange County as the heart of a biodiversity hotspot and probably the last best example of a globally unique ecosystem. The resource values this subregion supports are therefore irreplaceable (*sensu* Stein et al. 2000). This dictates that any conservation plan for the area deserves liberal application of the "precautionary principle," which holds that, given uncertainty about ecological processes and the consequences of habitat alteration, conservation plans must err on the side of conservation to hedge against loss of species or ecological collapse (Noss et al. 1997).

Principles of Conservation Planning

To ensure that the Southern Orange County NCCP is informed by the best available science, stakeholders in the process convened a prestigious group of science advisors in 1996. The group included well-known scientists from universities, museums, and other research institutions, as well as local field biologists having comprehensive understanding of southern Orange County's ecology and species. The Science Advisors produced a document entitled *Principles of Reserve Design, Species Conservation, and Adaptive Management for the Proposed Southern Orange County NCCP* (Atwood et al. 1996). The document translated broad "tenets" of reserve design prepared by the NCCP Scientific Review Panel (California Department of Fish and Game and California Resources Agency 1993) into more explicit principles to be used in designing a preserve system specifically for southern Orange County. In this document, we attempt to translate the Science Advisors' principles and our own findings into a map showing which areas are most critical to conserve in southern Orange County.

We adopted the following principles (based on Atwood et al. 1996) to guide mapping of core biological resource areas:

- Conserve species throughout the planning area.
- Maintain potential for re-establishment or enhancement of sensitive species (such as southern steelhead or peregrine falcon) and habitats (such as coastal sage scrub that has been converted to agriculture).
- Keep reserves large to support larger populations of species and to maintain ecosystem processes that operate over large landscapes (like natural fire and hydrological cycles).

- Keep reserves diverse by capturing broad environmental gradients, such as the full range of elevations, slopes, soil types, distance from coast, and vegetation types.
- Maintain important grassland areas and grassland-scrubland mosaics, especially in Gobernadora, Chiquita, Upper Gabino, and Cristianitos canyons and in areas northeast of San Clemente and San Juan Capistrano.
- Maintain the integrity of key riparian systems, especially San Juan Creek, Arroyo Trabuco, and key tributaries to San Mateo Creek (Gabino, Talega, and Cristianitos creeks). This includes protecting the natural hydrology and erosion regimes over entire watersheds.
- Keep reserves contiguous and connected, and avoid internal fragmentation of large habitat blocks.
- Minimize physical or visual barriers to species movement, such as roads through reserve areas.
- Direct development to already disturbed areas and away from native communities wherever possible.
- Maintain landscape linkages, especially along riparian systems or other naturally vegetated landscape features used by dispersing animals (especially wide-ranging species like mountain lions). Maintain ridgetop connectivity between Gobernadora and Bell canyons, which is considered essential for mountain lion movements (Beier and Barrett 1993).

Core Biological Resource Units

We delineated four Core Biological Resource Units (Figure 7) within the subregion using a variety of geographic information and the guiding principles outlined above. Each of these units supports unique resource values and therefore has unique biological objectives and management considerations. To ensure continued ecological integrity, each unit must be conserved essentially intact as mapped, without further habitat degradation or internal habitat fragmentation. Some minor modifications of the external boundaries may be acceptable based on further study. However, any development proposal in or near these core units must use the best available science to demonstrate that the project would not reduce any unit's ecological integrity, including its ability to support key species and ecological and environmental processes.

These core units do not necessarily represent all areas necessary to support all species of concern in the subregion. For certain species, such as narrow endemic plants that persist in small habitat fragments, smaller reserves outside of these core areas may also be necessary. Delineation of such areas is beyond the scope of this report and should be based on more detailed biological analysis as part of the NCCP process.

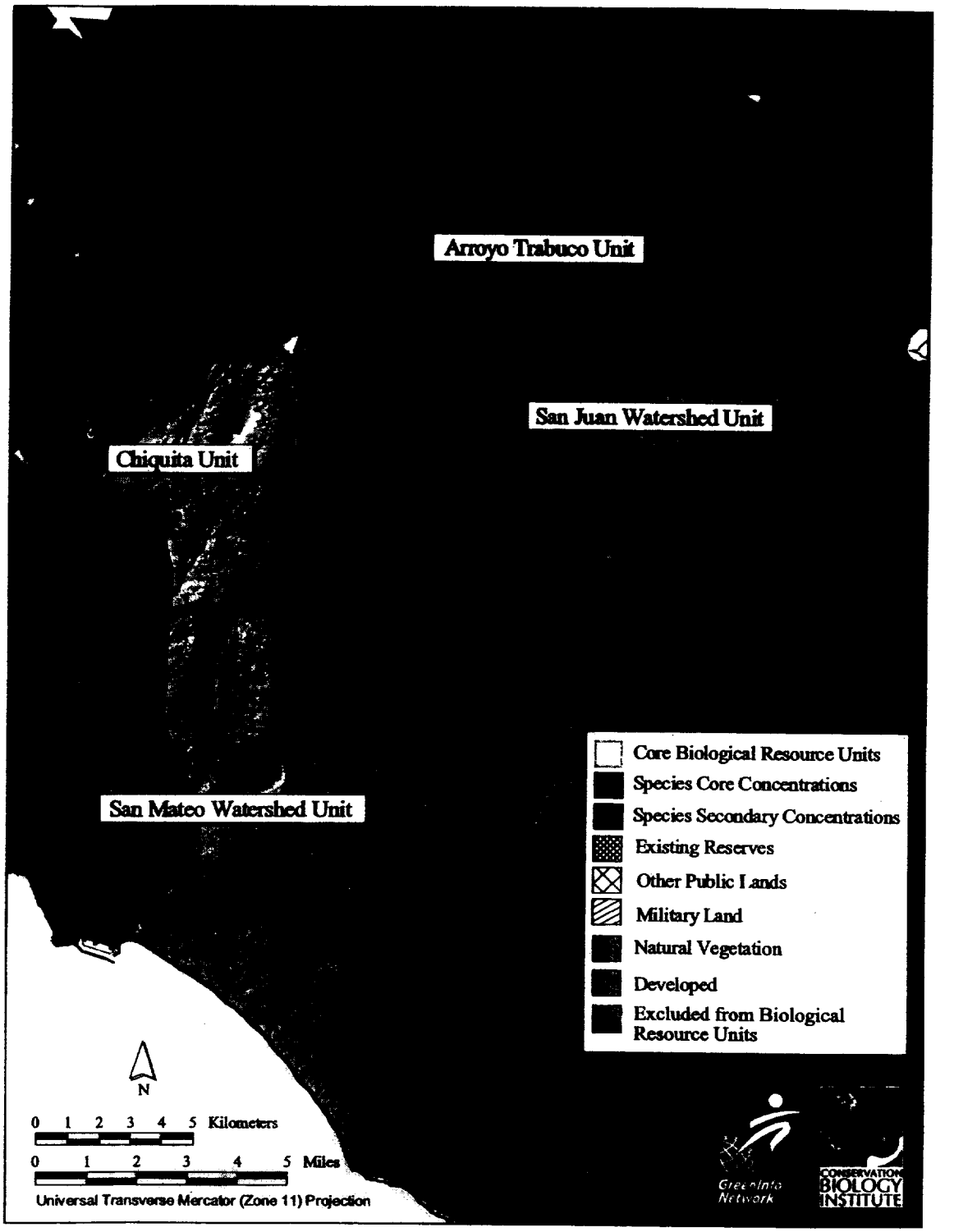

Figure 7 — Core biological resource units in the Southern Orange County NCCP Subregion.

Information sources used in mapping included a vegetation map for the area (1 inch = 4,000 feet; Dudek & Associates 1998b) and the combined core areas for key species (Figure 6). Where possible, entire watershed areas were delineated to meet the planning principles. Existing developed areas were excluded. In a few cases, recent developments are not depicted on existing maps, so development patterns may differ somewhat from those depicted on Figure 7.

Arroyo Trabuco Unit

The Arroyo Trabuco and associated riparian and watershed habitats support a rich biota despite some isolation by development in the lower reaches below the headwaters. In addition to supporting threespine stickleback, arroyo chub (P. Behrends personal communication), and a wide variety of nesting raptors (Dudek & Associates 1998a, 1998c), the Arroyo serves as a movement corridor for mountain lions (Beier 1993).

Arroyo Trabuco Unit

Size: 6,988 acres, including 4,595 acres of natural habitat; 2,000 acres are already protected (28.6%).

Primary Communities: Wetland and aquatic communities, including vernal pools and riparian forest; coastal sage scrub and chaparral linking the riparian/aquatic system to headwaters on Cleveland National Forest.

Special Elements: Vernal pools, raptor nesting sites.

Focal Species: Rare fishes (arroyo chub and threespine stickleback), nesting raptors, fairy shrimp, mountain lion, mule deer.

Essential Processes: Hydrological cycles, wildlife movement; ecological migration response to climate change.

Conservation & Management Goals: Manage edge effects, water runoff, and non-point source pollutants; maintain natural hydrological cycles; control trespass in sensitive areas; maintain linkages to Cleveland National Forest. and Chiquita Unit.

About 2,000 acres along Arroyo Trabuco are already conserved as biological open space. Due to the linear nature of the Arroyo, with dense housing developments on both sides, it is expected to suffer a variety of adverse edge effects. The headwaters in the northern portion of the study area are less constrained, having high ecological integrity where they arise in the Cleveland National Forest. Opportunities for further conservation in the area are limited, except in the northern areas south of Cleveland National Forest. Management plans should address adverse edge effects along the Arroyo, ensure continued function of natural hydrological cycles (flood-scour-deposition), and maintain water quality by controlling water runoff from development. Non-native aquatic species, such as bullfrogs, crayfish, sunfish, and mosquito fish, should be monitored and controlled. Public access and recreational uses should be managed consistent with resource protection goals in this area.

66% natural

Chiquita Unit

Cañada Chiquita represents the single most important core area remaining in southern California for the coastal cactus wren and the California gnatcatcher. This unit captures a broad range of variation of the coastal sage scrub ecosystem in one large contiguous block of habitat (over 7,000 acres), with pockets of native grasslands, alkali marsh, oak woodlands, and other native habitats. The lower and gentler slopes have been disced to support dry farming and some orchards have been planted in the lower canyon. These agricultural changes have somewhat fragmented the natural habitat and introduced exotic plants, but do not present barriers to dispersal or habitat use by key species, such as gnatcatchers, cactus wrens, and mountain lions. According to Fred Roberts (personal communication) the dry-farmed areas still support a number of sensitive plant species and areas of native grasslands. These disced areas could be restored to native sage scrub and grasslands.

Chiquita Unit

Size: 8,763 acres, including 7,017 acres of natural habitat; 1,745 acres are already protected (17.1%).
Primary Communities: Coastal sage scrub, grasslands (native and non-native), alkali marsh, riparian scrub, vernal pools.
Special Elements: Vernal pools, alkali marshes, native grasslands, and coastal sage scrub with wide ecological gradients.
Focal Species: Coastal cactus wren (core population), California gnatcatcher (core population), fairy shrimp, and numerous rare plants associated with vernal pools, alkali marsh, native grasslands, and clay soils.
Essential Processes: Fire/vegetation-succession cycle over a broad landscape; ecological migration response to climate change.
Conservation & Management Goals: Prevent internal fragmentation; restore agricultural areas to coastal sage scrub and native grasslands; maintain connections to other three units; manage for natural fire regime.

About 1,745 acres are already protected under conservation easement, most notably the Chiquita Canyon Conservation Area in the uppermost part of the Cañada. Housing developments have encroached on both the west (Mission Viejo and Ladera) and east (Coto de Caza). However, Cañada Chiquita is well buffered from these developments by topographic relief. Of more concern is internal fragmentation within the upper Cañada, due to recent extension of the Foothill tollroad to Oso Parkway and construction of a high school adjacent to the roadway.

8026

San Juan Watershed Unit

This large area (nearly 19,500 acres) of high ecological integrity supports a wide diversity of habitat types and species within the watershed of San Juan Creek, including pristine Bell Canyon. In addition to core concentrations of cactus wrens and nesting raptors, this area is critical for conserving several key aquatic species, including arroyo toad and arroyo chub. Conserving this area is essential for maintaining mountain lions in the subregion and perhaps the entire ecosystem surrounding the Santa Ana Mountains (Beier 1993). Primary biological goals include maintaining high ecological integrity by precluding internal fragmentation by roads, agricultural expansion, or development, and maintaining water quality and natural hydrological regimes within the watershed. Watershed protection, including protection of the underground aquifer, is essential to maintain conditions required by sensitive aquatic species in San Juan Creek and tributaries. New or deeper wells could lower the aquifer and the flow of water required by these species, and replacing native vegetation with development would increase runoff and add pollutants to the water.

San Juan Watershed Unit

Size: 19,490 acres, including 16,885 acres of natural habitat; 11,429 acres are already protected (58.6%).
Primary Communities: Coastal sage scrub, chaparral, oak woodland, riparian/aquatic systems.
Special Elements: Cliffs and outcrops, seeps and other wetlands.
Focal Species: Coastal cactus wren (core population), rare fishes, arroyo toad (core population), raptors, mountain lion, mule deer.
Essential Processes: Fire/vegetation-succession cycle over a broad landscape; natural hydrological cycles; ecological migration response to climate change.
Conservation & Management Goals: Prevent internal fragmentation; buffer and connect existing reserve areas; maintain broad landscape connections to Chiquita and San Mateo Watershed units; maintain watershed integrity and water quality; manage for natural fire regime.

Nearly 60% of this unit, including pristine Bell Canyon, is already protected as biological open space in Caspers Wilderness Park and Audubon Starr Ranch Sanctuary. The Ortega Highway (State Route 74) runs through the area, but other existing roads are relatively low impact ranch roads. This area is contiguous with the San Mateo Canyon Wilderness to the east. Additional conservation is required to connect these existing reserves via broad landscape linkages to the Chiquita Unit to the west and the San Mateo Watershed Unit to the south. Doing so would secure a large watershed reserve system of high ecological integrity.

~~16885~~
87%

San Mateo Watershed Unit

The San Mateo Watershed Unit is nearly 11,000 acres in total size, including nearly 10,000 acres of natural habitat. It supports some of the most pristine natural habitats left in southern California, including native grasslands, riparian woodlands, and broad canyons and ridges covered with coastal sage scrub, chaparral, and oak woodlands. San Mateo Creek is the last remaining undammed and undiverted major drainage in coastal California south of Ventura. This unit includes Cristianitos, La Paz, Talega, and Gabino creeks, which drain into San Mateo Creek near the boundary of Marine Corps Base Camp Pendleton.

As one tribute to the area's high ecological integrity, the San Mateo watershed is the only watershed south of Malibu Creek to support a breeding population of southern steelhead and is considered critical to recovery of this listed species. It also supports threespine stickleback, arroyo chub, and core populations of arroyo toads. Riparian areas downstream, on Marine Corps Base Camp Pendleton, also support core populations of endangered least Bell's vireos, southwestern willow flycatchers, and tidewater gobies. Grasslands in the area are considered critical foraging areas for the golden eagle pair nesting along nearby San Mateo Canyon (Bittner 2001). This area also supports the best remaining examples of native grasslands in the subregion, in part due to the moderate grazing pressure it has received relative to other areas (P. Bloom personal communication). Finally, this large, intact habitat area is considered essential to maintaining deer and mountain lion populations in the subregion.

San Mateo Watershed Unit

Size: 10,908 acres, including 9,855 acres of natural habitat; 1,271 acres are already protected (11.7%).

Primary Communities: Coastal sage scrub, grasslands (native and non-native), chaparral, oak woodland, riparian/aquatic systems.

Special Elements: Native grasslands (high quality), western juniper (relict population), cliffs and outcrops (raptor aeries), seeps and other wetlands.

Focal Species: Golden eagle (essential foraging area), steelhead trout (recovery watershed) and other rare fishes, arroyo toad, raptors, mountain lion, mule deer, and numerous rare plants.

Essential Processes: Fire/vegetation-succession cycle over a broad landscape; natural hydrological cycles over entire watershed; ecological migration response to climate change.

Conservation & Management Goals: Prevent internal fragmentation; conserve all grassland areas; buffer cliffs (raptor aeries); buffer and connect existing reserve areas; maintain broad landscape connections to Chiquita and San Juan Watershed units; maintain watershed integrity and water quality; manage for natural fire regime; manage trespass in or near sensitive areas, including raptor aeries.

The overall biological goal for this area must be to maintain the existing level of ecological integrity, water quality, and natural hydrological regime by precluding internal fragmentation by new roads or other development. The area is largely intact despite some fragmentation by Cristianitos Road and the existing TRW facility in the southern part of Cristianitos Canyon. The unit abuts Marine Corps Base Camp Pendleton on the south, the San Juan Watershed Unit on the north, and private inholdings between the subregion and the San Mateo Wilderness Area on the east. Only about 1,271 acres are already conserved, as the Rancho Mission Viejo Conservancy Area in the western portion of the watershed.

Conclusions

The Southern Orange County NCCP represents a unique opportunity to conserve what remains of a globally unique, diverse, and functioning ecosystem and its collection of endemic species. In many ways, this subregion—the heart of a global biodiversity hotspot—seems the last best hope to conserve a large, unfragmented, and ecologically intact representation of the natural ecosystem that once existed throughout the coastal foothills of Southern California. Without a doubt, this area represents the most important single tract of land in this ecoregion for conserving the coastal cactus wren and California gnatcatcher. Wise conservation decisions here would also help retain and recover populations of the southern steelhead, golden eagle, mountain lion, and mule deer, along with numerous other species unique to this ecoregion. The science of conservation planning dictates that large, intact, and unfragmented watershed units be conserved within this area, connected by landscape linkages, and where necessary, healed with ecological restoration. This can be achieved through the NCCP process, so long as society agrees that these resource values are irreplaceable.

Total Natural
i 4 core
38,352
-16,449 protected
21,907 unprotected natural

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U.S. Fish & Wildlife Service

Recovery Plan for the Pacific Pocket Mouse

(Perognathus longimembris pacificus)

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Pacific Pocket Mouse

(*Perognathus longimembris pacificus*)

Recovery Plan

Published by the U.S. Fish & Wildlife Service
Region 1
Portland, Oregon

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Date: 9/28/98

DISCLAIMER

Recovery plans delineate actions required to recover and/or protect listed species. We (the U.S. Fish and Wildlife Service) publish plans. Sometimes the plans are prepared with the assistance of recovery teams, contractors, State agencies, and other affected and interested parties. Recovery teams serve as independent advisors to us. Plans are reviewed by the public and submitted to additional peer review before they are adopted by us. Objectives of the plan will be attained and any necessary funds made available, subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Recovery plans do not obligate other parties to undertake specific tasks and may not represent the views nor the official positions or approval of any individuals or agencies involved in the plan formulation, other than us. They represent our official position only after they have been signed by the Regional Director or Director as approved. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks.

LITERATURE CITATION: U.S. Fish and Wildlife Service. 1998. Pacific Pocket Mouse (*Perognathus longimembris pacificus*) Recovery Plan. Portland, OR. 112 pp.

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ACKNOWLEDGMENTS

We (the U.S. Fish and Wildlife Service (Service)) wish to thank and acknowledge the many persons over the years who have provided helpful information and conversation relating to the Pacific pocket mouse and/or endangered rodent biology and ecology in general. Dr. Phillip Brylski, Loren Hays, and Jon Avery authored this final plan. Richard Erickson shared voluminous data and information; Peter Meserve, R.J. M'Closkey, and Richard MacMillan shared their field experience with the us and offered their insights on the detection, biology, and ecology of the Pacific pocket mouse; and Jim Patton and Dan Williams answered questions on the species' taxonomy. Mark Pavelka and Arthur Davenport of the U.S Fish and Wildlife Service Carlsbad Field Office; Mike Bentzien of the Jacksonville Field Office; Nick Holler of the National Biological Service; and biological consultants Steve Montgomery, Shana Dodd, Phil Behrends, Michael O'Farrell, and Wayne Spencer provided the benefit of their experience and expertise. Personnel of the Marine Corps Base, Camp Pendleton, particularly Slader Buck and Dave Boyer, assisted in the coordination of Pacific pocket mouse surveys and provided useful information and expertise. We acknowledge the tremendous contributions of specimens, journals, and files of the following museums/collections: San Diego Natural History Museum, Santa Barbara Museum of Natural History, Natural History Museum of Los Angeles County, Dickey Collection of the University of California, Los Angeles, and the Museum of Vertebrate Zoology at the University of California, Berkeley. Additional collection data were supplied by the U.S. National Museum in Washington D.C., University of Arizona, California State University, Northridge, and Northern Illinois University.

EXECUTIVE SUMMARY

Current Status: The Pacific pocket mouse (*Perognathus longimembris pacificus*) historically occurred on the immediate coast of southern California from Marina del Rey and El Segundo in Los Angeles County, south to the vicinity of the Mexican border in San Diego County. The subspecies has been recorded up to approximately 4 kilometers (2.5 miles) inland. Rediscovered in 1993 after a 20-year period during which the subspecies was not detected, the subspecies is currently known to occur at the Dana Point Headlands, Orange County, and two locations on the Marine Corps Base, Camp Pendleton in San Diego County. Current occupied habitat for the Pacific pocket mouse is estimated to be less than 400 hectares (1,000 acres) at the three known localities combined.

Habitat Requirements and Limiting Factors: The Pacific pocket mouse has occurred on fine-grain, sandy substrates in open coastal sage scrub, coastal strand, coastal dune, and river alluvium habitats. The extant populations at the three known locales occur within open coastal sage scrub habitats. The subspecies is imminently threatened by habitat destruction and fragmentation, documented depredation by domestic cats, and recreational activities.

Recovery Objective: Delisting, with an interim objective of reclassification to threatened status.

Recovery Criteria: We may consider reclassifying the Pacific pocket mouse to threatened status if and when:

1. Ten populations are independently viable and stable or increasing, and their habitats are secure (free of risk of loss) and fully protected through fee ownership by a resource agency or conservation program, conservation easement, or other means of permanent protection. Populations of Pacific pocket mice shall be considered viable if the appropriate analysis of measured population parameters indicate that each of the 10 populations has a 95 percent or greater chance of surviving for 100 years.

2. Occupied habitat consists of a minimum of 2,000 hectares (4,940 acres) that are secure and fully protected through fee ownership by a resource agency or conservation program, conservation easement, or other means of permanent protection.

3. All Pacific pocket mouse populations are managed through a program to maintain genetic diversity for future generations.

4. All Pacific pocket mouse populations and essential habitat are managed so that current and potential threats (e.g., predation and disease) are eliminated or minimized to the extent that each population is not at risk of extirpation. Essential habitat is defined to mean both suitable and potential habitat that is necessary for the full recovery of the subspecies.

We may consider delisting the Pacific pocket mouse if and when:

1. All actions necessary for reclassification to threatened have been implemented.

2. Any necessary protection, restoration and enhancement activities (on all sites that have been determined to be essential to the recovery of the subspecies) are successfully completed.

3. Populations of the Pacific pocket mouse should be representative of the full (existing) genetic variability and historical geographical range of the subspecies and occur in habitats that collectively represent the full range of parameters observed and described in the past or during prescribed, future research and monitoring efforts.

Actions Needed and their costs:

1. Identify and protect all extant populations and essential habitat.	$511,000
2. Prepare and implement management plans.	2,900,000

3. Enhance and expand occupied and potential habitat.	698,000
4. Conduct research on life history, ecology, and population biology.	1,053,000
5. Identify and implement measures to create additional populations.	2,096,000
6. Enhance public awareness.	211,000
Total	$7.5 million

These costs exclude land acquisition and other, as yet, undeterminable costs.

Dates of Reclassification: Reclassification to threatened status may occur by the year 2023, assuming full implementation of this plan. Research and other tasks prescribed by this plan are necessary to determine the potential for complete recovery and delisting. Accordingly, the date of delisting is presently uncertain.

TABLE OF CONTENTS

Executive Summary iii

I. Introduction 1

Species Overview 1

Description 2

Taxonomy 2

Historic and Current Range 3

Habitat Description 8

Life History/Ecology 10

Population Viability 16

Reasons for Listing: Decline and Current Threats 17

Habitat Destruction 17

Habitat Fragmentation and Degradation 20

Depredation 26

Conservation Efforts: Research 26

Conservation Efforts: Management and Protection 27

Federal Actions 27

State and Local Actions 30

II. Recovery 33

Recovery Strategy 33

Recovery Objectives and Delisting Criteria 35

Narrative Outline for Recovery Actions 37

III. Implementation Schedule 71

IV. References 82

APPENDIX 1. Genetic Analyses 97

APPENDIX 2. Essential Captive Breeding Protocol Elements 101

APPENDIX 3. Summary of the Agency and Public Comments on the Draft Pacific Pocket Mouse Recovery Plan 108

LIST OF FIGURES

Figure 1. Historic Localities Based on Museum Records 4
Figure 2. Locations of Known Populations 6

LIST OF TABLES

Table 1. Summary of the Natural History of *Perognathus longimembris* 12
Table 2. Implementation Schedule for Pacific Pocket Mouse Recovery 73

I. Introduction

The Endangered Species Act (Act) calls for preparation of recovery plans for those listed species that are likely to benefit from the effort. A recovery plan must establish, if practicable, recovery goals and objectives, describe site-specific management actions recommended to achieve those goals, and estimate the time and costs required for recovery. A recovery plan presents a set of recommendations.

Species Overview

The Pacific pocket mouse (*Perognathus longimembris pacificus*) is endemic to the coast of southern California from Marina del Rey and El Segundo in Los Angeles County, south to the vicinity of the Mexican border in San Diego County. The subspecies occurred on fine-grain, sandy substrates and inhabited coastal strand, coastal dunes, river alluvium, and coastal sage scrub habitats growing on marine terraces within approximately 4 kilometers (2.5 miles) of the ocean. Currently, the subspecies is found predominantly on sandy substrates within coastal sage scrub habitats.

We (the U.S. Fish and Wildlife Service) emergency listed the Pacific pocket mouse in February 1994 (59 *FR* 5306) following the rediscovery of a single population at the Dana Point Headlands in 1993. Upon expiration of the emergency rule, we federally listed the subspecies as endangered on September 29, 1994, in accordance with the Endangered Species Act (59 *FR* 49752). We gave the subspecies a recovery priority number of 3C which means it is facing a high degree of threat, including conflicts with development projects, yet has a high recovery potential. The California Department of Fish and Game also designated the Pacific pocket mouse as a "Species of Special Concern".

In 1995, Pacific pocket mice were discovered in two general locations on the Marine Corps Base, Camp Pendleton, in San Diego County. Current occupied habitat for the Pacific pocket mouse is estimated to total less than 400 hectares (1,000 acres) at all sites combined. None of the nine historic locales (Erickson

1994, Erickson 1998) are permanently protected and all have been damaged or are threatened by habitat destruction or fragmentation, human-caused fire, or other disturbances. Populations at six of the historic localities apparently have been extirpated.

This recovery plan summarizes the taxonomy of the Pacific pocket mouse, its historic and current distribution, known features of habitat and life history, and the current threats to the subspecies. The present status of conservation efforts on behalf of this subspecies is also described. In Part II of this plan, recommendations are made for a long-term program to affect the recovery of the subspecies.

Description

All members of the family Heteromyidae are nocturnal granivores with external, fur-lined cheek pouches. The body pelage of the little pocket mouse (*Perognathus longimembris*) is silky. The little pocket mouse shows wide geographic variation in pelage color (Hall 1981). The dorsal pelage is predominately brown, pinkish buff or ochraceous buff. The ventral pelage is whitish. There are typically two small patches of lighter hairs at the base of the ear. The tail can be either distinctly or indistinctly bicolored. The Pacific pocket mouse is among the smallest subspecies of little pocket mice, ranging up to 131 millimeters (5.2 inches) in length from nose to tip of tail (Hall 1981). Little pocket mice weigh 7 to 9 grams (0.25 to 0.33 ounces).

Taxonomy

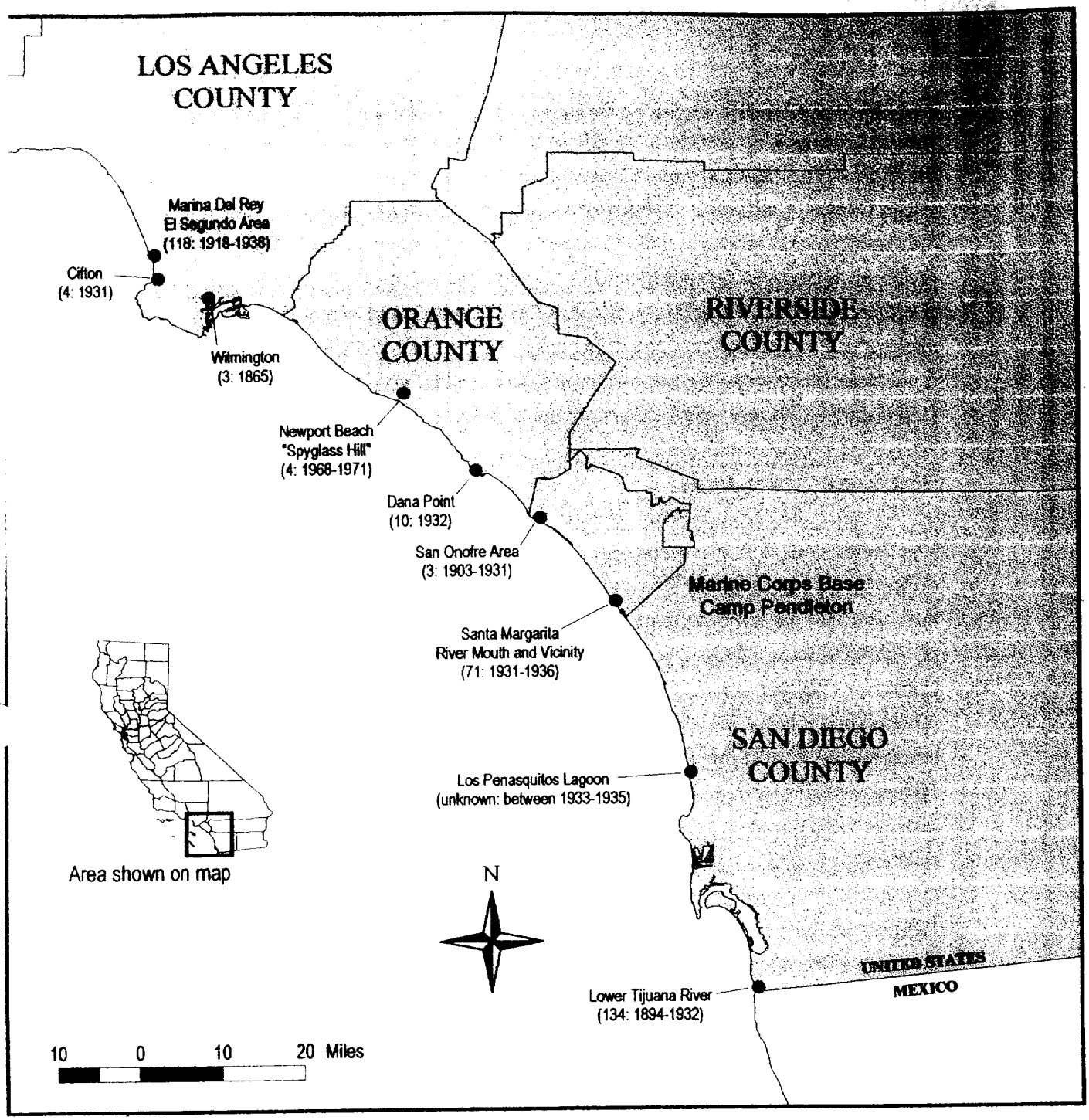
The Pacific pocket mouse (*Perognathus longimembris pacificus*) is 1 of 19 recognized subspecies of the little pocket mouse (*Perognathus longimembris)* (Hall 1981). This subspecies is the smallest member of the family Heteromyidae, which consists of spiny pocket mice (*Heteromys* and *Liomys*), pocket mice (*Perognathus* and *Chaetodipus*), kangaroo rats (*Dipodomys*), and kangaroo mice (*Microdipodops*).

The Pacific pocket mouse was originally described by Mearns (1898) as a distinct species, *Perognathus pacificus*, based on the type specimen that was collected on the shore of the Pacific Ocean at "Mexican Boundary Monument 258" in San Diego County, California. Although von Bloeker (1931a,b) initially recognized the Pacific pocket mouse as a distinct species, he subsequently concluded *P. pacificus* represented two subspecies of the little pocket mouse, *P. longimembris pacificus* and *P. l. cantwelli* (von Bloeker 1932). Subsequent to a biometric analysis of 331 specimens of the little pocket mouse, Huey (1939a) recognized *P. l. pacificus* inclusive of the two subspecies described by von Bloeker (1932). Hall (1981) and Williams *et al.* (1993) continued to rely on that treatment.

Historic and Current Range

The Pacific pocket mouse is endemic to the immediate coast of southern California from Marina del Rey and El Segundo in Los Angeles County, south to the vicinity of the Mexican border in San Diego County (Hall 1981; Williams *et al.* 1986; Erickson 1993). The subspecies has not been recorded outside of California (Williams *et al.* 1993; Erickson 1993) and has not been reliably reported more than 4 kilometers (2.5 miles) from the ocean. Erickson (1993) noted further that the Pacific pocket mouse has not been reliably recorded above 180 meters (600 feet) in elevation, but Spencer (1997) noted that elevation and distance from the coast are correlated values and doubted that elevation was relevant.

Range-wide survey data to date and all other relevant information indicate that the Pacific pocket mouse was and is a patchily distributed subspecies that has been described as never common or rare on carefully studied plots or, at best, historically and locally "...abundant on sandy bottoms near the coast of San Diego County..." (Bailey 1939). The available data indicate that the historical distribution of the Pacific pocket mouse was much more extensive prior to the large-scale development of the coastal lowlands of southern California. Between 1894 and 1972, the Pacific pocket mouse was recorded from 9 general locales and 30 specific localities from Los Angeles County south to the Mexican border in San Diego County (Figure 1) (Erickson 1998). Prior to the recent discovery or



Source: Adapted from Erickson, 1993; Erickson 1994.

Legend
(134: 1894-1932)
| Years collected
Individuals in
museum collection

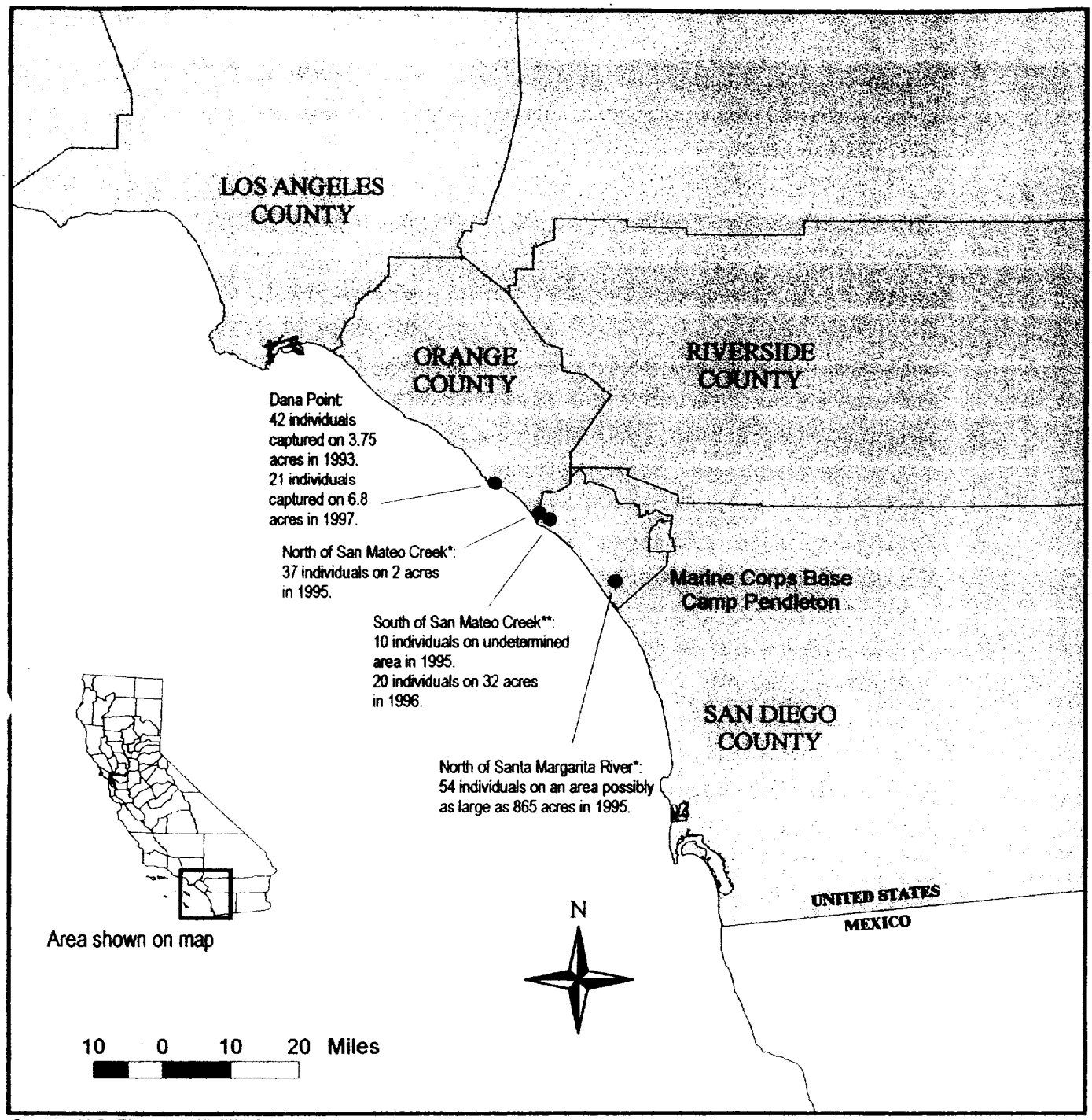
Figure 1. Historic localities, based on museum records.

rediscovery of the extant populations at the three known locales (Figure 2), approximately 80 percent of all Pacific pocket mouse records were from 1931 or 1932 (Erickson 1993).

There are three historic localities for the subspecies in Los Angeles County: Marina del Rey/El Segundo, Wilmington, and Clifton. There have been no records of Pacific pocket mice from Los Angeles County since 1938 (Erickson 1993; Brylski 1993). The Pacific pocket mouse has been confirmed at two locales in Orange County: the San Joaquin Hills and Dana Point. The only known extant Pacific pocket mouse population in Orange County occurs on the Dana Point Headlands, a historic Pacific pocket mouse locality that was discovered in the 1930's. The Pacific pocket mouse was known historically at four localities in San Diego County: San Onofre, the vicinity of the Santa Margarita River Estuary, Penasquitos Lagoon, and the lower Tijuana River Valley (Erickson 1994, Erickson 1998). Figure 1 depicts the historic localities where individuals were collected for museum research, or, in the case of "Spyglass Hill" in Newport Beach, where research was conducted on rodent community ecology (Meserve 1972; M'Closkey 1972).

In 1993, presence/absence surveys resulted in the capture of 25 to 36 individual Pacific pocket mice at Dana Point Headlands, spread over approximately 1.4 hectares (3.5 acres) of occupied habitat (Brylski 1993). Twenty-one individual Pacific pocket mice were captured at Dana Point Headlands in 1997 on approximately 2.8 hectares (6.8 acres) of occupied habitat (U.S. Fish and Wildlife Service 1998).

Two locations with extant Pacific pocket mouse populations were discovered (or rediscovered) in 1995 on the Marine Corps Base, Camp Pendleton in the vicinity of two historic locales. One location consists of two separate small pockets of animals detected immediately north and south of San Mateo Creek. The northerly site, which has been designated by Camp Pendleton as the San Mateo-North Site ("SMN"), is approximately 1.4 kilometers (0.9 mile) from the coast. The southerly site, which has been designated as the San Mateo-South Site ("SMS"), is approximately 2.1 kilometers (1.3 miles) from the coast. Presence/absence



Source: U.S. Fish and Wildlife Service
Brylski (1993, unpublished data)

* Minimum number of individuals known to occur at time of survey.

** North and South San Mateo Creek, map represent a single population.

Figure 2. Locations of known populations

surveys have been performed in much of this area as well as preliminary work aimed at determining if the two San Mateo groups are connected or distinct (MBA and LSA 1996; MBA 1997; OGDEN 1997). Twenty individual Pacific pocket mice were captured in 1996 at the San Mateo South site on approximately 13 hectares (32 acres) of occupied habitat; 37 individuals were captured in 1995 at the San Mateo North site on approximately 6.5 hectares (16 acres) of occupied habitat (OGDEN 1997). These surveys were designed to determine only the presence or absence of the Pacific pocket mouse in specific areas and did not employ the more intensive methods necessary to determine population numbers or demographics (OGDEN 1997).

Studies to definitively determine the relationship between these two groups (e.g., degree of exchange of genetic material) are not yet conclusive and will take more time and effort to complete than any of the studies conducted to date, especially if standard live trapping techniques are employed (M. Pavelka, pers. comm. 1998). Any movement occurring between these two groups probably is naturally sporadic and infrequent -- something limited surveys would not likely detect. Some impediments to movement now exist, including a roadway, cultivated agricultural lands, and San Mateo Creek wash. Consistent occupation of the San Mateo Creek wash or a "connecting corridor" is unlikely to occur under current conditions as Pacific pocket mice are not likely strong colonizers and probably could not maintain a presence in areas subject to periodic overwash/flooding or other continual disturbances (i.e., agriculture) (M. Pavelka, pers. comm. 1998). Nevertheless, periodic movement between groups across the wash may occur in the long term. As a result, linkage between these groups may prove necessary to maintain genetic integrity, allow for habitat dynamics and ecosystem function, and provide for recolonization should one group become extirpated.

The second, separate Camp Pendleton locale with an extant population occurs on a marine terrace north of the Santa Margarita River in an area that is designated by Camp Pendleton as training area Oscar-1. The extent of occupied habitat in the Oscar-1 training area ranged from approximately 2.5 to 4 kilometers (1.6 to 2.5 miles) from the coast in 1996 (U.S. Fish and Wildlife Service, unpublished data). Fifty-four individual Pacific pocket mice were captured in 1995 at the Oscar-1

site, estimated to possibly be as large as 350 hectares (865 acres) of occupied habitat (OGDEN 1997). Surveys of the coastal area between the two known locales with extant populations on Camp Pendleton have almost been completed and no additional populations have been found (Buck 1997). Although supporting data are presently lacking, both Camp Pendleton locales with extant populations could be part of a metapopulation operating in the long term with populations occupying a dynamic mosaic of habitats. Even though the Pacific pocket mouse appears to be extirpated from suitable patches today, it does not necessarily mean that these populations do not function as a metapopulation. Given the temporal mosaic of suitable and unsuitable patches throughout this subspecies range, it appears more likely that they functioned as a classic metapopulation (A. Davenport, pers. comm. 1998). The locations and relative sizes of the extant populations at the three known locales are depicted in Figure 2.

Fewer than 150 individual mice (when recaptures are considered) were live-captured at these sites from 1993 to 1997. Numerous recent surveys within the historic range of the subspecies have failed to detect additional extant populations (U.S. Fish and Wildlife Service 1994c; U.S. Fish and Wildlife Service, unpublished data; OGDEN 1997, SAPPHOS 1997). Given the small numbers of known populations, the small area known to be currently occupied, and total individual animals captured to date, the Pacific pocket mouse remains highly endangered and vulnerable to extinction.

Habitat Description

Pacific pocket mice occur on fine-grain, sandy or gravelly substrates in the immediate vicinity of the Pacific Ocean (Mearns 1898; von Bloeker 1931a, b; Grinnell 1933; Bailey 1939). Although individual Pacific pocket mice have been collected or observed in several plant communities, the subspecies has narrow habitat requirements and typically occurs on sandy soils. The Pacific pocket mouse was known to inhabit coastal strand, coastal dunes, river alluvium, and coastal sage scrub growing on marine terraces (Grinnell 1933; Meserve 1972; Erickson 1993), however, recent survey efforts have found the subspecies in sandy substrates within coastal sage scrub.

Specific habitat descriptions for various localities are as follows:

(1) Spyglass Hill, San Joaquin Hills, Orange County: The habitat occupied by the population of *P.l. pacificus* studied by Meserve (1976b) comprised open sand (26.1 percent), perennial shrubs (59.9 percent), grasses (11.6 percent), and forbs (2.4 percent).

(2) Tijuana River Valley, San Diego County: There are three accounts of the area. Mearns (1898) noted that the type specimen was captured on "...a flat, often submerged by high ocean tides, at the mouth of the Tijuana River, where it appears to be abundant." Recounting his discovery of a population, von Bloeker (1931a, b) recorded the following: "The mistake was made of trying to trap for *P. pacificus* on the ocean shore in the immediate vicinity of Monument No. 258." Instead, he found them in a neighboring field: "This field gave the appearance from the road of being covered by a dense growth of weeds and brush. However, after I entered the field, small open spaces of alluvial river-bottom sand were encountered that make an ideal situation for pocket mice. Two series of pocket mice were taken from three separate fields in the bed of the Tijuana River near its mouth. In two of the fields, fox-tail, or barleyweed (*Hordeum murinum*), salt grass (*Distichilis spicata*), ice plant (*Mesembryanthemum crystallinum*), star thistle (*Centaurea melitensis*), and telegraph weed (*Heterotheca grandiflora*) were the predominating plants. In the other field, arrow-weed (*Pluchea sericea*), telegraph weed, salt grass, ice plant, and *Croton californicus* were the predominating plants." Bailey (1939) described the Pacific pocket mouse as "abundant on sandy bottoms near the coast".

(3) Oceanside, San Diego County: The Pacific pocket mouse was formerly found "...among the sand dunes along the shore near Oceanside" where the animals were apparently abundant over their restricted habitat. Burrows were noted "under the edges of creeping vegetation". "None was discovered in the high hard clay soil back of the beaches". The burrows were simple and ended in a small cavity or nest chamber a foot or so below the surface (Bailey 1939).

(4) Dana Point Headlands, Orange County: Pacific pocket mice at this locale were detected in open coastal sage scrub dominated by *Artemisia californica*, with fine, sandy soil with bare sandy areas (Brylski 1993). Exposed sandy soil covered 13 percent of the surface area in occupied habitat (Brylski, unpublished data).

The Pacific pocket mice found in the Oscar-1 area on Camp Pendleton currently occur in non-coastal sage scrub habitats, including non-native grasslands and disturbed areas dominated by filaree (*Erodium* sp.). Anecdotal evidence suggests that the areas of dense grasslands are not occupied (to a level of being detectable during surveys), but the small coastal sage scrub, bare ground, and low density non-native grassland patches within the more dense grasslands are occupied. It is unclear whether the mice occupy the dense grasslands in low numbers, use them only for movement to/from the smaller patches of suitable habitat, or only move across those areas following burn events (which are quite frequent within Oscar-1) when the vegetation is less prohibitive to movements. The Pacific pocket mouse also exploits the friable (easily crumbled) soils in berms created during road maintenance in this area. It appears that the occurrence of the Pacific pocket mouse is closely associated with loose or friable soils that permit burrowing (M. Pavelka, pers. comm. 1998).

Life History/Ecology

Table 1 summarizes basic information on the natural history of the Pacific pocket mouse and other *P. longimembris* subspecies. Few studies have been conducted on the ecology and life history of the Pacific pocket mouse. However, the attributes of the little pocket mouse (*P. longimembris*) and the available data that pertain to the Pacific pocket mouse suggest that the subspecies is facultatively or partially fossorial, relatively sedentary, primarily granivorous, and able to become torpid, estivate, or hibernate in response to adverse environmental conditions (Bailey 1939; Kenagy 1973).

Little pocket mice are among the smallest mammals known to hibernate. They hibernate in winter (O'Farrell 1974), typically from September to April. In

contrast to other hibernators that accumulate fat reserves for hibernation, little pocket mice feed on seed caches stored in their burrows. Individuals become torpid when deprived of food for 24 to 36 hours. During hibernation, the body temperature of pocket mice is slightly above that of, and varies directly with, ambient temperature (Bartholomew and Cade 1957). Periods of dormancy have neither a daily or strictly seasonal pattern. In captivity, dormant individuals may show some activity each day within their burrows. Emergence from hibernation in spring (typically in March) correlates with availability of forb and grass seeds (Meserve 1976b).

Relatively little is known of the breeding biology of Pacific pocket mice. Meserve (1972) noted that pregnant and lactating females have been found from April through June with immatures noted from June through September. Brylski (1993) observed lactating females in July of 1993 on the Dana Point Headlands and noted that two litters were produced. One or more of the juveniles in the Dana Point Headlands population were considered to have limited reproductive capabilities (Brylski 1993).

Table 1. Summary of the Natural History of *Perognathus longimembris*
Food Habits *P. longimembris pacificus*: Pacific pocket mice prefer seeds and stems of grasses and some forbs (Meserve 1976a); arthropods and larva are eaten somewhat (von Bloeker 1931; Meserve 1972; Meserve 1976a). Bailey (1939) recorded seeds of the following species from the pouches of collected specimens: "*Lotus prostratus*, two species of salt bush, heliotrope, mustard, *Monanthochloe*, *Franseria*, a rush..." From the pouches of collected specimens, von Bloeker (*in* Bailey 1939) recorded the seeds of *Heterotheca grandiflora*, *Chrysothamnus*, *Centaurea melitensis*, *Croton californicus*, *Pluchea sericea*, and *Hordeum murinum*. *P.l. pacificus* was observed to drink water regularly in captivity (Bailey 1939). Other *P. longimembris*: *P.l. longimembris* typically forage in and adjacent to clumps of vegetation (Brown and Lieberman 1973).
Activity *P. longimembris pacificus*: apparently hibernates in winter and generally remains in underground burrows from November to February (Meserve 1972). Other *P. longimembris*: Kenagy (1973) observed that little pocket mice may stay in their burrows continuously for up to 5 months in winter, alternating between periods of dormancy and feeding on stored seeds. Periods of dormancy apparently may be induced by, or correlated with, food shortage (Kenagy 1973). In the Owens Valley, the activity of *P.l. longimembris* differed in three consecutive winters, ranging from 0 to 5 months of inactivity (Kenagy 1976). In 1969-70, the year of greatest survival (82 percent) and the largest population number (27) for this group, they were active all winter. Precipitation in the season prior to the 1969-1970 winter was three times normal, and plants produced a prolific crop of seeds. This population was active foraging above ground during a different winter following poor seed production, although it is not clear that all individuals were active. Less fit individuals and young of the year may be forced into winter activity due to low food stores. In the same study, males were observed in the spring before females. Winters are less severe in the range of Pacific pocket mouse than of other subspecies, which may explain (and predict) some differences in activity patterns (Spencer 1997).

Table 1. Summary of the Natural History of
Perognathus longimembris

(Continued)

Density and Movements

P. longimembris pacificus: Thirty-six animals were captured in approximately 1.4 hectares (3.5 acres) of occupied habitat on the Dana Point Headlands in 1993 (Brylski 1993). Ogden (1997) reported a movement (by recapture) of about 22 meters. Most other recaptures are at the first capture location (Spencer 1997). Twenty individual Pacific pocket mice were captured in 1996 at the San Mateo South site on approximately 13 hectares (32 acres) of occupied habitat; 37 individuals were captured in 1995 at the San Mateo North site on approximately 6.5 hectares (16 acres) of occupied habitat (OGDEN 1997).

Other *P. longimembris*: Little pocket mice are often the most abundant rodent in arid habitats. Hall (1946) estimated a population density in Nevada to be as high as 990 individuals/hectare (400 individuals/acre). Home ranges ranged in size from 0.12 to 0.56 hectares (0.30 to 1.4 acres) and populations ranged in density from 1 to 5.5 individuals per hectare (0.4 to 2.2 individuals per acre) in Joshua Tree National Monument, California (Chew and Butterworth 1964). In Nevada, home ranges of males averaged 0.3 to 1.9 hectares (0.7 to 4.7 acres) and home ranges of females averaged 0.5 to 3.1 hectares (1.2 to 7.6 acres). One studied population density fluctuated from 1 to 5.4 individuals per hectare (0.4 to 2.2 individuals per acre).

Little pocket mice have ranged up to 305 meters (1,000 feet) from their burrows in a 24-hour period (Burt and Grossenheider 1976). In the Owens Valley, California, Kenagy (1973) observed movements of less than 50 meters (165 feet).

Population densities of *P. flavus* fluctuate widely: in one Arizona study area, animals were absent for years and yet later were the most abundant species. Average range of movement was 62.5 meters (205 feet) (Chew and Chew 1970) and the average dispersal distance during a lifetime was 202 meters (660 feet) (Brown and Zeng 1989). Home ranges have been reported at 0.11 hectares (0.27 acres) in Arizona and 0.24 to 0.63 hectares (0.6 to 1.6 acres) in New Mexico; males' home ranges are larger than those of females.

Table 1. Summary of the natural history of *Perognathus longimembris*

(Continued)

Reproduction

P. longimembris pacificus: Breeds from April through July. A minority of juveniles may breed within a month of weaning.

Other *P. longimembris*: The species as a whole breeds from January to August, with a peak from March to May. Reproduction is keyed to the availability of green vegetation. Nests are constructed in the burrow with roots, leaves, and other organic materials. Gestation is approximately 22 to 23 days, although extremes of 21 to 31 days were recorded by Hayden *et al.* (1966). Young of the year are capable of breeding in the same season they are born.

Longevity

P. longimembris pacificus: Two *P.l. pacificus* lived about 4 and 6 years in captivity (Bailey 1939). A *P.l. bangsi* trapped as an adult lived 3.5 years in captivity; when it died it was probably more than 4 years old (Behrends 1997).

Other *P. longimembris*: Within a population of *P. longimembris* studied at Joshua Tree (apparently *P. l. bangsi*), 30 percent of the marked individuals survived from one spring to the next (Chew and Butterworth 1964).

Behavior

P. longimembris pacificus: Observations by Bailey (1939) and Meserve (1972) on captive animals indicate this subspecies, like other heteromyids, is aggressively solitary.

Table 1. Summary of the natural history of *Perognathus longimembris*

(Continued)

Age Structure and Sex Ratio

P. longimembris pacificus:
Age Structure: At the Dana Point Headlands and San Mateo Creek populations, 61 percent and 75 percent of the captures, respectively, were young of the year (juveniles and subadults). Both studies were conducted during July and August. Despite a potential trap bias (juveniles may be more trappable than adults), the age structure of these populations after reproduction is dominated by juveniles.

Sex Ratio: At the Dana Point Headlands, the sex ratio was 1.1 to 1 (♂♂:♀♀). At the San Mateo Creek population, the sex ratio was 0.8 to 1.

Other *P. longimembris*: No data found.

Predation

P. longimembris pacificus: House cats are known predators on the Dana Point Headlands population.

Other *P. longimembris*: Little pocket mice are preyed upon by owls, loggerhead shrikes, foxes, snakes, and feral cats.

Population Viability

Population viability is the capacity of a population to persist over time and is influenced by both deterministic and stochastic factors. Deterministic factors lead to long-term population trends and may include such things as the amount of suitable habitat, predation rates, reproduction rates, etc. Stochastic factors are random or unpredictable events which may cause an instantaneous extinction, or more commonly, reduce a population to the point where it enters one of several "extinction vortices" or positive feedback loops of biological and environmental interactions that have further negative impacts on a population, possibly leading to its extinction (Gilpin and Soule' 1986). Efforts to manage a species or its habitat can alter the deterministic factors but it may be much more difficult to ameliorate or minimize the stochastic ones.

Generally, small populations are more vulnerable than large ones (Pimm 1991, Noss and Cooperrider 1994). Noss and Cooperrider (1994) identified four major factors which predispose small populations to extinction:

- Environmental variation and natural catastrophes. Unusually harsh weather, fires or other unpredictable environmental phenomena.

- Demographic stochasticity. Chance variation in age and sex ratios or other population parameters.

- Genetic deterioration. Small isolated populations are prone to inbreeding depression and genetic drift or random changes in gene frequencies.

- Metapopulation dynamics. Many species are distributed as systems of local populations linked by occasional dispersal that wards against demographic or genetic deterioration.

Reasons for Listing: Decline and Current Threats

Although suitable Pacific pocket mouse habitat apparently remains in San Onofre and contiguous coastal areas of the Marine Corps Base, Camp Pendleton, San Joaquin Hills, Palos Verdes Peninsula, El Segundo Dunes, and at scattered localities elsewhere in the historic range of the subspecies, this habitat is becoming increasingly scarce and likely will continue to be destroyed, disturbed or otherwise adversely affected by human activities. Williams (1986) concluded that habitat losses resulting from off-road vehicle activities, highways, and urbanization likely were extensive. Erickson (1993) observed that industrial and agricultural development likely were additional factors contributing to the decline of the subspecies. Studies of the effects of habitat fragmentation and depredation on small mammal populations suggest further reasons for the decline of the Pacific pocket mouse. All such major threats directly or indirectly implicated in the decline of the Pacific pocket mouse are individually discussed below.

Habitat Destruction

The conversion of native habitats resulting from urban, suburban, and agricultural development apparently is the leading cause of the large-scale destruction of Pacific pocket mouse habitat. A recent, comprehensive review of the Pacific pocket mouse (Erickson 1993) included considerations of the fate of confirmed (historically-occupied) Pacific pocket mouse habitat. Other, more recent data, pertinent research, and analyses have been integrated into the following account.

The large majority of native habitats within the historic range of the Pacific pocket mouse in coastal Los Angeles, Orange, and San Diego counties have been converted to urban, suburban, and agricultural uses (U.S. Fish and Wildlife Service 1993). Less than 400 hectares (1,000 acres) or 1 percent of approximately 11,340 hectares (28,000 acres) within 3.2 kilometers (2 miles) of the coast in Los Angeles County apparently are undeveloped (U.S. Fish and Wildlife Service, unpublished data, 1993). In Orange County, about 17,600 hectares (43,500 acres), or 81 percent of approximately 21,600 hectares (53,500 acres) within 3.2 kilometers (2 miles) of the coast, have been developed (U.S. Fish and Wildlife

Service, unpublished data, 1993). Land uses in coastal San Diego County are reportedly similar. Oberbauer and Vanderwier (1991) reported that 72 percent of the original coastal sage scrub, 94 percent of native grasslands, 88 percent of coastal mixed chaparral, 88 percent of coastal salt marsh, 100 percent of coastal strand, and 92 percent of maritime sage scrub habitats in San Diego County had been converted to urban and agricultural uses by 1988.

Although the historic distribution of the coastal sage scrub element of Pacific pocket mouse habitat was undoubtedly patchy to some degree, this condition evidently has been greatly exacerbated by urban and agricultural development. All of the published literature on the status of coastal sage scrub vegetation in California supports the conclusion that this plant community is one of the most depleted habitat types in the United States (U.S. Fish and Wildlife Service 1993). In a broader context, the California floristic province, which is recognized as a separate evolutionary center by botanists, is identified by Wilson (1992) as one of the recognized world "hot spots", which are defined to be "...habitats with many species found nowhere else and in greatest danger of extinction from human activity." The California floristic province is the only designated "hot spot" in North America and Mexico (Wilson 1992).

The available information further suggests that the quantity of potential Pacific pocket mouse river alluvium substrate has significantly declined since the subspecies was last recorded in numbers in the 1930's. With few exceptions (such as the Santa Margarita River), essentially all of the rivers and creeks within the historic range of the Pacific pocket mouse are now partially or completely channelized. In many cases (e.g., Los Angeles River, San Gabriel River, Santa Ana River), stream and sediment flows are regulated or inhibited by dams, reservoirs or other water conservation or impoundment facilities (Erickson 1993).

Although described as locally abundant in the Tijuana River Valley environs in south westernmost San Diego County by Mearns (1898) and Bailey (1939), the Pacific pocket mouse has not been detected at that locale since 1932 despite recent, repeated attempts to locate an extant population (Taylor and Tiszler 1991; U.S. Fish and Wildlife Service 1994a,c; U.S. Fish and Wildlife Service 1995a,b;

Montgomery 1995). And, although small populations have been discovered further north in San Diego County in upland areas near the Santa Margarita River and near San Mateo Creek, recent, intense survey efforts at the historically occupied vicinity of the Santa Margarita River mouth similarly did not result in any Pacific pocket mouse detections (OGDEN 1997; Salata 1981; U.S. Fish and Wildlife Service 1994c; Zembal 1984). During the 1930's when Pacific pocket mice were detected at the mouth of the Santa Margarita River, the Marine Corps Base, Camp Pendleton did not exist. The southern half of the Santa Margarita River Estuary was destroyed in the early 1940's during the establishment of Camp Pendleton and the related construction of a boat basin and harbor facilities. In addition, the adjacent Oceanside area has been extensively developed since the Pacific pocket mouse was last recorded there in the 1930's.

Within Orange County, the Pacific pocket mouse has been confirmed at two locales: the San Joaquin Hills and Dana Point. Development of the "Spyglass Hill" area in the San Joaquin Hills began in 1972 and has resulted in the destruction of the site where the Pacific pocket mouse and a number of other small rodent species were studied for a 3-year period (P. Meserve, pers. comm., 1994; R. M'Closkey, pers. comm., 1994; R. MacMillan, pers. comm., 1994; M'Closkey 1972; Meserve 1972). Prior to the rediscovery of the Pacific pocket mouse in 1993 on the Dana Point Headlands (Brylski 1993), the last record of the subspecies was from "Spyglass Hill" in the San Joaquin Hills in 1971 (Erickson 1993). June to October trapping efforts totaling 6,411 trap nights in the San Joaquin Hills and adjacent Laguna Canyon in 1993 resulted in no detections of the Pacific pocket mouse (Erickson, pers. comm., 1993).

The Pacific pocket mouse has persisted on the Dana Point Headlands in southern, coastal Orange County. Given the data and analysis presented by Brylski (1993), it is apparent that from 25 to 36 Pacific pocket mice occupied approximately 1.4 hectares (3.5 acres) of habitat within a coastal sage scrub community at that locale in 1993. This population was located on land under consideration for development (e.g., City of Dana Point, *in litt.*, 1994; EDAW 1994). An April 28, 1998, approval by the Dana Point City Council supported a development proposal on the 49 hectare (122 acre) site with 28 hectares (70 acres) of the site designated

as open space. The Dana Point Headlands population is within this open space area, but the open space is currently slated to remain private property with undetermined conservation protection.

Within Los Angeles County, the Pacific pocket mouse historically was detected in three areas: Marina del Rey/El Segundo/Hyperion, Wilmington, and Clifton. Two of the three historic locales for the Pacific pocket mouse (Clifton and Wilmington) in Los Angeles County have been developed (Erickson 1993). We are currently unaware of potential Pacific pocket mice habitat at these two locales; none was disclosed or revealed as a result of our request for information (U.S. Fish and Wildlife Service 1994c). The third historic locale (Marina del Rey/El Segundo/Hyperion) apparently has been substantially altered since the subspecies was last detected there (Erickson 1993; P. Brylski, *in litt.*, 1993). The Hyperion area, which formerly contained relatively large expanses of coastal strand and wetland habitats, has been extensively developed. Although potential habitat remains at the El Segundo Dunes, the available information suggests that it is unlikely that the Pacific pocket mouse presently occurs there (P. Brylski, *in litt.*, 1993). The El Segundo Dunes within the Los Angeles Department of Airports property were extensively trapped in 1997 with negative results (SAPPHOS 1997, B. James, pers. comm. 1998). This trapping was performed in conjunction with environmental baseline studies for the Los Angeles International Airport 2015 Expansion Master Plan Project. There have been no records of the Pacific pocket mouse in Los Angeles County since 1938 (Erickson 1993; Brylski, *in litt.*, 1993; B. James, pers. comm. 1998). Given the available information at the time, Williams (1986) concluded that it was probable that all populations north of the San Joaquin Hills in Orange County were extinct.

Habitat Fragmentation and Degradation

Habitat fragmentation is thought to reduce habitat quality and increase local extirpation of native wildlife (e.g., Terborgh and Winter 1980; Wilcox 1980; Ehrlich and Ehrlich 1981; Wilson 1992; Bolger *et al.* in press; Soule' *et al.* 1992). Based on studies of native bird, rodent, and flowering plant species persistence in chaparral and coastal sage scrub habitat remnants in coastal San Diego County,

California, Soule' *et al.* (1992) concluded that "[t]he effects of fragmentation in a scrub habitat in California on 3 taxa (plants, birds, and rodents) are concordant. Extinctions within the habitat remnants occur quickly and the sequence of species disappearances of birds and rodents is predictable based on population density in undisturbed habitat." Terborgh and Winter (1980) observed previously that "[r]arity proves to be the best index of vulnerability."

Bolger *et al.* (*in press*) concluded that "[f]ragments support fewer species [of native rodents] than equivalently sized plots in large plots of unfragmented chaparral indicating that local extinctions have occurred following insularization." Given a composite of the available data on the local status and distribution of select species within the study area in coastal San Diego County, Soule' *et al.* (1992) remarked that it was possible to assess with reasonable accuracy the date that a particular habitat remnant became isolated.

Soule' *et al.* (1992) further noted that "...urban barriers including highways, streets, and structures, impose a very high degree of isolation." Similarly, Ehrlich and Ehrlich (1981) observed that "smaller animals may also suffer fragmentation of their populations by highways, railways, canals, etc., changing population structures and making the remaining populations smaller and more subject to random extinction. One study has indicated that a four-lane divided highway may be a barrier to the movement of small forest mammals equivalent to a river twice as wide (Ehrlich and Ehrlich 1981). Although not a forest animal, the Pacific pocket mouse must now be considered rare by any standard and therefore vulnerable to the effects of continuing habitat destruction and fragmentation (see Terborgh and Winter 1980).

Population persistence and expansion should be maintained by precluding actions which result in physical barriers to movement, habitat fragmentation, or an increase in edge effects. All ecosystem components of Pacific pocket mouse habitat should be maintained or reestablished, including predator-prey relationships, retention of pollinators, linkages with other habitats necessary for ecosystem functioning, maintenance of corridors between potential populations,

and protection of habitat currently unoccupied due to successional cycling of the vegetation community.

Wildfires due to anthropogenic ignitions have contributed to the loss, degradation, and fragmentation of coastal sage scrub vegetation in southern California (U.S. Fish and Wildlife Service 1993). Most of these human-caused fires occur during the fall in conjunction with Santa Ana wind conditions. Natural fires most often likely occurred during the late spring and early summer (May to June) in conjunction with occasional late season lightning storms (R. Minnich, pers. comm. 1989). Lightning (an ignition source) more rarely strikes the coast than the foothill-mountain region and prehistoric fires probably burned from the foothills to the coast infrequently (R. Minnich, pers. comm. 1989). Natural fires near the coast (generally consisting of coastal sage scrub) likely occurred episodically and less frequently than in the foothills (more often composed of chaparral). Coastal sage scrub is a fire adapted plant community (Beyers and Wirtz 1996), but unlike for chaparral, little biological justification exists for maintaining high fire frequency in coastal sage scrub (Zedler 1996). Coastal sage scrub does not appear to have high senescence risks (the chance that long intervals without fire will result in population decline or local extinction) as compared to immaturity risks (the chance that populations will be harmed by recurrence of fire when insufficient time has elapsed for regrowth or build up of seed reserves) (Zedler 1996). An increased fire frequency may favor invasion of exotics in coastal sage scrub (Zedler 1996).

The seasonality, size, intensity, and frequency of fire in coastal southern California has likely changed drastically in the last century (R. Minnich, pers. comm. 1989). Most of coastal southern California's remaining natural areas are likely subject to less frequent, aseasonal, and comparatively larger/hotter wildfires than occurred prehistorically. Camp Pendleton habitats likely suffer from an increased fire frequency, with many fires occurring aseasonally. Although it is true that the largest areas of relatively unfragmented coastal sage scrub vegetation remain on the Marine Corps Base, Camp Pendleton, over 6,070 hectares (15,000 acres) of native vegetation, much of it coastal sage scrub, have burned on the Base during 3 recent years as a result of fires started incidental to military training

activities. Two of these fires consumed over 2,630 hectares (6,500 acres) of coastal sage scrub vegetation. High fire frequencies and the lag period associated with recovery of the vegetation may significantly reduce the viability of affected habitats throughout much of the current and historic ranges of the Pacific pocket mouse.

Some habitats that would otherwise generally remain sub-optimal for Pacific pocket mouse may be repeatedly manipulated such that they will support the taxon in the short term. Other habitat areas that would typically (and likely historically did) support optimal habitat may be made occupiable by removal of some perturbing influence (such as reduction of exotic species cover). A portion of the Oscar-1 population of Pacific pocket mice on Camp Pendleton currently occurs in areas that have burned recently, either by wildfire or controlled burning, including some areas that have been burned annually for several years (Buck 1997). The Pacific pocket mice found in the Oscar-1 area on Camp Pendleton currently occur in non-coastal sage scrub habitats, including non-native grasslands, and disturbed areas dominated by filaree (*Erodium* sp.). Anecdotal evidence suggests that the areas of dense grasslands are not occupied (to a level of being detectable during surveys), but the small coastal sage scrub, bare ground, and low density non-native grassland patches within the more dense grasslands are occupied (M. Pavelka, pers. comm. 1998).

Little is known of the relation between fire and Pacific pocket mouse habitat. Fire of unknown frequency, intensity, and season may intermittently create or sustain Pacific pocket mouse habitat mosaics. Two of the three locales with extant populations of the Pacific pocket mouse occur solely in open coastal sage scrub habitats and are absent from adjacent patches of dense coastal sage scrub. Disturbance to the dense shrub canopy, as a result of disturbances such as fire, may improve habitat for the subspecies. In the short term, fire in the proper season and intensity could temporarily reduce shrub canopy coverage that may be too dense to provide optimum habitat for the Pacific pocket mouse (e.g., over much of the Dana Point Headlands and San Mateo sites). By contrast, fire could potentially eliminate occupied habitat for the Pacific pocket mouse and may also result in development of a denser (and unacceptable) understory of non-native

annual grasses and sprouts of native shrubs. Previously, it was reported that increased fire frequency may contribute to the type conversion of coastal sage scrub to annual grassland habitats (U.S. Fish and Wildlife Service 1993). Currently, minimal data are available to evaluate the overall effects of fire on Pacific pocket mice or their habitat. We conclude that current fire prevention measures and unnaturally high fire frequencies resulting from anthropogenic ignitions may directly or indirectly impact the Pacific pocket mouse. It will be necessary to evaluate the role of fire prevention and management practices to develop measures that are consistent with the long-term maintenance of Pacific pocket mouse habitats.

The vegetation of the marine terraces from Dana Point to southern Camp Pendleton today is heavily influenced by annual grasses and other non-native species, partly in response to exotic plant introductions and agricultural use of these lands during the late nineteenth and early twentieth centuries (as well as the fire regime changes noted above). Such dense exotic vegetation, in concert with relatively hard soils, probably precludes occupation by the Pacific pocket mouse, whereas relatively low densities of animals may have historically occurred in the same areas in association with the original, more open, native vegetation.

Historic agricultural uses appears to have had lasting, adverse effects on Pacific pocket mouse habitat function. Results of surveys on Camp Pendleton illustrated a potentially strong negative relationship between known Pacific pocket mouse distribution on Base and areas that have been farmed in the past (OGDEN 1997). No Pacific pocket mouse captures occured within these former agricultural areas, which include many sites that otherwise appear suitable (OGDEN 1997). One of the largest blocks of high potential habitat that has not been farmed supports the largest population on Base (Oscar-1); the other population on Base seems likewise restricted to unfarmed portions of the high potential soils in the San Mateo area (OGDEN 1997). Unfortunately, it appears that no extant population is adjacent to an agricultural area that has gone fallow, which would help confirm this potential relationship.

As a consequence of a recent survey, we (U.S. Fish and Wildlife Service 1994a) reported that selected habitats and lands in a historically occupied Pacific pocket mouse locality apparently have been adversely affected by pedestrian and horse traffic, artificial lighting, and the presence of non-native rodent species. All factors considered, heteromyid rodents, including the Pacific pocket mouse, may be more susceptible to the adverse effects of the human presence than cricetid rodents (R. MacMillan, pers. comm., 1994).

Artificial night-time lighting may cause problems for nocturnal rodents such as the Pacific pocket mouse through potential modification of predation rates, obscuring of lunar cycles, and/or causing direct habitat avoidance. Artificial lighting has the potential to increase the efficiency of predators and could have a negative effect on the Pacific pocket mouse (M. Pavelka, pers. comm. 1998). Illumination of foraging habitat by artificial light during Pacific pocket mouse surface activity periods likely makes detection by predators easier, potentially increasing the predation rate by owls, coyotes, fox, house cats, etc. Artificially lit habitat areas may also be directly avoided by Pacific pocket mouse for unknown behavioral reasons. Artificially lit but otherwise apparently suitable habitat was avoided by Heteromyid rodents (evidenced by absence of burrows), while adjacent unlit habitat areas were occupied, in a survey performed on Fallbrook Naval Weapons Station (A. Davenport, pers. comm. 1998).

Exotic Argentine ants are invading coastal sage scrub areas near Pacific pocket mouse habitats. These ants could have adverse direct or indirect effects on Pacific pocket mouse populations (R. Fisher, pers. comm. 1997). Argentine ants are known to exclude most native ant species upon invasion in coastal southern California habitats (R. Fisher, pers. comm. 1998). Ants are a major ecosystem component of most terrestrial ecosystems (Wilson 1992). Argentine ants could adversely affect Pacific pocket mouse individuals (such as nestling mortality) and burrow sites directly. They could also affect seed producing plants, or could disrupt key ecosystem functions, including those typically carried out by native ants. Invasion of these ants may be expedited by development and associated irrigation.

In summary, habitats within the historic range of the Pacific pocket mouse have been highly fragmented or degraded by highways, roads, structures, lighting, foot traffic, other human activities, and the proliferation of non-native plant and animal species. Fragmented and degraded habitats support smaller populations, which are more susceptible to random extinction events.

Depredation

Feral or domestic cats are one of the existing threats to the population of Pacific pocket mice at the Dana Point Headlands. Feral and domestic cats are known to be efficient predators of rodents (e.g., Hubbs 1951; George 1974). Pearson (1964) concluded that the removal of 4,200 mice from a 14-hectare (35-acre) test plot was accomplished largely by 6 cats over 8 months. For the Anastasia Island field mouse (*Peromyscus polionotus phasma*), a reduction in feral cats was followed by an immediate and sustained increase in mouse population density (Frank 1993). Phil Brylski examined one dead specimen of Pacific pocket mouse taken from the mouth of a house cat (P. Bryski, pers. comm. 1998).

Other non-native species, including the red fox (*Vulpes vulpes*), are also potential predators of the Pacific pocket mouse. The explosive proliferation of non-native populations of red foxes in coastal southern California is well documented (e.g., Lewis *et al.* 1993). Given the relative abundance of the red fox in coastal southern California (Lewis *et al.* 1993) and the fact that the diet of red foxes invariably include mice (Ingles 1965; Jameson and Peeters 1988; Burkett and Lewis 1992; Lewis *et al.* 1993), red foxes could substantially impact populations of Pacific pocket mice where they are sympatric.

Conservation Efforts: Research

Research on the life history and ecology of the Pacific pocket mouse has been limited (see previous section on life history and ecology). It should be noted that much of the information concerning the Pacific pocket mouse was collected incidental to more general rodent studies or is derived from other subspecies that

may not apply to the Pacific pocket mouse (e.g., daily and seasonal activity patterns, home ranges, diet, etc.) (Behrends 1997).

Conservation Efforts: Management and Protection

The only known extant populations of the Pacific pocket mouse occur on two areas on the Marine Corps Base, Camp Pendleton and on a small parcel of land on private property at the Dana Point Headlands. To date, recovery activities to achieve the protection and conservation of the Pacific pocket mouse have been recent and limited in scope. Future efforts will, by necessity, include habitat protection and species management accomplished through the cooperation of Federal, State, and local agencies; species experts; landowners; and other interested citizens.

Federal Actions

Section 7(a) of the Act, as amended, requires Federal agencies to evaluate their actions with respect to any species that is proposed or listed as endangered or threatened and with respect to its critical habitat, if any is designated. Regulations implementing this interagency cooperation provision of the Act are codified at 50 CFR Part 402. If a species is listed, section 7(a)(2) requires Federal agencies to ensure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of such a species or to destroy or adversely modify its critical habitat. If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency must enter into formal consultation with us (the Service) in accordance with the regulations at 50 CFR 402. Federal agencies that authorize, fund, or carry out activities that may affect the Pacific pocket mouse include the Service; Department of the Navy; Marine Corps Base, Camp Pendleton; the Army Corps of Engineers; and Federal Highways Administration. These agencies, which are all individually charged to utilize their resources to further the purposes of the Endangered Species Act, are individually treated below:

1) U.S. Fish and Wildlife Service: Since the designation of the subspecies as a candidate for listing in 1985, we have attempted to conserve the subspecies by seeking the support and cooperation of other government agencies and the interested public to achieve that goal. In an open letter dated May 7, 1992 to local planning agencies and concerned parties within the historic range of the subspecies, we solicited relevant information and comments pertaining to the status, distribution, and the possible listing of the Pacific pocket mouse and eight coastal plant species. Prior to listing the subspecies, we coordinated with local jurisdictions on specific projects in the range of the Pacific pocket mouse and asked for focused surveys for the subspecies and the avoidance of impacts to potential habitats. Also prior to listing, we contacted the Marine Corps Base, Camp Pendleton natural resource office personnel regarding the precarious status of the Pacific pocket mouse and asked for their assessment of the status and distribution of the subspecies within their jurisdiction.

Since the subspecies was listed, we, in accordance with our responsibilities under the National Environmental Policy Act and Endangered Species Act, have continued to ask for focused Pacific pocket mouse surveys in appropriate habitats throughout the historic range of the subspecies. We have also conducted two such surveys on our own (National Wildlife Refuge) lands. We have authorized, in partnership with the California Department of Fish and Game, projects in accordance with section 6 of the Endangered Species Act that provide for the identification and delineation of potential habitat and, hopefully, additional extant populations. We are also undertaking studies on Camp Pendleton to gather information on habitat affinities and demographics of the Pacific pocket mouse, and have performed presence/absence surveys on our Refuge lands in the Tijuana Estuary area. In addition, we have issued recovery permits in accordance with section 10(a)(1)(A) of the Endangered Species Act that allow for appropriate and prudent Pacific pocket mouse surveys and management.

2) The Department of the Navy (Navy): The Navy is charged with protecting trust resources on multiple areas of land containing potential Pacific pocket mouse habitat. Biologists with the Navy's Environmental Planning and Natural Resource Management Division (Southwest Division) have coordinated and conducted five

focused surveys for the Pacific pocket mouse on Federal lands. Because no Pacific pocket mice have been detected during the course of these surveys, it is likely that none will be directly affected by impending projects.

3) Marine Corps Base, Camp Pendleton: Camp Pendleton has authorized, coordinated, and funded multiple surveys for the Pacific pocket mouse in recent years. Focused surveys for the Pacific pocket mouse were conducted in appropriate habitats along the coastal portion (within 3 miles of the shoreline) of Camp Pendleton during 1994, 1995, 1996, and 1997. Presence/absence surveys for the Pacific pocket mouse are scheduled to be completed in 1998 (Buck 1997); these surveys cover a majority of the potential habitat on base.

For purposes of continued military training and land management activities, the level of survey effort is considered sufficient to conclude absence of the Pacific pocket mouse on those training areas where no Pacific pocket mice were found by this or previous studies. However, construction projects in areas typical of Pacific pocket mouse habitat may still require specific trapping surveys, according to our (Service) protocols (Ogden 1997).

Survey efforts authorized by Camp Pendleton in 1995 led to the discovery of two of the three locales with known extant populations of the Pacific pocket mouse. The Base also developed a habitat evaluation model (Spencer 1997). Camp Pendleton is funding some additional surveys on the Base, with trapping in 1998 on Edson Range Impact Area and in the Stuart Mesa area (Spencer 1997). The Base has noted that they would authorize the translocation of animals from the Base to off-base locales for purposes of establishing new populations. Camp Pendleton personnel are additionally preparing a management plan for Base upland habitats and have begun the process of identifying potential habitats by developing a model that relies on data pertaining to soils, vegetation, elevation, and distance from the coast.

4) U.S. Army Corps of Engineers: The U.S. Army Corps of Engineers (Corps) regulates and permits the discharge of fill into wetlands and waters of the United States in accordance with various provisions of section 404 of the Clean Water

Act. Because the Pacific pocket mouse could occur in areas that are designated as wetlands or waters of the United States, the Corps may regulate some projects that could affect the subspecies. For the International Wastewater Treatment Plant Project in the Tijuana River Valley, the Corps funded surveys for the Pacific pocket mouse within the action area of the project. Like any Federal agency, the Corps is required to consult with us in accordance with section 7 of the Endangered Species Act if their discretionary authority to issue permits "may affect" federally listed species, including the Pacific pocket mouse. Avoidance or compensation measures are generally integrated into projects that may affect listed species.

5) Federal Highways Administration: The Federal Highways Administration has required and authorized focused surveys for Pacific pocket mice in conjunction with the proposed Foothill (South) Transportation Corridor project. It is expected that the Federal Highways Administration will continue with informal consultation (ongoing as of April 1998) and will initiate formal consultation with us in accordance with the regulations at 50 CFR 402 if the project may adversely affect the Pacific pocket mouse population(s) near San Mateo Creek. At the present time, the project applicant, the Transportation Corridor Agencies, apparently is redesigning the proposed project to avoid direct impacts to the local Pacific pocket mouse occupied habitat as it was defined in the last survey effort. The applicant's proposed preferred alternative currently parallels San Mateo Creek. One alternative alignment for the proposed project avoids San Mateo Creek drainage altogether by connecting with Interstate-5 farther to the north. We are evaluating a number of alternatives in coordination with the Federal Highways Administration.

State and Local Actions

California Department of Fish and Game (Department): Because the Pacific pocket mouse is not a State-listed threatened or endangered species, it is not presently protected in accordance with the California Endangered Species Act (CESA). However, the Department formally supported the listing of this

subspecies (K. Berg, California Department of Fish and Game, *in litt.*, 1992) and recognizes the Pacific pocket mouse as a Species of Special Concern.

The California Environmental Quality Act (CEQA), enacted in 1970, provides for the disclosure and mitigation of project impacts to State-designated rare animals and plants in accordance with the CEQA environmental review process conducted by the Department. The rediscovery of the Pacific pocket mouse in 1993 was a result of the Department's formal request for a focused survey for this subspecies on the Dana Point Headlands.

The Department is also responsible for enforcing various codes established to protect native California plants and animals. In this capacity, the Department could issue citations for the unauthorized capture of Pacific pocket mice. As such, authorization to trap and collect the Pacific pocket mouse is excluded from standard collecting and trapping permits.

Most recently, the Department, at the request of the State of California Resources Agency, initiated a Natural Community Conservation Planning (NCCP) program in an attempt to conserve the coastal California gnatcatcher (*Polioptila californica californica*), that species' coastal sage scrub habitat, and other sensitive plant and animal species therein. The NCCP planning effort has developed to the point where a minimum of 30 cities, 2 counties, 35 landowners, and 3 land management agencies have formally committed to develop or to assist in the development of conservation plans that (based on process guidelines finalized by the California Resources Agency on September 1, 1992) meet the standards for allowing incidental take of a federally listed species under section 10 of the Endangered Species Act and are in compliance with the 4(d) rule established for the coastal California gnatcatcher. Landowner/land management agency enrollments, which allow for the destruction of 5 percent of the remaining coastal sage scrub, encompass about 18,200 hectares (45,000 acres) of coastal sage scrub habitat.

Conservation needs of the Pacific pocket mouse or the subspecies' potential habitat are being addressed by several plans being developed under the NCCP program. At the present time, however, the Pacific pocket mouse is not the

primary focus of any NCCP and few subregional plans or individual plans have been completed or implemented that provide for specific protection of the subspecies, with the exception of the approved Central/Coastal NCCP plan in Orange County. This plan has identified potential Pacific pocket mouse habitat within the proposed conservation (reserve) area.

California State Parks (State Parks): A branch of The Resources Agency, State of California, this agency leases land from the Marine Corps Base, Camp Pendleton that contains a significant portion of the north Camp Pendleton Pacific pocket mouse population. State Parks is responsible for managing these lands as well as other park property in southern California that apparently contains suitable Pacific pocket mouse habitat. One of State Parks' land management mandates is the conservation of sensitive species and their habitats. The agency also participates fully in NCCP planning and conservation efforts.

City of Dana Point: The City of Dana Point (City) has expressed an interest in the conservation of the Pacific pocket mouse population and other sensitive animals and plants within their jurisdiction. In this regard, the City suggested the potential need for conservation measures above and beyond those in the Orange County Central/Coastal NCCP plan. On April 28, 1998, the Dana Point City Council unanimously supported a development proposal that calls for 185 homes and 28 hectares (70 acres) of open space on the 49-hectare (122-acre) Dana Point Headlands parcel. Apparently most of this 28 hectare open space, which includes the Dana Point Headland Pacific pocket mouse population, would be privately owned. It is undetermined what retention of this habitat area as private property general open space means for the short- and long-term conservation of the Pacific pocket mouse at this location.

II. Recovery

Recovery Strategy

The recovery strategy for the Pacific pocket mouse consists of two components. The first is to stabilize the existing populations by protecting currently occupied habitat. In addition to providing protection to the known populations, the first component also entails searching for additional populations, and providing protection to any that are found. The second component involves establishing additional populations through: 1) natural colonization/recolonization into nearby and adjacent habitats, coupled with habitat management in these areas, and 2) translocation and/or the release of captive-bred individuals.

The success of translocations into continental (as opposed to island) habitats is poor (Soule' 1996). In the case of the Pacific pocket mouse, the number of individuals available for translocation are likely to be small, making success more tentative (Soule' 1996). Extant populations of Pacific pocket mice currently may not be large enough to support a captive breeding program; a substantial number of individuals probably will be needed to establish a successful breeding program (Behrends 1997). Releases of wild-caught animals are usually more successful than releases of captive bred animals, and introductions of widespread species are more successful than introductions of species with limited ranges (Soule' 1996, Pimm 1991).

Because establishing additional populations is experimental and, to date, has met with limited success with other species, we intend to work with a closely related surrogate species to refine captive breeding and release techniques. If translocation is successful with a surrogate species, we would pursue such techniques with the Pacific pocket mouse. However, prior to the implementation of a translocation or captive breeding program for the Pacific pocket mouse, suitable unoccupied habitat must be identified and research must be conducted on the protocols for both the translocation and captive breeding of *P. longimembris*. The narrative outline to follow and Appendix 2 delineate protocols for captive breeding and translocation techniques and activities.

The immediate recovery goal is to avert the extinction of the Pacific pocket mouse by focusing on short-term strategies to improve the subspecies' prospects for survival. Foremost among these are the immediate protection and restoration of existing populations and the habitat of the subspecies. Considering the extremely small population size of the Pacific pocket mouse (fewer than 150 individual animals were detected from 1993 to 1997) and the fragmentation and depletion of the coastal strand, river alluvium, and coastal sage scrub habitats upon which the subspecies depends, further losses of occupied or potential habitat would seriously reduce the probability of the persistence of the subspecies. Given the small sizes of the populations at the three known extant locales, the apparent sedentary nature of the subspecies (Meserve 1972), and the severe fragmentation and diminution of the subspecies' habitat, the Pacific pocket mouse is highly susceptible to extinction as a result of environmental or demographic factors alone (see Mace and Lande 1991).

Unless, or until sufficient, additional viable populations are discovered and/or established and protected, it is imperative that existing populations be protected and expanded through active management. Loss or degradation of any of the populations at the three known extant locales could irretrievably diminish the likelihood of the subspecies' survival. All known extant populations are essential, including the Dana Point Headlands population (Boggs 1997, Buck 1997, Price 1997, Silver 1997, Silver and Drumm 1996, Soule' 1996). Concurrent with the initial priority of protection, conservation, and appropriate management of existing populations, recovery should focus on the identification of potential habitat and creation of additional habitat and viable populations. Although the fundamentals of population biology and conservation biology (e.g., Mace and Lande 1991) strongly suggest that additional (or larger) populations of the Pacific pocket mouse are critical to reduce the risks of stochastic extinction, the biology and life history of the Pacific pocket mouse currently is not sufficiently well known to permit conclusive assessments of viable population size and the amount and configuration of essential habitat. "Essential" habitat is defined hereby to be those areas necessary for the recovery of the subspecies.

Accordingly, this recovery plan should be reviewed within 3 years of becoming final and every 5 years thereafter. However, this document should be immediately reviewed if, at any time, new data and analyses pertaining to the subspecies' natural history, population/metapopulation dynamics, viable population sizes, and management measures reveal that the subspecies is not responding, or is likely not to respond, to the recovery measures prescribed herein.

Recovery Objectives and Delisting Criteria

The ultimate objective of this recovery plan is to protect and maintain sufficient populations and habitat of the Pacific pocket mouse to allow the removal of this subspecies from the List of Endangered and Threatened Wildlife in accordance with the Endangered Species Act. The recovery of the Pacific pocket mouse will involve a two-stage process, beginning with reclassification of the subspecies from endangered to threatened status.

Recovery of the Pacific pocket mouse will likely take approximately 25 years (until the year 2023). We may consider reclassifying the Pacific pocket mouse to threatened status if and when:

1. Ten populations are independently viable and stable or increasing and their habitats are secure (free from risk of loss) and fully protected through fee ownership by a resource agency or conservation program, conservation easement, or other means of permanent protection. Populations of Pacific pocket mice shall be considered viable if the appropriate analysis of measured population parameters indicate that each population has a 95 percent or greater chance of surviving for 100 years.

2. Occupied habitat consists of a minimum of 2,000 hectares (4,940 acres) that are secure and fully protected through fee ownership by a resource agency or conservation program, conservation easement, or other means of permanent protection.

3. All Pacific pocket mouse populations are managed through a program to maintain genetic diversity for future generations.

4. All Pacific pocket mouse populations and essential habitat are managed so that current and potential threats (e.g., predation and disease) are eliminated or minimized to the extent that each population is not at risk of extirpation. Essential habitat is defined to mean that habitat necessary for the full recovery of the subspecies.

We may consider delisting the Pacific pocket mouse if and when:

1. All actions necessary for reclassification to threatened have been implemented.

2. Any necessary protection, restoration, and enhancement activities (on all sites that have been determined to be essential to the recovery of the subspecies) are successfully completed.

3. Populations of the Pacific pocket mouse are representative of the full (existing) genetic variability and historical geographical range of the subspecies and occur in habitats that collectively represent the full range of parameters observed and described in the past or during prescribed, future research, and monitoring efforts.

In order to delist the subspecies, we must also determine that the following five factors no longer continue to adversely affect the survival and recovery of the subspecies: (1) the present or threatened modification, or curtailment, of the subspecies' habitat or range; (2) overutilization for commercial, recreational, scientific, or educational purposes; (3) disease and predation; (4) inadequacy of existing regulatory mechanisms; and (5) other human-made or natural factors affecting the continued existence of the subspecies (50 CFR 424.11). A final decision relating to the delisting of the subspecies would be made only after a thorough review of all relevant information, including prescribed research.

Narrative Outline for Recovery Actions

1 **Identify and protect all extant populations and essential habitat.** Pacific pocket mouse populations occur at three sites: the Dana Point Headlands in Orange County and San Mateo Creek (northern Camp Pendleton) and Oscar-1 (southern Camp Pendleton) in San Diego County. Fewer than 150 individuals (with recaptures considered) have been live-captured at these sites (OGDEN 1997, U.S. Fish and Wildlife Service 1998). The historic range of the Pacific pocket mouse has been adversely affected by urban and suburban development and the demand for further coastal development within its range can be expected to continue indefinitely. Consequently, achieving the objectives of the recovery plan requires that the identification, selection, and protection of essential habitats and populations be done expeditiously.

1.1 Protect and secure extant populations.

The recovery criteria indicate that 10 viable populations are required. Loss or degradation of any of the populations at the three known extant locales could irretrievably diminish the likelihood of the subspecies' survival. All extant populations are essential. These populations should be protected and secured from significant potential impacts. This should include dedicating the biological resource open space that has been secured for the area occupied by the Dana Point Headlands population to conservation of the Pacific pocket mouse population on site in perpetuity.

1.2 Undertake surveys to locate unknown populations.

Learning whether additional populations exist is critical to achieving the objectives of the recovery plan to the extent it influences the nature and intensity of management efforts on populations. The location of additional populations may make

intensive management efforts to establish additional populations less imperative.

Efforts to locate any additional populations are occurring through two avenues: *a*) through the environmental review process of proposed development projects required under the California Environmental Quality Act (CEQA), the National Environmental Policy Act (NEPA), and the Endangered Species Act, and *b*) through special studies undertaken by various State, Federal, and local agencies, such as the Service, the Marine Corps Base, Camp Pendleton, and the California Department of Parks and Recreation. The Service and the California Department of Fish and Game should communicate survey methods and data reporting requirements to the appropriate agencies, jurisdictions, and individuals, and advise them on when and where surveys are needed.

Surveys should be performed in Baja California, Mexico to determine possible occupation. Current aerial photos and satellite imagery of this area should be obtained, as well as any available soils and vegetation data/maps. Historic sampling of much of this area did occur and these records should be researched for clues to potential locations. Coordination between U.S. and Mexican authorities and experts should occur. Cooperative and systematic searches by U.S. and Mexican mammalogists should be performed in Baja California Norte in coastal locales between the U.S./Mexico border and the city of El Rosario.

1.3 Continue to refine a standardized survey approach.

We have developed a standardized survey approach to help ensure that the results of surveys are reliable, and correctly indicate presence or absence of the Pacific pocket mouse. The standardized survey approach should continue to be tested and refined because:

- Like most small mammal populations, populations of the Pacific pocket mouse are expected to show dramatic fluctuations in numbers. Survey results in one area should not be applied to other, even adjacent, areas. The survey protocol should be sensitive enough to detect the subspecies when numbers are naturally low.

- The Pacific pocket mouse may persist in unlikely places, and all populations are important to the conservation of this subspecies. Small populations in isolated locales may: *a*) be important in maintaining the genetic and ecological diversity of the subspecies, *b*) persist in the long term if carefully managed, and *c*) provide animals for translocation or the possible establishment of captive breeding populations.

1.4 Identify prospective habitat and population sites.

Reconnaissance surveys are needed to identify potential habitat that is either occupied by the subspecies or can serve as a host site for translocation efforts. Because of the subspecies' reliance on sandy soils, such efforts should begin with a range-wide analysis of soils and identify those similar to those that support existing populations. Regional planning efforts identify and protect potential and prospective habitat areas.

Potential habitat should be identified based on soils maps, foot surveys of the site, and live-trapping surveys. Detailed analysis of these and other appropriate features should be performed to revise and refine the existing habitat evaluation model developed by Camp Pendleton. Potential habitat sites in Los Angeles County include the El Segundo dunes adjacent to Los Angeles International Airport and selected areas of the Palos Verdes Peninsula. Prospective sites in Orange County include (from north

to south) Bolsa Chica (uplands around the wetlands and grasslands to the south), the Central/Coastal Orange County Reserve, San Joaquin Hills, University of California Irvine, Crystal Cove State Park, Dana Point Headlands, and San Clemente State Park. The largest number of sites and acreage of habitat occurs in San Diego County, including San Onofre State Park, the coastal portions of Camp Pendleton, Batiquitos Lagoon, Torrey Pines State Park, Border Fields State Park, and the mouth of the Tijuana River. Surveys should also be performed in and around the following areas: the Naval Radio Receiving Facility (NRRF) on the Silver Strand, Spooner's Mesa, Outlying Landing Field (Tijuana River), Penasquitos Lagoon, San Dieguito Lagoon, San Elijo Lagoon, Aqua Hedionda Lagoon, and Buena Vista Lagoon.

1.5 Identify essential habitats and sites.

Essential habitats required for the recovery of the Pacific pocket mouse should be identified based on studies of population size, extent of potential habitat, dynamics of habitat occupation and/or succession, ecosystem interactions, opportunities for population and habitat management, and the results of research on viable population sizes and metapopulation dynamics (see Section 4). The identification of essential Pacific pocket mouse habitat should begin immediately.

1.6 Evaluate and prioritize protection alternatives for essential habitat.

Multi-species planning efforts are underway within the historic range of the Pacific pocket mouse. Protection options for habitats include fee ownership, voluntary landowner protection plans, deed restrictions, resource management plans, easements and memoranda of agreement. The adequacy of these protection alternatives should be evaluated with respect to the long-term

viability of Pacific pocket mouse populations and habitat at these sites. Regional planning efforts should take into account overall ecosystem functions, self-sustainability, dynamic nature of habitat occupation through time, connectivity and fragmentation, fire and fire abatement effects, and the influence of adjacent land uses.

1.7 Protect essential habitats and sites.

Utilizing the protection alternatives considered and prioritized above, essential habitats and populations should be protected in perpetuity. As development pressure intensifies, areas of potential Pacific pocket mouse habitat will likely become more fragmented and isolated. Conservation and management of these important sites is essential, but we recognize that even the best sites may continue to lose species (loss of diversity) if isolated from other similar habitat patches (Margules *et al.* 1982). Research in relation to island biogeography and extended to the study of nature reserves has shown that fragmented habitats will not support a full range of species (Jones *et al.* 1996; Harris and Gallagher 1989). To maintain their full potential, these ecosystems as a whole must be managed in a way which will support and complement full ecosystem functioning to the extent currently possible. Occupied habitat, potential habitat, and surrounding linkages should be secured and protected so that the ecosystem upon which the Pacific pocket mouse depends is conserved.

2 Prepare and implement habitat management plans.

The conservation and maintenance of existing populations of the Pacific pocket mouse and its habitat, as well as suitable habitat at historical locations, are immediate recovery plan priorities. Protecting and maintaining existing populations includes a range of potential actions and interventions. In the short term, it involves protection against conversion of occupied habitat and various disturbances in and around occupied

habitat that could reasonably be expected to adversely affect the Pacific pocket mouse population. Such disturbances include off-site activities that would fragment Pacific pocket mouse populations, on-site off-highway vehicle use, excessive foot or bicycle traffic, and predation by cats and other predators (particularly exotic predators and artificially high native predator levels). In the long-term, it involves actively managing habitat in some areas, but providing for self-sustaining ecosystem functions wherever possible so as to minimize the risk of extinction and to conserve the ecosystem upon which the Pacific pocket mouse depends.

Management plans should be prepared for each extant population as a means to identify, avoid, minimize, and off-set threats, to protect and enhance existing ecosystems, habitats and populations, and to manage habitat to maximize pocket mouse population viability/size. If additional populations are located, site-specific management goals and objectives should be developed, included in the appropriate management plan, and implemented. Conservation of the ecosystem upon which the Pacific pocket mouse depends should be the long-term goal of all management plans. All research described below should be coordinated and combined as appropriate.

2.1 Monitor population trends and identify potential threats and management needs.

Limited population data are currently available for the populations at the three known extant locales: Dana Point Headlands; San Mateo Creek (north and south sites); and Oscar-1 in southern Camp Pendleton. Annual, long term monitoring of these populations based on capture/recapture studies is essential. Studies designed to monitor existing populations will need to be carefully designed to yield useful data because of the small population sizes and limited number of populations (Behrends 1997). Statistically determining significant factors that affect population viability will be difficult. Monitoring proposals should be peer reviewed by

qualified biostatisticians or scientists to ensure that proposed studies clearly define research methods and analytical techniques, including statistical analyses that will be employed (Behrends 1997). Although the most significant current threats to the Pacific pocket mouse are habitat destruction, fragmentation, and depredation, all potential threats should be monitored on a continuing basis. Potential threats include invasion by exotic plant and animal species, disease, recreational activities, and changes in habitat (e.g., vegetation densities, edaphic factors, meso-predator population increases). Once potential and real threats are identified, appropriate corrective measures should be incorporated into management plans for each site.

2.2 Develop habitat and species management plans.

Management plans that direct management of the subspecies and its habitat should be prepared for each known population. The management plans must provide site and population-specific details and should concisely describe the actions to be taken, building on the menu of actions listed below. The habitat and species management plan should be ecosystem oriented and place site-specific efforts in the context of various regional planning efforts such as the NCCP. The plans should provide details of avoidance, minimization, and mitigation measures needed, including issues of habitat avoidance, indirect effects, adjacent land use, edge effects, fire, predator retention, fragmentation, wildlife movement corridors, exotic species, habitat secession and cycling, restoration needs, self-sustainability, and preservation of long-term ecosystem functioning. All recommendations should focus on key problems, not indicators or symptoms, and be long-term if possible. Management plans should be amended whenever necessary to incorporate new information and to implement field proven techniques.

2.2.1 Develop an adaptive management plan for Federal lands on the Marine Corps Base, Camp Pendleton.

Two of the three locales with known extant populations of the Pacific pocket mouse are found on the Marine Corps Base, Camp Pendleton, where training exercises result in various forms of landscape disturbance. Certain forms and magnitudes of disturbance may be beneficial for the Pacific pocket mouse. Many forms of disturbance are likely destructive to Pacific pocket mouse habitat and resident populations. The Base and Service staff should co-develop management and enhancement strategies and impact avoidance measures for incorporation into the Base-wide upland species and habitat management plan now in preparation. This plan should incorporate monitoring, research, and management needs for all potential Pacific pocket mouse sites on the Base. Fire management plans and other existing management plans on the Base should be reviewed, and updated if necessary to include provisions for avoiding and minimizing impacts to the Pacific pocket mouse. This management plan should incorporate the Marine Corps and Service responsibilities under section 7(a) of the Act and the military mission of the Base.

2.2.2 Develop and implement adaptive management plans for other locales as necessary.

Management plans should also be prepared for populations and habitats outside of Camp Pendleton. Management plans in these areas can be a requirement of the permitting process for proposed development projects. In the case of public lands (e.g., State, County, or city park lands or other public open spaces), they can be prepared as separate management plans or incorporated into resource management or multi-species planning efforts.

2.5 Protect Pacific pocket mouse habitat from fire and fire abatement measures at occupied sites.

The Dana Point Headlands and San Mateo Creek populations are located on the perimeter of residential areas, where human-caused accidental fires are possible. The Oscar-1 population is located within a Marine Corps Base, Camp Pendleton training area, where repeated human-caused fires are possible. Habitat adjoining this population recently burned. Until the effects of various fire and fuel abatement regimes are known, Pacific pocket mice and their habitat should be protected from fires or fuel abatement practices that could impact occupied habitats and individuals. Potential but unoccupied habitat should be protected from fuel abatement measures.

2.6 Fence Pacific pocket mouse habitat where necessary.

Two Pacific pocket mouse populations are adjacent to residential areas, where urban and recreational uses (including unexpected changes in the pattern and intensity) could have adverse impacts. Documented impacts have occurred in Pacific pocket mouse habitat from activities of residents adjacent to occupied habitat (M. Pavelka, pers. comm. 1997). For example, one Pacific pocket mouse population has recently been subjected to vegetation clearing and ground disturbance for creation of a bicycle motocross track (J. Avery, pers. obs.). Potential impacts include, but are not limited to, vegetation clearing/ground manipulation, fire, fuel abatement, dumping/littering, bicycle/off-road vehicle use, pets, exotic plant and animal introduction, trail creation, and vegetation trampling. As yet undiscovered populations may also exist near residential areas, and would likely benefit from fencing that separates residential zones from potential habitat. Fencing may only have limited usefulness in reducing some of the impacts noted above. The type of fencing used needs to be considered carefully

to ensure that important predator-prey relationships are maintained (Behrends 1997), including maintaining coyote presence. For example, perching predators such as great horned owls should not be encouraged by such fencing (Price 1997). This can be accomplished by using large enough buffers to distance potential perches from occupied habitat, or fence design that minimizes perching benefits. Signage on fencing may be appropriate.

2.7 Control depredation by house and feral cats and other exotic predators as needed.

Because of their relative locations, at least two of the three locales with extant Pacific pocket mouse populations (Dana Point Headlands and north Camp Pendleton/San Mateo Creek) are at significant risk due to predation by house and feral cats. An ongoing program that results in the removal of house and feral cats from these locations (and maintains viable presence of coyotes and other native predators) is needed. Camp Pendleton should continue to discourage house cat ownership on Base. Supplemental feeding of any wild animals, including feral cats, should be discouraged Basewide. Local residents in proximity to the populations should be provided educational outreach material on Pacific pocket mouse habitat/coastal sage scrub ecology and the influence of non-native animals and land use practices (e.g., outdoor feeding of animals, trash placement, etc.) that modify predator numbers and other ecosystem functions. Activities that are compatible with native ecosystem functions should be outlined and encouraged. Using ecosystem management, predator management programs should be developed or existing ones modified to keep all native predators extant at viable/natural levels and to eliminate exotic predators/competitors in the long term. A healthy coyote population on Camp Pendleton may help control the feral house cat populations there (Spencer 1997). Predator-prey relationships of the Pacific pocket mouse need to be

maintained. Adjacent land uses practices that contribute to self-sustaining and relatively natural population levels of native animals should be encouraged.

2.8 Control exotic plants.

Two known Pacific pocket mouse populations occur in coastal sage scrub communities that have been invaded by aggressive exotic grasses and forbs. Other escaped exotic species such as hottentot fig (*Carpobrotus edulis*) have invaded portions of the Dana Point Headlands site, which is also vulnerable to invasion by crystal ice plant (*Mesembryanthemum crystallinum*). Pacific pocket mice currently do not occur in portions of the site invaded by these plants. These invasive plants should be removed from potential habitat and from sites targeted for translocation efforts. As coastal sage scrub is invaded by non-native taxa, particularly annual grasses, sites on sandy soils along the coastal terraces and slopes acquire an understory that may be too dense to provide useable habitat. Other negative effects are likely. The invasion of exotic plant species should be monitored and effects/control evaluated further.

2.9 Monitor the success of management efforts.

The effectiveness of management plans and efforts should be evaluated regularly. Evaluation criteria should include population stability and trends, area of occupied habitat, adult fecundity, and other factors for individual sites.

3 Enhance and expand Pacific pocket mouse habitat.

Management of Pacific pocket mouse habitat has not yet been attempted, and there is limited information on techniques that can be used to create, restore, enhance, or expand Pacific pocket mouse habitats. The regulatory

agencies should prepare, or direct the preparation of, a habitat management plan component that provides for optimization of Pacific pocket mouse habitat at managed sites. Techniques that could be employed include revegetation (with or without salvaged materials such as topsoil) and selective habitat enhancement, including experimenting with fire. Small degraded areas incapable of supporting Pacific pocket mouse populations or other listed species may serve as sources for plants (seeds and transplants) or substrate materials (particularly sandy topsoil) for restoration/enhancement efforts. Plant and substrate materials should be salvaged from all development projects where appropriate. Emphasis should be placed on self-sustaining, long-term, natural habitat optimization techniques. Simple, low-tech, and easy methods should be tried first with movement to more complex and high-tech methods if simple methods do not work (Behrends 1997).

3.1 Select target sites for actions that enhance or expand pocket mouse habitat.

The habitat at known population localities is surrounded by plant communities that are candidates for selective vegetation manipulations to expand suitable habitat and pocket mouse populations. Other actions that enhance or expand pocket mouse habitat may be recommended at other sites. The sites for these actions should be identified and prioritized for their importance to achieving the objectives of the recovery plan.

3.2 Undertake habitat manipulations near or adjacent to occupied habitat to expand available habitat and increase population numbers.

Opportunities to promote expansion of Pacific pocket mouse populations likely exist where occupied habitat is surrounded by dense cover of *Artemisia* scrubs and in sandy areas devoid of vegetation (or dominated by certain exotic plant species). Where

existing vegetation is dense, removal of individual shrubs or groups of shrubs could create additional habitat that may be colonized by dispersers from nearby or adjoining occupied habitat. Where sandy areas are devoid of vegetation, or where it is dominated by exotic species (e.g., *Mesembryanthemum crystallinum* or European grasses) and not utilized by the Pacific pocket mouse, exotics control and revegetation with appropriate native species (including reintroduction of soil microflora where necessary) could also create/enhance habitat to support populations of the Pacific pocket mouse. Manipulated vegetation would likely require on-going management efforts. For example, hand clearing or coverage reduction may result in rapid regrowth following root sprouting by sage scrub species. Consequently, thinning to prevent closed canopy conditions from rapidly reoccurring may be required.

Another approach to reduce vegetative cover would be the use of a herbicide containing relatively benign glyphosates, which could be applied to sprouts when Pacific pocket mice are underground. Experiments could be undertaken away from, and possibly adjacent to, occupied sites to ascertain the effectiveness of this strategy to keep areas between shrubs open, or to reduce understory grasses. A principal concern of these efforts would be to ensure that adequate seed sources that provide food for the Pacific pocket mouse are maintained in occupied habitat. Compacted areas such as abandoned roads would likely be more attractive to the Pacific pocket mouse if they were decompacted and covered with several centimeters of sand. Sand should preferably come from the same general locality if removable without harm to native habitats (e.g., removed from areas already legally disturbed by construction).

Techniques that are more self-sustaining/long-term and ecosystem oriented should be experimentally sought. A reduction in overall

plant cover and understory could be obtained through reduction in soil fertility or "anti-fertilization", which can be accomplished by adding organic matter (e.g., wood chips) to the soil matrix (T. St. John, pers. comm. 1996) or by adding coarse inorganic material (e.g., sand washed of fine materials). Conversely, care should be taken when experimenting with soil properties, as soil texture and structure (e.g., crusts) may be as essential to the Pacific pocket mouse as optimum plant cover (Spencer 1997). Allopathic plant effects or artificial changes in soil chemistry could also be utilized to reduce plant cover. If senescent coastal sage scrub is unoccupied by the Pacific pocket mouse, then earlier seral stages may be more attractive. Earlier seral stages could be created by fire (discussed below) or other methods. A mosaic of potential habitat types and ages could be created outside of occupied habitat in this manner.

Some habitats that would otherwise generally remain sub-optimal for the Pacific pocket mouse may be repeatedly manipulated such that they will support the taxon. Other habitat areas that would typically (and likely historically did) support optimal habitat may be made occupiable by removal of some perturbing influence (such as exotic species). The latter has the greater potential for long-term success.

The Pacific pocket mice found in the Oscar-1 area on Camp Pendleton currently occur in non-coastal sage scrub habitats, including non-native grasslands, and disturbed areas dominated by filaree (*Erodium* sp.). Anecdotal evidence suggests that the areas of dense grasslands are not occupied (to a level of being detectable during surveys), but the small coastal sage scrub, bare ground, and low density non-native grassland patches within the more dense grasslands are occupied. Where appropriate, habitat manipulations that convert adjacent exotic grassland areas back to coastal sage scrub should be attempted, particularly those actions that promote

essentially self-sustaining and long-term habitat trends. Pacific pocket mice also exploit the friable soils in berms created during road maintance in this area. We (the Service) do not advocate creation of additional berms, but protection of these existing berms could be important (M. Pavelka, pers. comm. 1998).

3.3 Adaptively manage Pacific pocket mouse habitat and populations.

Conservation of Pacific pocket mouse populations depends largely on the adequate and adaptive management of populations and their habitat. Two of the most important issues to be addressed at each site are how to increase habitat utilization and viability, and remove obstacles (particularly artificial ones) to population expansion and dispersal between populations.

Preparation of interim management plans should promote management of Pacific pocket mouse habitats that is flexible and quickly responds to needs as they arise. Interim plans should be prepared first for known populations, then for other populations as they are discovered. The urgency of the need for interim management plans (and updated versions thereof) will be influenced by the current status and distribution of populations; relative opportunities for habitat or population expansions; and ongoing threats, including development proposals and depredation.

Management plans, methods for monitoring and determining population viability and threats, and criteria of monitoring the success of management plan actions will be updated on an as-needed basis. If substantial changes are recommended, they should be incorporated into updated management plans. Management plans should seek long-term solutions that promote self-sustainability and full ecosystem functionality, thus minimizing the need for, and potential problems of, active management.

The San Mateo population(s) at Camp Pendleton is subject to natural and artificial impediments to periodic movement between currently occupied habitat areas. Most of these impediments are temporary, dynamic, or relatively easy to improve. Artificial barriers such as roadways, agriculture, and flood damage reduction efforts may need to be removed, modified, or enhanced so that connectivity between the San Mateo north and south groups is improved. Natural upland habitats, particularly coastal sage scrub, in this portion of the San Mateo Creek watershed, should be restored and/or enhanced to improve habitat linkage, facilitate movement between the two sites by Pacific pocket mice, allow for population/habitat dynamics, and improve ecosystem integrity. San Mateo Creek wash should be restored and maintained in a natural state; this includes restoration of native floodplain vegetation and maintenance of the wash area free of roads, lighting, exotic vegetation, and linear structures (such as walls, rip-rap, etc.). Provisions for native animal (Pacific pocket mouse, snakes, coyote, fox, bobcat, mountain lion, etc.) movement should be included within any artificial structures remaining in the area, such as a series of bridges along Christianitos Road. All future actions in this area should improve ecosystem function and habitat linkage/connectivity.

3.4 Undertake habitat manipulations at sites targeted as host sites for reintroduction efforts.

Habitat manipulation may also be undertaken at sites targeted to receive translocated individuals. Such sites will contain suitable or nearly suitable habitat for the Pacific pocket mouse, and are likely to require some manipulation to optimize the habitat for the subspecies. Such habitat manipulations will need to be completed prior to any translocation efforts at a given locality.

3.5 Evaluate and monitor the success of habitat restoration efforts.

Successes and deficiencies in the restoration efforts should be identified, reported, and corrected. Appropriate corrective measures should be taken if restoration efforts do not produce results consistent with the objectives and needs identified by relevant research. Monitoring and restoration efforts may be necessary for at least 10 years if difficulties are encountered in maintaining high function and value habitats.

4 Conduct research on the life history, ecology, and population biology of the Pacific pocket mouse.

Data should be collected and analyzed pertaining to the genetic variability (see Appendix 1), population dynamics, life histories, ecological requirements, and viable population sizes of the listed subspecies. Such information should be used to guide recovery actions and to construct mathematical models that help in predicting the likelihood of the persistence of the subspecies over time. Care should be taken to not over-extend the population viablity analysis approach by relying solely on such mathmatical models to predict persistence over time (Spencer 1997). Population viability anylasis is a powerful tool of modern demographic modeling, but it must be used with caution (Price 1997). Population viability analysis is most useful for comparing the relative merits of alternative preserve configuration or plans, and the relative effects of various parameters and model assumptions or predicted metapopulation survivorship (Spencer 1997).

Historic, potential, and occupied habitats should be mapped on GIS, along with soils, fire history, vegetation, and senstive species data. All associated GIS digital data from Camp Pendleton, cities, counties, and other associated agencies with potential habitat should be delivered to us by 1999, with updates provided as they develop. All research should be

coordinated and combined as appropriate and possible to increase effeciency and reduce costs.

4.1 Collect basic information on the natural history of the Pacific pocket mouse, particularly habitat relations and diet.

This Pacific pocket mouse is known from few populations and has not received adequate historic research in the field to allow a clear understanding of many aspects of the subspecies' habits and life history. These data should be collected as they are important to the development of sound strategies pertaining to the habitat manipulation and ecosystem enhancement.

Because heteromyid rodents are a relatively ecologically uniform group, information pertaining to one species can often be applied to others with only minimal additional data collection to verify that the Pacific pocket mouse adheres to patterns typical for the family (Price 1997). Using existing information in this way could reduce redundancy and the cost of implementing this task. We should encourage additional communication with active heteromyid rodent researchers who could assist in compiling relevant existing information and help determine how it can be used.

4.2 Research on potential and known predator ecology.

Research on predator ecology within Pacific pocket mouse habitats should be performed (Bloom 1997). Radio telemetry studies of likely predators including the three most abundant snake species (pacific rattlesnake, gopher, king), barn owls, great horned owls, coyotes, fox, and bobcats should be completed. Other nocturnal predators should also be considered, including house cats. House cats may prey differentially on other species of mice (e.g. *Mus musculus*) which may indirectly effect Pacific pocket mouse

populations (Spencer 1997). The main goal of this research is to determine the abundance of predators within Pacific pocket mouse areas, and the level of predation of each species. If removal of "surplus" dispersing juvenile Pacific pocket mice for translocation is considered, knowledge of predation levels may be influential in decisions on how many animals to be moved in a particular year (Bloom 1997). Predator ecology and movement information would also be beneficial when considering the potential for successful release of Pacific pocket mice into unoccupied sites (Bloom 1997).

4.3 Evaluate Argentine ant invasions into existing and potential habitat.

Exotic Argentine ants are invading coastal sage scrub areas near Pacific pocket mouse habitats. These ants could have adverse direct or indirect effects on Pacific pocket mouse populations and other native species, including replacement of native ant species (R. Fisher, pers. comm. 1997, Chris Nagano, pers. comm. 1998). Potential ecosystem effects include, but are not limited to, Pacific pocket mouse nestling mortality, insect population shifts, and modification of seedling survival rates. Invasion of these ants may be expedited by urban or agricultural development, possibly as a result of supplemental water being made available. Argentine ant invasions should be monitored and overall ecosystem effects evaluated. Ant control methods, including biological control and land use changes, should be developed if necessary.

4.4 Evaluate the role of fire and fire management.

Currently, very little data are available to evaluate the overall effects of fire on Pacific pocket mice or their habitat. Research is needed to develop a long-term fire management, fuel management, and/or fuel abatement program that would protect the animals and

their habitat. If the prescribed research reveals that certain fire and fuel abatement measures are warranted or preferred, such measures should be implemented.

The design and implementation of warranted or preferred fire suppression and management and fuel abatement activities, including controlled burns, fuel thinning, crushing, mowing, clearing, and fire suppression efforts, should be coordinated among all regulatory and fire management agencies and landowners to ensure the development of site-specific Pacific pocket mouse management plans that specify optimum habitat management practices. The potential role of fire in managing or disturbing habitat of the Pacific pocket mouse is poorly known. This question should be addressed for each locality with occupied habitat. Any information obtained on fire effects should be incorporated into the individual management plans.

Some areas of unoccupied potential habitat should be treated with a controlled burn and evaluated in a scientifically-based experimental approach with the goal of determining the positive and negative effects of fire. Ecosystem effects of fire should be evaluated rangewide as opportunities present themselves by wildfire. Existing fire history data (including GIS digital data) should be delivered to us, and necessary GIS maps should be created and maintained for all potential Pacific pocket mouse habitat. The role of fire in its positive and negative influence on the invasion or persistence of various exotic plant species should be evaluated. The potential advantages and disadvantages of fire as a management tool should be addressed.

4.5 Evaluate the effects of artificial night-time lighting.

Artificial night-time lighting may cause problems for nocturnal rodents such as the Pacific pocket mouse through potential

modification of predation rates, obscuring of lunar cycles, and/or causing direct habitat avoidance. Artificial lighting/light pollution and its influence on Heteromyid rodents (particularly those taxa closely related to the Pacific pocket mouse) and overall ecosystem functioning, should be evaluated. Predator-prey relationships in illuminated and unilluminated coastal sage scrub should be researched, with the goal of attaining empirical data on effects. Secondary and tertiary effects should be examined. Illumination of habitat by artificial light and activity patterns/densities of owls, coyotes, foxes, bobcats, house cats, snakes, and rodents should be correlated with lunar cycles and other appropriate habitat attributes. All experimentation with potential for adverse effects should take place in areas unoccupied by the Pacific pocket mouse.

4.6 Evaluate the role of past agricultural uses on habitat function.

The effects of historic agricultural practices on habitat function should be evaluated in areas that have been passively or actively restored to a moderate level of coastal sage scrub functioning. Preliminary evidence suggests that areas previously tilled do not support the Pacific pocket mouse, although they seem to be appropriate habitat otherwise (open, sandy coastal sage scrub adjacent to existing Pacific pocket mouse populations) (Spencer 1997, OGDEN 1997). Soil characteristics, soil microfauna/microflora, plant structure, plant diversity (including exotics), insect diversity, and seed production should be characterized and compared in occupied habitat and former agricultural areas that otherwise appear suitable. Care should be taken to not misidentify relationships and coincidences.

4.7 Develop biological control methods for exotic plant species.

Current management of non-native vegetation requires a considerable commitment to thoroughly remove or kill all above-

and below-ground parts of the target species and follow-up in subsequent years to control any exotics outbreaks. Eradication of most exotic species currently requires a combination of mechanical and chemical control.

The development of biological control of non-native plant species through U.S. Department of Agriculture (USDA), international, and/or university programs should be initiated. Biocontrol programs for some plant pest species have already been developed, including the use of six insect species to control yellow-star thistle (*Centaurea* sp.), an exotic from southern Europe (Randall 1994) and the release of European beetles in New York State for biological control of purple loosestrife (*Lythrum* sp.), an invasive exotic from Europe (U.S. Fish and Wildlife Service 1997). The USDA is currently proposing release of *Tamarix*-specific leaf beetles and mealybugs in nine areas throughout the southwestern U.S. (USDA 1997). The USDA and the International Institute of Biological Control headquartered in Switzerland reportedly have staff and facilities to perform the international research needed to perform the type of work required for biological control of invasive exotic plant species in the range of the Pacific pocket mouse (Dr. Bernd Blossey, Professor of Biology, Cornell University, pers. comm. 1997). Biological control programs hold the promise of long-term, self-sustaining, and very wide-ranging control of invasive plant species with relatively limited costs or use of chemicals, but are not without the biological risks associated with releasing additional exotic species (Mlot 1997, Beardsley 1997, Perlman 1997).

4.8 Conduct research to understand viable population sizes and metapopulation dynamics, and construct appropriate mathematical models to guide management efforts.

To predict the likelihood of survival, information on the number of offspring produced, the life span, and the mating habits of this subspecies should be collected and evaluated. It is sometimes possible to estimate a populations' chance of survival, based upon a number of assumptions. However, more reliable estimates are only possible after conducting appropriate studies. The following studies should be carefully coordinated to produce the most usable results.

4.8.1 Determine the reproductive potential of the subspecies using Leslie matrix models.

The survival or extinction of a population, or of an endangered species, are chance events (Dennis and Scott 1991) for which probability estimates can be obtained. The Leslie matrix model requires estimates of age specific survival and fecundity, rough estimates for which should be used in preliminary analyses while the population studies needed to obtain more reliable estimates are conducted.

4.8.2 Determine habitat area requirements and dispersal distances.

After completing the research prescribed above, a realistic estimate of the acreage of habitat required to support a population of the Pacific pocket mouse should be calculated. This habitat acreage will likely be different for each population and in part depend on the habitat quality and degree to which populations fluctuate naturally.

Currently, virtually nothing is known about dispersal characteristics of the Pacific pocket mouse such as the timing, magnitude, and distance of dispersal, and whether particular habitat or landscape features are preferred. These data should be collected for the Pacific pocket mouse. To obtain these data, radio tracking may be, if logistically feasible, the best methodology available. If radio-tracking is used, emphasis should be to telemeter a large number of juveniles/subadults in the late summer to maximize the potential to track dispersers (Spencer 1997). Otherwise, live-trapping studies could be conducted at varying distances from the source population of marked individuals. A standard trapping grid without drift fences should be utilized due to the potential for interference with home ranges, foraging and social interactions, and the possibility of the fences attracting predators to Pacific pocket mice (Behrends 1997).

4.9 Conduct research on conservation genetics of the Pacific pocket mouse.

An understanding of the genetics of the known populations of the Pacific pocket mouse using modern molecular techniques is needed. The goals of this task are to describe genetic variation in naturally occurring populations of *Perognathus longimembris pacificus*; assess whether any of the disjunct populations show evidence of reduction in genetic variation; describe any genetic subgroups within the Pacific pocket mouse; and integrate the results into conservation planning efforts for the subspecies.

Populations with unusually low variability may be candidates for interventions to bolster genetic variation through mixing of populations. It may be necessary to concentrate conservation

efforts on "priority" populations. The priority ranking of populations requires an assessment of how genetic variation within the species is apportioned or represented and the development of a strategy for maintaining the greatest amount of genetic variation in the long term. Data on interpopulational patterns of genetic variation should be used to identify genetically unique groups or subgroups.

Part of this study includes an examination of the intrapopulational and interpopulational genetic variation. This information is important in order to identify populations at risk due to consequences of the lack of genetic variation such as loss of adaptive flexibility within changing environments. Protein allozyme and molecular evidence should be used to calculate Wright's Coefficient of Relatedness, quantify amounts of genetic variation within the populations, and estimate historic levels of gene flow among the populations. We (the Service) should encourage standard protocols for tissue collection and encourage permitted trappers to collect and submit samples (Spencer 1997), if safe and appropriate.

4.10 Refine management plans.

Based upon the results of these studies, refine the management plans developed under task 2 above.

4.11 Refine recovery criteria.

The results of the population viability analyses and metapopulation dynamics are needed to further refine these criteria. Fewer than 10 populations may be needed for recovery if they are sufficiently large and highly unlikely to be extirpated. Many more than 10 populations may be required if they are small, unstable, and/or isolated.

5 Identify and implement measures to create additional populations.

Protection of all existing, enhanced, and any newly discovered Pacific pocket mice populations and habitat may be insufficient to ensure recovery of the subspecies. In addition to implementing the habitat management objectives in Task #3, it may be necessary to remove individuals from selected populations for the purpose of establishing a captive breeding population, or introducing wild-bred or captive-bred individuals into suitable but currently unoccupied habitat. Potentially suitable habitat apparently occurs within existing publicly-owned and managed natural areas that are within the subspecies' historic range. Reconnaissance-level surveys are needed to evaluate whether the habitat (substrate and vegetation) within a number of these areas can potentially support Pacific pocket mouse populations.

Most occupied Pacific pocket mouse habitat patches are now small and fragmented. Although there are a limited number of sites with suitable or potentially suitable habitat, the establishment of populations in these areas could contribute to the subspecies recovery by increasing the number of populations and constituent, individual animals.

5.1 Evaluate the feasibility of carrying out a translocation effort for the Pacific pocket mouse.

Nielsen (1988) recommended that a feasibility study should include, in part, considerations of the: (1) reason for translocation; (2) status of the wild population(s) to be translocated; (3) ecology, biology, and ethology of the subspecies; (4) current size and density of the wild population(s); (5) movements and distribution of the subspecies; (6) male:female ratio, (7) annual recruitment; (8) mortality rates and causes; (9) health and condition of the populations; (10) genetic variability and integrity; (11) status of remaining habitat; (12) depredation rates in target areas; (13)

translocation strategy (e.g., time of release, number and sex of animals involved); (14) capture technique and technology; (15) number and location of release sites; and (16) post-release support of translocated animals. Research and management tasks described above should provide enough information to determine the feasibility of attempting to translocate Pacific pocket mouse individuals.

Translocation should be considered after the feasibility tasks above are performed and: (1) surveys indicate that the potential for undiscovered populations is very low, and previously defined conservation and management measures fail to produce sufficient, essential habitat and populations, (2) research reveals that animals may be safely translocated into target habitats, and (3) the donor population can withstand the loss of individuals.

5.2 Develop a translocation protocol for wild-reared and captive-bred individuals.

A protocol for translocation of wild-reared or captive-bred individuals should be prepared that addresses all phases of the translocation effort, including host site selection, habitat manipulation, animal capture and release, and monitoring.

Only sites containing apparently suitable, albeit unoccupied habitat are to be considered for translocation efforts unless genetic studies reveal that the translocation of individuals from another population is necessary to enhance genetic variability of the host population, or otherwise benefit the subspecies.

The protocol should consider: a) suitable times of the year for translocation, b) the number of individuals to be moved and target densities, c) the number and type of artificial burrows and food (seeds and leafy vegetation) to be provided, d) spacing patterns of

individuals and sexes, e) the optimum period of time to maintain animals within artificial burrows to allow them to become accustomed to the unfamiliar surroundings, and f) the genetic makeup of translocated animals (see Appendices 1 and 2).

5.3 Implement a translocation program.

Translocations should be limited to sites that were previously occupied by the Pacific pocket mouse or that contain the appropriate substrates and habitat attributes. Translocations to occupied habitat should be done according to the prescribed protocol.

5.4 Monitor translocated populations.

Translocation efforts are to be accompanied by long-term monitoring of the population. Monitoring can be accomplished through establishment of trapping stations where live-trapping is conducted at least twice each year, once to sample adults upon their emergence from their burrows between late April and May, once between late July and late August to sample adults and their annual offspring.

5.5 Develop a protocol for captive breeding and implement first using a non-listed related species.

The captive breeding protocol should follow Hayden *et al.* (1966) and Daly *et al.* (1984). The protocol should require routine or regular observations of natural estrous cycles in large numbers of captive females in order to determine the most favorable mating time, and pairing receptive females with males under conditions that minimize mortality of individuals. Pairs should be observed for 15 to 20 minutes and immediately separated if violent behavior is observed. If the pair appears to be compatible, they may be left

together from 3 to 4 hours or overnight. After this, the female should be removed to an observation cage. Mated females should be kept in a relatively quiet place, away from daily disturbance, and provided with a refugium (see also Appendix 2).

A protocol for captive breeding additionally should address the following issues:

- Whether captive-breeding efforts should be undertaken in light of the results of other recovery plan actions and trends in population numbers.

- Whether or not suitable or potentially suitable host sites have been identified within the subspecies' historic range.

- A captive breeding protocol for the Pacific pocket mouse surrogate species. The protocol should contain the essential tasks discussed and prescribed in Appendix 2. Hayden *et al.* (1966) successfully bred *P. longimembris bangsi*; it seems reasonable to assume that the same or similar protocol can be used to successfully breed *P. longimembris pacificus*. Experience at breeding pocket mice should be gained by repeating their experiments with two relatively common taxa, *P. longimembris longimembris* or *P. longimembris bangsi*. Efforts to breed Pacific pocket mice should be undertaken after successful results are obtained working with these surrogate species. The captive breeding facility for the surrogate subspecies should not be located within the range of the Pacific pocket mouse. Although interbreeding of subspecies is common in nature, mixing of genetic lineages as a result of accidental releases of animals should be avoided.

- The minimum effective size of the captive breeding colony. To maximize the opportunity for success of the effort, the breeding colony should start with the largest feasible number of individuals. Hayden *et al.* (1966) used over 200 females in their program, in part because it was known that not all individuals would be reproductively receptive during a given, desired time window. Males will have to be screened for their "sexual interest" (Behrends 1997).

- Genetic analysis. The results of the genetic analysis of existing populations of the Pacific pocket mouse should be evaluated, including the source population(s) for the captive breeding and translocation programs prior to the removal of animals. The genetic analysis should be consistent with the protocol presented in Appendix 1. The purpose of the genetic study is to determine whether there are important genetic differences between populations, whether any populations have reduced genetic variability, and determine the minimum number of individuals needed to capture at least 90 percent of the population's genetic variability. The results of the genetic study would be used to determine whether it is desirable for a captive breeding program to interbreed individuals from two or more localities to increase genetic variability. Small tissue samples should be taken from individual animals for any necessary future studies. As an alternative, there is new technology available using fecal analysis as a far less invasive technique for extracting DNA.

5.6 Implement a captive breeding program for a related species.

The captive breeding program should be consistent with the protocol presented in Appendix 2. In particular:

- Individuals for the captive breeding program should be obtained from populations whose distribution and abundance are well known, and whose population is expected to be able to withstand the removed individuals. Populations with restricted opportunities for recruitment (e.g., populations surrounded by unsuitable habitat), are likely to produce more individuals in average years than are typically recruited into the population. The juvenile production beyond that required to maintain a viable population level could be removed late in the season (i.e., late September, early October) and potentially be used in either translocation or captive breeding programs.

- Individuals should be kept individually in gallon jars or other appropriate containers, containing sand and refuge, and fed a diet of seeds (grass and sunflower) soaked in water soluble vitamins (pet vitamins or equivalent). Freshly cut grasses or lettuce are supplied every other day. The laboratory conditions successfully established by Hayden *et al.* (1966), including temperature, relative humidity, and lighting, should be duplicated or used as a basis for the development of a protocol specifically designed to suit the needs of the Pacific pocket mouse.

- Captive-bred animals are to be released at the host site as soon as feasible. The offspring produced in captivity by Hayden *et al.* (1966) were born from April to July; all individuals would be weaned by early August. Preliminary evidence indicates that young of the year disperse from their natal home range from August to September in search of unoccupied habitat. The release of captive bred animals would attempt to mimic this natural pattern to the extent feasible. To minimize the impact of captivity on the fitness of captive-bred individuals, juveniles should be released in

family groups as soon as is feasible, possibly as early as 4 weeks after birth.

5.7 Implement a captive breeding program for the Pacific pocket mouse.

Captive breeding of Pacific pocket mice for their reintroduction into suitable unoccupied habitat could potentially play a role in recovery under specific conditions, particularly if it becomes infeasible to obtain founding populations by regular, selective removal of individuals from existing populations. Captive breeding could be undertaken if necessary to prevent the likely, imminent extinction of the subspecies or to produce relatively large numbers of individuals that are as genetically diverse as possible for the purpose of translocation. The chain of command and the decision-making process should be clearly established at the beginning of any captive breeding program for the Pacific pocket mouse (Behrends 1997).

6 Enhance public awareness of, and appreciation for, the Pacific pocket mouse recovery program through educational and interpretive programs.

Public awareness of restoration and other recovery efforts will create a positive image of these efforts and help to reduce impacts to protected populations. Interpretive exhibits should be established adjacent to habitats containing Pacific pocket mouse populations. Outreach and education efforts will enhance the public's understanding and appreciation of these rare animals and potentially reduce accidental impacts to the subspecies. Interpretive signs and exhibits should describe and depict sensitive local resources and the involvement and contributions of volunteers; announce the availability of published materials and

information; and advertise the locations and times of interpretive walks and programs. Mailings/flyers to residents living near Pacific pocket mouse habitat should be developed outlining ecosystem and life history details, as well as recommendations for pet care, trash placement, fire and fuel abatement precautions, hiking and bicycle use, etc. Care should be taken to not induce or direct vandalism.

6.1 Federal and State agencies should work with private parties to develop participation plans to implement specific recovery tasks.

The success of Pacific pocket mouse recovery efforts will depend on cooperation among Federal, State, and local agencies, researchers, conservation organizations, the public, and land owners to manage lands containing Pacific pocket mouse habitat for the protection of the subspecies. To further such cooperation, outreach efforts that encourage landowners to conserve Pacific pocket mouse habitat and populations should be undertaken.

The agencies and organizations that can be expected to cooperate in recovery planning efforts are the Service, the Marine Corps Base, Camp Pendleton, Department of the Navy, California Department of Fish and Game, California State Parks, the Nature Reserve of Orange County, the Orange County Environmental Management Agency (through its role as lead agency in the Central and Coastal NCCP program), the Transportation Corridor Agencies, the Dana Point Headlands landowners, and the City of Dana Point (through its jurisdiction over land use planning for the Dana Point Headlands). In addition, the following organizations and agencies may be involved in plan implementation: Department of the Navy, Army Corps of Engineers, Federal Highway Administration, Transportation Corridor Agencies, City of San Clemente, and the Endangered Habitats League. The list of

cooperating agencies will be finalized in the first stage of recovery plan implementation.

6.2 Distribute information on recovery plan actions and results to appropriate agencies, jurisdictions, landowners, land managers, and the interested public.

The support and involvement of local jurisdictions, landowners, the public, and State agencies are important where occupied and suitable habitats occur. Updated information on potential habitats, results of the recovery plan efforts, and suggested mitigation guidelines and protection alternatives should be provided periodically to appropriate city and county planning departments. An important element of this cooperation is to interface with the NCCP effort. In addition, a concerted effort must be made to coordinate recovery activities with interested landowners, land managers, scientists with relevant expertise, and interested citizens and citizens' groups.

6.3 Integrate implementation of the recovery plan with local agencies, including appropriate NCCP lead agencies.

The historic range of the Pacific pocket mouse overlaps with three existing programs being implemented under the NCCP program: the Multiple Species and Multiple Habitat Conservation Plans in San Diego County and the Central and Coastal Conservation Plan in Orange County. The Service and California Department of Fish and Game should work with the appropriate agencies to optimize the opportunity for the NCCP to affect the conservation of the Pacific pocket mouse. Long-term self-sustainability and ecosystem functionality of existing and potentially occupied sites should be considered in land use planning of adjacent areas, as well as the sites themselves.

III. Implementation Schedule

The Implementation Schedule that follows outlines the specified actions and estimated costs for the recovery of the Pacific pocket mouse. It is a guide for meeting the objectives discussed in the "Recovery" section of this plan and depicts task numbers, descriptions, priorities, and durations; responsible agencies; and estimated costs. The implementation schedule utilizes the numbering system from the narrative outline in the Recovery section of this document to identify recovery actions. These actions, when accomplished, should bring about the recovery of the Pacific pocket mouse and the protection of its habitat. Because the monetary needs for all parties involved in recovery are identified, this schedule reflects the total estimated financial requirements for the recovery of the subspecies. All costs related to recovery efforts except those associated with possible perpetual maintenance of optimum habitat and populations, possible regulatory needs beyond the year 2005, possible land acquisition, and possible monitoring of restored sites beyond the year 2005 are estimated and included in the schedule. The potential for these additional costs, which remain to be determined (TBD), are disclosed in the comments section of the implementation schedule.

Priority numbers given in Column 1 of the implementation schedule are defined as follows:

Priority 1	An action that must be taken to prevent extinction or to prevent the subspecies from declining irreversibly.
Priority 2	An action that must be taken to prevent a significant decline in the subspecies population or habitat quality, or some other significant negative impact short of extinction.
Priority 3	All other actions necessary to provide for full recovery of the subspecies.

Acronyms used:

COE	= U.S. Army Corps of Engineers;
CORNELL	= Cornell University;
CSP	= California State Parks;
DFG	= California Department of Fish and Game;
FWS	=U.S. Fish and Wildlife Service;
IIBC	= International Institute of Biological Control;
LAWA	= Los Angeles World Airports;
MCBCP	= Marine Corps Base, Camp Pendleton
NROC	= Nature Reserve of Orange County;
OCEMA	= Orange County Environmental Management Agency;
SWDIV	= Department of the Navy, Southwest Division
TBD	= to be determined;
TCA	= Transportation Corridor Agencies
USDA	= U.S. Department of Agriculture

Table 2. Implementation Schedule for Pacific Pocket Mouse Recovery

Priority #	Task #	Task Description	Task Duration (Years)	Responsible Agencies	Estimated Total Cost ($1,000s)	Costs $1,000s					Comments
						FY 01	FY 02	FY 03	FY 04	FY 05	
1	1.1	Protect and secure extant populations.	5	All	TBD						TBD
1	1.2	Undertake surveys to locate unknown populations	10	FWS DFG MCBCP SWDIV LAWA TCA	400	40	40	40	40	40	Potential additional costs beyond agency costs. TBD
1	1.3	Continue to refine a standardized survey approach	1	FWS	5	5					
1	1.4	Identify prospective habitat and population sites	10	FWS CSP DFG NROC MCBCP SWDIV TCA LAWA	60	10	10	5	5	5	
1	1.5	Identify essential habitats and sites	10	All	20	2	2	2	2	2	

Priority #	Task #	Task Description	Task Duration (Years)	Responsible Agencies	Estimated Total Cost ($1,000s)	Costs $1,000s					Comments
						FY 01	FY 02	FY 03	FY 04	FY 05	
1	1.6	Evaluate and prioritize protection alternatives for essential habitat	10	All	26		5	4	3	2	
1	1.7	Protect essential habitat	25+	All	TBD						Extent of essential habitat and possible costs presently unknown
1	2.1	Monitor population trends and identify potential threats and management needs	25	FWS CSP DFG MCBCP SWDIV	2,000	80	80	80	80	80	
1	2.2.1	Develop and implement adaptive management plan for Camp Pendleton	25	MCBCP	300	20	20	20	20	20	
1	2.2.2	Develop and implement adaptive management plans for other locales	25	FWS DFG LAWA SWDIV CSP TCA	142	22	27	27	26	20	Implementation costs are presently unknown
1	2.3	Protect habitat from fire and fire abatement measures	25	All	TBD						TBD

Priority #	Task #	Task Description	Task Duration (Years)	Responsible Agencies	Estimated Total Cost ($1,000s)	Costs $1,000s					Comments
						FY 01	FY 02	FY 03	FY 04	FY 05	
1	2.4	Fence Pacific pocket mouse habitat where necessary	3	FWS CSP DFG MCBCP SWDIV LAWA	TBD						
1	2.5	Control depredation by cats and other exotic predators	25+	FWS CSP DFG MCBCP SWDIV	252	12	10	10	10	10	Control to be achieved per integrated predator management plans after 2001
2	2.6	Control exotic plants	25	All	140	5	10	10	10	5	Possible, future costs TBD
2	2.7	Monitor success of management efforts	22	FWS CSP DFG MCBCP SWDIV	66				3	3	

Priority #	Task #	Task Description	Task Duration (Years)	Responsible Agencies	Estimated Total Cost ($1,000s)	Costs $1,000s					Comments
						FY 01	FY 02	FY 03	FY 04	FY 05	
2	3.1	Select target sites for actions that enhance or expand habitat	8	FWS CSP DFG MCBCP SWDIV LAWA TCA	13	1	1	1	2	2	
2	3.2	Undertake habitat manipulations to increase population numbers	24	FWS CSP DFG MCBCP SWDIV LAWA	360		15	15	15	15	
2	3.3	Adaptively manage Pacific pocket mouse habitat and populations.	25	All	265		20	20	60	60	
2	3.4	Undertake habitat manipulations for reintroduction efforts	TBD	FWS DFG MCBCP SWDIV LAWA	TBD						Costs and task duration TBD

Priority #	Task #	Task Description	Task Duration (Years)	Responsible Agencies	Estimated Total Cost ($1,000s)	Costs $1,000s					Comments
						FY 01	FY 02	FY 03	FY 04	FY 05	
2	3.5	Evaluate and monitor success of habitat restoration efforts	20	FWS CSP DFG MCBCP SWDIV LAWA	60						
2	4.1	Collect basic information on natural history	3	FWS DFG MCBCP SWDIV	20	10	5	5			
2	4.2	Research predator ecology	4	FWS CSP DFG MCBCP SWDIV	50		20	10	10	10	
2	4.3	Evaluate Argentine ant invasions into existing and potential habitat	5	All	65		15	15	15	10	
2	4.4	Evaluate role of fire and fire management	25	All	104	10	10	11	4	4	Potential additional costs TBD

Priority #	Task #	Task Description	Task Duration (Years)	Responsible Agencies	Estimated Total Cost ($1,000s)	Costs $1,000s					Comments
						FY 01	FY 02	FY 03	FY 04	FY 05	
2	4.5	Evaluate effects of night-time lighting	3	FWS CSP DFG MCBCP SWDIV	45		15	15	15		
2	4.6	Evaluate effects of past agriculture on habitat function	2	FWS CSP DFG MCBCP SWDIV	16			8	8		
2	4.7	Develop biocontrol methods for exotic plant species	15	FWS USDA CORNELL	500		100	100	100	100	Potential additional cost TBD
2	4.8.1	Determine reproductive potential of the subspecies	4	FWS DFG	95	20	30	25	20		
2	4.8.2	Determine habitat area requirements and dispersal distances	4	FWS DFG	85	30	20	20	15		
2	4.9	Conduct research on conservation genetics	3	FWS	45		15	15	15		

Priority #	Task #	Task Description	Task Duration (Years)	Responsible Agencies	Estimated Total Cost ($1,000s)	Costs $1,000s					Comments
						FY 01	FY 02	FY 03	FY 04	FY 05	
2	4.10	Refine management plans	10	FWS CSP DFG MCBCP SWDIV	20					10	
2	4.11	Refine recovery criteria	4+	FWS	8				2		
2	5.1	Evaluate feasibility of carrying out translocation efforts	6	FWS DFG MCBCP SWDIV LAWA	24	8	8	8			
2	5.2	Develop a translocation protocol for wild-reared and captive-bred individuals	1	FWS DFG	6			6			
2	5.3	Implement a translocation program	10	FWS DFG LAWA	750			75	75	75	To be undertaken only if feasible and necessary (as determined by prescribed research); possible future costs TBD

Priority #	Task #	Task Description	Task Duration (Years)	Responsible Agencies	Estimated Total Cost ($1,000s)	Costs $1,000s					Comments
						FY 01	FY 02	FY 03	FY 04	FY 05	
2	5.4	Monitor translocated populations	20	FWS CSP DFG MCBCP SWDIV LAWA TCA	100						
2	5.5	Develop a protocol for captive breeding (if necessary)	4	FWS DFG	16	4	4	4	4		
2	5.6	Implement a captive breeding program for a related species	6	FWS DFG TCA	500						To be done only as a last resort; possible future costs TBD
2	5.7	Implement a captive breeding program for Pacific pocket mouse	20	FWS DFG TCA	700						To be done only as a last resort; possible future costs TBD
2	6.1	Develop participation plans to implement recovery	25	ALL	100	4	4	4	4	4	

Priority #	Task #	Task Description	Task Duration (Years)	Responsible Agencies	Estimated Total Cost ($1,000s)	Costs $1,000s					Comments
						FY 01	FY 02	FY 03	FY 04	FY 05	
2	6.2	Distribute information on recovery plan actions and results	25	ALL	55	4	4	3	2	2	
2	6.3	Integrate implementation of recovery plan with local agencies, including NCCP	8	ALL	56	7	7	7	7	7	

REC'D AUG 06 2004

SUPPORTING TECHNICAL DOCUMENTS

(Part 2 of 2)

Volume 4

Supporting Technical Documents to Comment Letter
Prepared by Shute, Mihaly & Weinberger LLP for
the South Orange County Transportation
Infrastructure Improvement Project

SUPPORTING TECHNICAL DOCUMENTS

Part One

1. South Coast Air Quality Management District, Improvement of Specific Emission Factors (BACM Project No. 1), Final Report (March 29, 1996).

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196-025

MRI REPORT

Improvement of Specific Emission Factors (BACM Project No. 1)

Final Report

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South Coast AQMD Contract No. 95040
MRI Project No. 3855

March 29, 1996

IMPROVEMENT OF SPECIFIC EMISSION FACTORS

(BACM PROJECT NO. 1)

FINAL REPORT

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March 29, 1996

Contents

Preface iii
Figures vii
Tables ix
Executive Summary ES-1

1 Introduction 1-1

2 Background 2-1
  2.1 Emission Estimates for Construction Activities 2-2
  2.2 Paved Road Emission Estimates 2-6

3 Field Sampling and Data Collection Activities 3-1
  3.1 Construction Sites 3-1
  3.2 Paved Road Surface Silt Loading 3-14

4 Data Analysis 4-1
  4.1 Recommended Emission Factor for On-Site Construction Activities . . 4-1
  4.2 Focused Emission Measurements 4-8
  4.3 Paved Road Emission Factors 4-12
  4.4 Collection of Information Needed for Construction Emission Factors . 4-16

5 Example Use of the Factors Recommended for Construction 5-1
  5.1 Site 3.1 5-1
  5.2 Site 3.2 5-4
  5.3 Estimates of Wind Erosion and Mud/Dirt Trackout 5-6

6 Conclusions and Recommendations 6-1

7 References 7-1

Appendices

A. Photocopies of the Field Logs
B. Site Inventories
C. Assumptions Used to Develop Level 2 Estimates

Preface

This report was prepared under South Coast Air Quality Management District (SCAQMD) Contract No. 95040. Mr. Mel Zeldin of the SCAQMD and Mr. Will Cates of the Clark County Department of Comprehensive Planning serve as project monitors. Dr. Gregory Muleski and Mr. Gary Garman authored this report.

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March 29, 1996

Figures

1. Site 1.1 3-3
2. Site 1.2 3-5
3. Site 2.1 3-6
4. Site 2.2 3-7
5. Site 3.1 3-9
6. Site 3.2 3-10
7. Site 5.2 3-11
8. Equipment Deployment for Focused Emission Measurements 3-15
9. Cyclone Preseparator 3-16
10. Comparison of Silt-Loading Values Obtained in This Study with AP-42 Database for High-ADT Roads 4-14
11. Comparison of Silt-Loading Values Obtained in This Study with AP-42 Database for Low-ADT Roads 4-15
12. Front Page of Questionnaire 4-18
13. Back Page of Questionnaire 4-19
14. Output from WIND Model 5-7

Tables

ES-1. Summary of Uncontrolled PM_{10} Emission Rates Estimated for the Construction Sites ES-2
ES-2. Recommended Emission Factors ES-4
ES-3. Recommended Paved Road PM_{10} Emission Factors ES-5
1. Recommended Emission Factors for Construction Operations 2-3
2. Surveyed Construction Sites 3-2
3. Summary of Uncontrolled PM_{10} Emission Rates Estimated for the Construction Sites 4-2
4. Second Aggregation of Estimated Emissions 4-5
5. Mean Emission Rates for Scrapers 4-7
6. Mean Emission Rates for On-Road Trucks 4-7
7. Recommended Emission Estimation 4-9
8. Test Site Parameters for the Focused Emission Measurements 4-10
9. Measured PM_{10} Emission Factors 4-11
10. Comparison of Table 1 Emission Factors and Measurements 4-12
11. Paved Road Surface Sampling Results 4-13
12. Recommended Paved Road PM_{10} Emission Factors 4-16

Executive Summary

This summary describes the improved emission factors that were developed in this study for construction activities and paved roads in western states. For construction activities, four levels of emission estimation are presented. The first level (area-based) may be directly substituted into any prior inventory that incorporated the original AP-42 construction emission factor. The other three levels offer increasing accuracy as compared to the area-based factor but require successively more detail on the types and intensities of construction activity in the inventory study area.

Emission Factors for Construction Activities

In addition to the area-based emission factor, the current version of AP-42 also includes a series of factors for "unit operations" that occur at construction sites. These operations include activities such as loading and unloading of earth and aggregate materials; land clearing and general vehicle traffic. The unit operation approach can be expected to provide a more accurate emission estimate than the area-based factor for a given site because site-specific information can be used. On the other hand, the unit operation approach cannot be directly applied to the large-scale emission inventories maintained by air regulatory agencies because of the intensive input information required. The project described in this report bridges the gap between the two approaches.

This report describes a series of emission inventories (based on the unit operation approach) prepared for seven construction projects that were visited during the study. The sites were located in four study areas: Las Vegas, Coachella Valley, South Coast, and the San Joaquin Valley.

For each of the construction sites visited, the emission inventory took into account the type and intensity of construction activities observed at the site during the morning (before lunch break) and afternoon. Inventories made use of the "unit operation" emission factors given in AP-42 Table 13.2.3-1 together with activity observations and other data collection activities.

The investigation results for each site are summarized in Table ES-1. The table presents the range, mean, and standard deviation of the estimated hourly PM_{10} emission rate for on-site construction activities. In addition, the mean hourly rate is divided by the area of the construction site to develop an overall area-based PM_{10} emission factor of the same sort as the original TSP AP-42 emission factor that has been used in inventories since 1975. Given the range in size and level of activity from one construction site to another, it is not surprising that the overall, area-based emission factors range over two orders of magnitude.

Table ES-1. Summary of Uncontrolled PM_{10} Emission Rates Estimated for the Construction Sites

Site	Estimated uncontrolled PM_{10} emission rate (lb/hr)		Overall uncontrolled PM_{10} emission factor	
	Range	Mean ± S.D.	(lb/acre-work hr)	(ton/acre-month)[a]
1.1	82 - 150	116 ± 28	0.39	0.032
1.2	67 - 161	133 ± 44	3.8	0.32
2.1	18 - 146	82 ± 73	0.95	0.080
2.2	0.68 - 0.81	0.74 ± 0.065	0.046	0.0039
3.1	300 - 494	393 ± 80	4.8	0.40
3.2	560 - 793	712 ± 104	5.1	0.43
5.2	82 - 228	164 ± 74	4.1	0.34
			Geometric mean: 1.3 x/÷ 5.9	Geometric mean: 0.11 x/÷ 5.9

[a] Based on 168 work-hours per month.

Note that in a 1990 study for South Coast Air Quality Management District (SCAQMD), Midwest Research Institute (MRI) recommended an adjusted version of the original factor to reflect PM_{10} (rather than TSP) emissions from construction sites. The revised value for PM_{10}—0.31 ton/acre-month—serves as the basis for comparisons in this study.

Table ES-1 shows that the geometric mean of the emission factors is 0.11 ton/acre-month. Substitution of this value for the original AP-42 emission factor represents the simplest revision that can be recommended based on the present study.

The revised overall factor (0.11 ton/acre-month) is roughly three times smaller than the previous value of 0.31 ton/acre-month. However, direct comparisons between the original and revised factors can be somewhat misleading for at least two reasons:

- First, about half of the surveyed sites yielded an overall factor **greater** than 0.31 ton/acre-month. These sites were associated with large-scale earthmoving operations and trucking of fill material. On the other hand, sites without large-scale cut/fill operations yielded area-based factors smaller than the 0.31 ton/acre-month value. To at least partially account for this variability, the sites with active large-scale earthmoving operations were considered separately to obtain worst-case overall factor of 0.42 ton/acre-month.

- Second, the original factor includes effects of at least two emission sources not included in the proposed overall factor of 0.11 ton/acre-month. Because the original factor was based on air quality monitoring over areas that were several square miles in extent, any localized wind erosion or trackout would affect the

monitors and hence the resulting emission factor. It is not clear how much wind erosion or mud/dirt trackout occurred at the sites that were tested in developing the original AP-42 factor.

It is important to recognize that the emission inventories (and any emission factors based on these results) reference uncontrolled conditions, i.e., they do not account for any mitigative effects of watering or other dust controls. This is in keeping with the EPA's guidance that AP-42 emission factors should represent the uncontrolled state. Although almost all sites visited regularly watered travel routes, none of the water truck traffic nor any effect of the water on emissions was included in the inventories.

The value of 0.11 ton/acre-month represents a straightforward means of revising current inventories by direct substitution of one emission factor for another. However, direct substitution retains the same problems associated with the generality of the original AP-42 ("one size fits all") emission factor. For example, how well do the characteristics of the inventoried sites match the characteristics of construction sites in general? Do the inventoried sites contain a disproportionally large amount of earthmoving?

To account for differences in activity levels from one site to another, a second level of aggregation was undertaken to develop an improved emission factor. This approach recognized that operations related to off-highway and over-the-road vehicle movement of cut/fill and other materials typically accounted for more than half of emissions estimated for a site. Emissions from those activities were removed from the site totals. Remaining emissions were averaged and normalized by the site's area. The remaining emission estimates were deemed "general construction." The "general construction" emission factors exhibit far less variability than do overall factors, presumably because they isolate the effect of important source contributions.

This report also contains normalized truck and scraper factors that can be used to estimate emissions from earthmoving operations. Recognizing that end-users will not always have readily available information on numbers of tons and miles transported, a third level of aggregation yielded default factors for off-highway scrapers and over-the-road trucks hauling construction materials (e.g., fill, road base, etc.).

Table ES-2 summarizes the emission estimation methods recommended on the basis of the present study. As shown, four different levels are recommended. The first level represents direct substitution of the overall factors and represents an areawide average. Levels 2, 3, and 4 require that progressively more information be known about the site. The information needed to apply Levels 2 or 3 to areawide emission inventories could be developed by an agency through review of building or dust control permits, or through direct survey of construction contractors. Agencies would develop guidelines to estimate the amount of cut/fill for different classes (e.g., residential, commercial, institutional, etc.) of construction in much the same manner as they currently estimate area disturbed on the basis of a construction project's valuation. Level 4, on the other

hand, requires detailed knowledge and probably represents a methodology that can only be used to generate site-specific rather than areawide emission estimates.

Table ES-2. Recommended Emission Factors

Basis for emission factor	Recommended PM_{10} construction emission factor
Level 1—Only area and duration known	Apply 0.11 ton/acre-month (average conditions) 0.42 ton/acre-month (worst-case conditions)
Level 2—Area and amount of earthmoving known	Apply 0.011 ton/acre-month for each month of construction activity Plus 0.059 ton/1,000 yard^3 of on-site cut/fill 0.22 ton/1,000 yard^3 of off-site cut/fill These values are based on an assumption that one scraper can move 70,000 yard^3 of earth in one month and 35,000 yard^3 of material can be moved by truck in one month. If the on-/off-site fraction is not known, assume 100% on-site.
Level 3—More detailed information available on duration of earthmoving and other material movement.	Apply 0.13 lb/acre-work hr plus 49 lb/scraper-hr for on-site haulage[a] 94 lb/hr for off-site haulage[b]
Level 4—Detailed information on number of units and travel distances available	Apply 0.13 lb/acre-work hr plus 0.21 lb/ton-mile for on-site haulage 0.62 lb/ton-mile for off-site haulage[b]

[a] If the number of scrapers in use is not known, a default value of 4 may be used. In addition, if the actual capacity of earthmoving units is known, values given in the body of the report should be used.
[b] Factor for use with over-the-road trucks. If "off-highway" trucks are used haulage should be considered "on-site."

Emission Factors for Public Paved Roads

Concurrent with the surveys of construction sites, a field sampling program was undertaken to determine spatially averaged values of paved road surface silt loading and total loading in the four study areas. The purpose of this testing was to determine how silt loadings in the study areas compare to the distributions given in AP-42.

The results obtained in this study support suspicions that the AP-42 public road silt-loading database represents roads with higher than normal surface loadings. Median silt-loading values measured in this study were roughly 5 to 10 times lower than in AP-42. In fact, some of the high-ADT roads produced silt loadings slightly lower than the AP-42 default value for limited access roads (i.e., 0.02 g/m^2). During this program, no strictly quantitative method was used to distinguish between "low" and "high" ADT roads. Instead, roads were classified on the basis of how they were depicted on city street maps or on functional classification maps provided by the study area liaison. In general, the high ADT roads would be classified as "arterials" on "major streets," while the low ADT roadways could be termed "collectors" or "local streets."

Table ES-3 summarizes the revised paved road emission factors recommended for general use. Alternately, this report contains the information needed so that member agencies may employ the individual silt-loading and mean vehicle data in the same manner that AP-42 encourages readers to use individual values presented in AP-42.

Table ES-3. Recommended Paved Road PM_{10} Emission Factors

	Emission factor (g/VMT)		
	High-ADT	Low-ADT	Average[a]
Average conditions[b]	0.37	1.3	0.81
Worst-case conditions[c]	0.64	3.9	2.1

[a] Based on 65% of high- and 35% of low-ADT sL value.
[b] Based on median value and 2.4 tons.
[c] Based on 90th percentile and 2.4 tons.

Section 1
Introduction

The U.S. Environmental Protection Agency's (EPA) reclassification of five areas in the southwestern United States from "moderate" to "serious" PM_{10} nonattainment represents a challenge to state and local air regulatory groups. Simply put, to effectively plan and design control programs that will bring an area into attainment, regulators require reasonably accurate emission inventories. However, compiling accurate PM_{10} inventories in the Southwest is an extremely difficult task for the following reasons:

- Unlike other areas in the United States, fugitive dust from nontraditional sources accounts for a far greater portion of PM_{10} emitted in the planning area. Here, "nontraditional" is used to describe emission sources that typically were not subject to stringent air regulations in the past. Industrial plants (such as manufacturers, quarries, etc.), which have long been subject to air permitting and emission inventorying activities, are examples of "traditional" sources. Although construction activities are issued building permits, the need to control emissions from construction operations has only recently been included by many agencies that use planning to achieve air quality goals. Construction thus represents a nontraditional source. "Nontraditional" also refers to **public** PM_{10} sources (such as reentrainment of material from paved streets) as well as activities (such as unpaved driveways or off-road recreational vehicles) of **individual citizens.**

- Nontraditional sources are geographically diverse throughout a planning area and can usually be considered "moving targets." In other words, beyond the fact that it is difficult to locate and inventory all important nontraditional sources at any one time, many sources may not be present 6 months later while new sources will have appeared.

- Nontraditional sources can often have interaction effects. For example, emissions from public streets are usually higher near construction sites, unpaved driveways, etc., because loose material is "tracked off" and deposited on the paved road surface. As another example, off-road vehicles make open areas more susceptible to wind erosion.

- Unlike factors for ducted sources, techniques to estimate fugitive dust emissions are of more recent vintage and the techniques continue to evolve. Furthermore, fugitive dust emission factors usually take the form of predictive equations. Thus, to develop an accurate emission inventory, one must have confidence in the values input to each equation as well as appropriate measures of source activity.

Federal, state, and local regulators are well aware of deficiencies in currently available fugitive dust inventories. Even though the EPA recently completed updates to its emission factor handbook ("AP-42"),[1] there are still limitations in directly incorporating the revised factors into existing emission inventories. To address these problems, the BACM (best available control measure) Working Group has initiated several research studies. MRI performed one of these studies to improve certain emission factors based on field sampling, data collection, and analysis, as described in this report. Specifically, the objectives of the subject study are to:

1. **Recommend improved emission factors for use in estimating paved road dust emissions (on both an annual and 24-hr basis) for public roadways within each of the four study areas.**[a] As discussed in Sections 3 and 4, the plan has been designed to allow one not only (a) to distinguish between different functional classes of roadways but also (b) to further differentiate between the same class of roads in areas with different land use patterns.

2. **Recommend methods to estimate emissions (on both a 24-hr and annual basis) from construction activities within the four study areas.** As discussed in Sections 3 and 4, the plan has been designed to permit one not only (a) to develop areawide inventories based on summary types of information, but also (b) to prepare site-specific inventories for individual construction sites so that effective dust control plans can be developed for the sites.

The remainder of this report is structured as follows. Section 2 briefly summarizes background information on emission factor methodologies for paved roads and construction activities as well as limitations on their use. Section 3 describes the field test sites visited during the project and the field activities conducted at each site. Section 4 discusses how the field data were used to refine emission factor methodologies for the study areas. Section 5 summarizes the conclusions and recommendations, and Section 6 contains the references.

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[a] In this plan, the term "study area" is used to refer to any of the four geographical areas in which field measurements will be made. The four areas are Las Vegas Valley, San Joaquin Valley, South Coast Air Basin, and Coachella Valley.

Section 2
Background

This section first discusses what methods are available for estimating emissions from paved roads and construction activities and then describes the underlying basis for each factor. The section also describes limitations of the different methodologies and what sort of refinements are necessary to improve the overall accuracy of emission inventories.

It is important that the reader keep several points in mind throughout the report. First, emission factors can serve several purposes. For example, one can produce estimates of either (a) areawide average emissions from a broad class of activity, or (b) emissions from a specific activity at an individual site, over a clearly defined time period. Each type of estimate serves a useful purpose, and any improved methodology should be capable of providing either. In other words, the study plan must be designed such that the resulting emission factors provide flexibility and can accommodate a variety of spatially and temporally resolved input parameters.

Also, emission factors generally are best suited to reflect average and relatively long-term conditions. In other words, an estimate for total emissions from a number of sources over a period of time is usually far more accurate than is an estimate for a single source condition at a specific time. For example, the paved and unpaved road emission factor equations in AP-42[1] reference combined emissions from all vehicles traveling a road. That is to say, one should not consider individual vehicles or vehicle classes and then attempt to combine separate emission estimates. This poses little problem in preparing emission inventories because source combinations are of primary interest.

Finally, it is important to recognize the similarities and differences between open dust sources at construction sites and those in other industries. For example, earthmoving and trenching in construction are comparable to materials handling operations used in mining and aggregate processing. Earthmoving and mining use similar types[2] of equipment to remove, transport, and reclaim materials. Like many other industries, construction also relies on truck deliveries of materials. These similarities justify use of the emission factors developed for the other industries.

Of course, the most important distinction to be drawn regarding construction involves its time duration. Unlike other industries, there usually is no "steady-state" or annual average condition. Whereas general mining activities can be expected to occur at least two-thirds of the year in most locations, earthmoving at a construction site may be completed within a one- or two-week period.

In practical terms, this means that it can be quite difficult to plan field activities for a construction site based on the results of a previous visit to the site. There is no "next year" that one can presume to be similar to years past.

2.1 Emission Estimates for Construction Activities

In 1993, EPA updated[3] fugitive dust emission factors contained in *Compilation of Air Pollutant Emission Factors* (AP-42).[1] The update specifically focused on problems that had been noted about factors for construction activities and paved roads.

The section on construction had not been revised to any substantive extent since its incorporation into AP-42 in 1975. The original section provided a single TSP emission factor to be used for a construction operation from start to end:

$$E = 1.2 \text{ ton/acre-month of activity}$$

where E represents TSP emissions.[b] The update found that, although the existing factor may have been useful for providing conservatively high emission estimates for broad geographic areas of interest, it cannot either (a) provide reliable estimates for a specific site or (b) subdivide construction source contributions for control planning purposes.

The updated AP-42 section includes emission estimates based on a unit operation approach. Under this approach, construction activities are broken down into generic operations, such as truck travel over paved or unpaved surfaces, site preparation by scrapers and graders, or the handling of aggregate material, and emission factors in other sections of AP-42 are recommended to develop estimates. Table 1 reproduces the new guidance on estimating emissions at construction sites.

The updated methodology offers improved emission estimates for a specific site. However, the new approach cannot be directly incorporated into current inventories that use the older factor based on disturbed surface area. The new approach requires more types of information and a higher degree of resolution.

To develop a means that Working Group members can use to develop areawide inventories, a series of field measurement activities (surface and activity characterization) were conducted so that a "mini-inventory" of PM_{10} emissions at each construction site was performed. Section 3 discusses how the field activities were conducted, and Section 4 describes how that information was used to develop an improved methodology.

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[b] Note that MRI recommended a revised factor of 0.31 ton/acre-month for use by the SCAQMD in a 1990 review.[4]

Table 1. Recommended Emission Factors for Construction Operations

Construction phase	Dust generating activities	Recommended emission factor	Comments
I. DEMOLITION AND DEBRIS REMOVAL	1. Demolition of buildings or other (natural) obstacles such as trees, boulders, etc.		
	1a. Mechanical dismemberment ("headache ball") of existing structures	NA	
	1b. Implosion of existing structures	NA	
	1c. Drilling and blasting of soil	Drilling factor (1.3 lb/hole) in Table 11.24-4 Blasting factor NA	Blasting factor in Table 11.24-1,-2 not considered appropriate for general construction activities
	1d. General land clearing	Dozer equation (overburden) in AP-42 Section for Western Surface Coal Mining (old Table 8.24-1, -2) $e = 0.75\ (s)^{1.5} / (M)^{1.4}$ where e = PM10 emission rate (lb/hr) s = surface silt content (%) M = surface moisture content (%)	
	2. Loading of debris into trucks	Material handling factor in Section 13.2.2 $e = 0.0011\ (U/5)^{1.3} / (M/2)^{1.4}$ where e = PM10 emission factor (lb/ton) U = mean wind speed (mph) M = material moisture content (%)	
	3. Truck transport of debris	Unpaved road emission factor in Section 13.2.1, $e = 2.1\ (s/12)\ (S/30)\ (W/3)^{0.7}\ (w/4)^{0.5}$ where e = PM10 emission factor (lb/vmt) s = surface material silt content (%) S = mean vehicle speed (mph) W = mean vehicle weight (tons) w = mean number of wheels per vehicle or Paved road emission factor in Section 13.2.4 $e = 0.016\ (sL/2)^{0.65}\ (W/3)^{1.5}$ where e = PM10 emission factor (lb/vmt) sL = silt loading (g/m²) W = mean vehicle weight (tons)	

Table 1 (Continued)

Construction phase	Dust generating activities	Recommended emission factor	Comments
	4. Truck unloading of debris	Material handling factor in Section 13.2.2 $e = 0.0011\ (U/5)^{1.3} / (M/2)^{1.4}$ where e = PM10 emission factor (lb/ton) U = mean wind speed (mph) M = material moisture content (%)	May occur off-site
II. SITE PREPARATION (EARTH MOVING)	1. Bulldozing	$e = 0.75\ (s)^{1.5} / (M)^{1.4}$ where e = PM10 emission rate (lb/hr) s = surface silt content (%) M = surface moisture content (%)	
	2. Scrapers unloading topsoil	Scraper unloading factor 0.04 lb/ton in old Table 8.24-4	
	3. Scrapers in travel	Scraper (travel mode) expression in old Table 8.24-1, -2 $e = 0.0000037\ (s)^{1.4}\ (W)^{2.5}$ where e = PM10 emission factor (lb/vmt) s = surface material silt content (%) W = mean vehicle weight (tons)	
	4. Scrapers removing topsoil	5.7 kg/VKT (20.2 lb/VMT)	
	5. Loading of excavated material into trucks	Material handling factor in Section 13.2.2 $e = 0.0011\ (U/5)^{1.3} / (M/2)^{1.4}$ where e = PM10 emission factor (lb/ton) U = mean wind speed (mph) M = material moisture content (%)	
	6. Truck dumping of fill material, road base, or other materials	Material handling factor in Section 13.2.2 $e = 0.0011\ (U/5)^{1.3} / (M/2)^{1.4}$ where e = PM10 emission factor (lb/ton) U = mean wind speed (mph) M = material moisture content (%)	May occur off-site
	7. Compacting	Dozer equation in old Table 8.24-1, -2 $e = 0.75\ (s)^{1.5} / (M)^{1.4}$ where e = PM10 emission rate (lb/hr) s = surface silt content (%) M = surface moisture content (%)	Emission factor downgraded because of differences in operating equipment

Table 1 (Continued)

Construction phase	Dust generating activities	Recommended emission factor	Comments
	8. Motor grading	Grading equation in Table 8.24-1, -2 $e = 0.031\ (S)^{2.4}$ where e = PM10 emission factor (lb/vmt) S = mean vehicle speed (mph)	
III. GENERAL CONSTRUCTION	1. Vehicular traffic	Unpaved road emission factor in Section 13.2.1, $e = 2.1\ (s/12)\ (S/30)\ (W/3)^{0.7}\ (w/4)^{0.5}$ where e = PM10 emission factor (lb/vmt) s = surface material silt content (%) S = mean vehicle speed (mph) W = mean vehicle weight (tons) w = mean number of wheels per vehicle or, Paved road emission factor in Section 13.2.4 $e = 0.016\ (sL/2)^{0.65}\ (W/3)^{1.5}$ where e = PM10 emission factor (lb/vmt) sL = silt loading (g/m^2) W = mean vehicle weight (tons)	
	2. Portable plants		
	2a. Crushing	Factors for similar material/operations in Section 11 (old Section 8) of AP-42	
	2b. Screening	Factors for similar material/operations in Section 11 (old Section 8) of AP-42	
	2c. Material transfers	Material handling factor in Section 13.2.2 $e = 0.0011\ (U/5)^{1.3} / (M/2)^{1.4}$ where e = PM10 emission factor (lb/ton) U = mean wind speed (mph) M = material moisture content (%)	
	3. Other operations	Factors for similar material/operations in Section 11 (old Section 8) of AP-42	

The study plan also made provision for focused emission testing at construction sites, because the emission measurement database for construction operations was extremely limited.[3] Although AP-42 has included an entry for construction-related dust emissions for almost 20 years, there had been little emission characterization performed that was directly applicable to construction. As indicated in Table 1, even the revised AP-42 Section 13.2 (formerly Section 11.2) borrows heavily from tests in the mining industries as well as the so-called "generic" fugitive dust factors. Although mining industry factors have been routinely applied to construction sites over the years, there have been no independent data against which the accuracy of the estimates can be assessed. It is generally unknown how accurately those factors predict emissions from construction sites. For example, many construction sites contain temporary, unimproved travel routes. At present, one cannot confidently answer the question: How well does the unpaved emission factor equation—which is based on field tests conducted on permanent roads—estimate emissions from the unimproved routes? Section 3.1 also describes how the limited-scale emission testing was conducted to address this shortcoming in the available database.

2.2 Paved Road Emission Estimates

The AP-42 update[3] also addressed shortcomings in the methods used to estimate emissions from paved roads. For over 10 years, AP-42 presented three sets of paved road emission factor models, and it was sometimes difficult to select the set that was appropriate for a particular application. During that period, distinctions between "urban" and "industrial" paved roads became blurred, and it was unknown how well the "urban" emission factors performed for cases of increased surface loading on public roads (such as after application of antiskid materials, within areas of track-out from construction, or after the accumulation of "blowsand").

The recent AP-42 update addressed these issues by combining the old "urban" and "industrial" emission factor databases and supplemented the combined database with additional tests. The end result consolidated two older AP-42 sections into a single section containing an emission factor in the form:

$$e = k\,(sL/2)^{0.65}\,(W/3)^{1.5}$$

where:

e	=	emission factor in g/vehicle-mile traveled (g/VMT) for a particular particle size range (see k below)
sL	=	silt loading (amount of loose, dry material smaller than 200 mesh present on the road surface area) in g/m^2
W	=	mean weight in tons of vehicles traveling the road
k	=	base emission factor (g/VMT) for particle size range as given below

Particle size range	k (g/VMT)
$PM_{2.5}$	3.3
PM_{10}	7.3
PM_{15}	9.0
PM_{30}	38

In contrast with the alternate AP-42 methodology for construction, the revised paved road equation can be fairly readily substituted into existing emission inventories. There remains some question about what silt-loading values are appropriate for public roads. Although AP-42 stresses the need to collect site-specific silt-loading ("sL") data, the new section assembled a public paved road sL database for possible use when site-specific information is not available.

The paved road sL database is limited in its usefulness in developing improved methodologies for the present study for various reasons:

- Almost two-thirds of the available data were collected in Montana, and only data collected in Montana provide information on the seasonal variation of sL.
- There has been little uniformity in either the sampling/analysis methods used to determine sL values or in schemes used to report roadway classifications.
- Examination of the database did not reveal any meaningful relationship between silt loading and other variables (such as average daily traffic [ADT], road class, etc.).
- It is suspected that the sL database is somewhat skewed toward high values. This is because the majority of measurements were collected during the first calendar half (which was found to have substantially higher values than the second half) and because of anecdotal information that at least some of the sampling programs focused on suspected trouble spots that were heavily loaded (such as after snow/ice storms, near construction sites, etc.).

Several sL sampling programs have been undertaken since the time of the AP-42 update. One study centered on the effectiveness of controls for mud and dirt trackout from construction sites.[5] The Idaho Department of Environmental Quality measured road loadings during the 1993 winter season in Pocatello. Washoe County, Nevada, is currently conducting a year-long study that will better define temporal variations. Although all provide useful information, none remove the limitations noted above.

The field program discussed in Section 3.2 was conducted to develop site-specific sL data for the study areas of interest. The study plan provided for collection of spatially averaged sL data for (a) different roadway classifications and (b) under "normal" and "elevated" conditions.

Section 3
Field Sampling and Data Collection Activities

This section discusses the field measurement and other data collection activities that were undertaken during the program.

3.1 Construction Sites

Two types of field activities were conducted at the selected construction sites. The first dealt with a demonstration case study that was conducted for each site. MRI collected site-specific aggregate material samples and monitored activity at each site over a period of 2 or 3 days. This information was used in conjunction with the factors in Table 1 to generate an **emission inventory of major PM_{10} dust sources at the time of the visit.** The inventories, in turn, were used to develop revised estimation methods (see Section 4.1).

The second type of field activity concerned limited **emission testing of certain PM_{10} sources** at construction sites. As noted in Section 2.1, the measurement database directly applicable to the construction emission sources is extremely limited. Testing conducted in this program provided independent data against which the accuracy of available emission factors may be assessed.

3.1.1 Description of Construction Test Sites

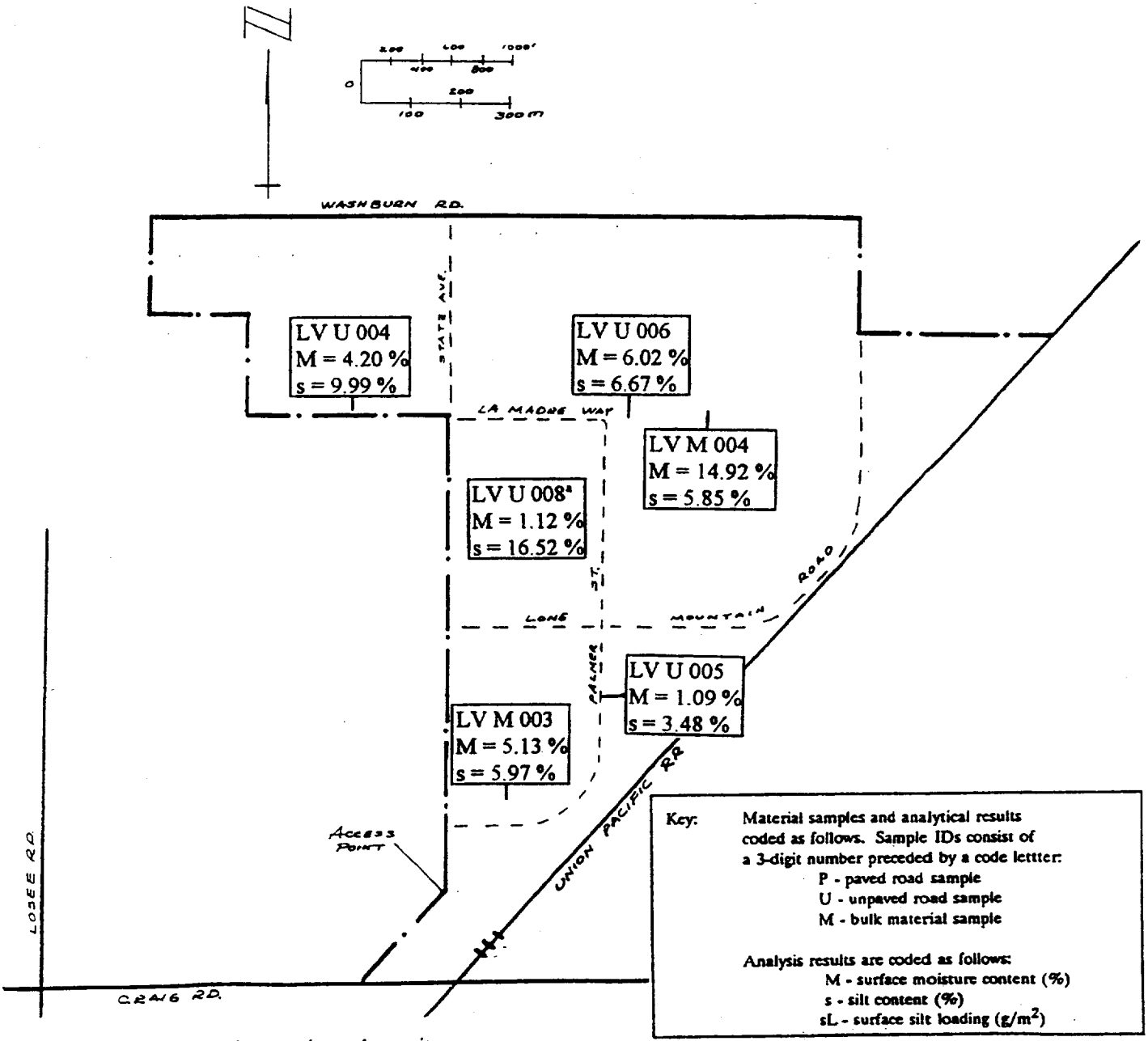
During the period of April 3 through 12, 1995, MRI visited candidate construction test sites in the four study areas. Sites had been identified by a Working Group liaison for the study area. From the candidates, MRI selected sites suitable for both field objectives (i.e., inventory and source testing). Table 2 presents the construction sites visited and describes what activities were present during the site visit and what activities were projected for the field sampling visit. MRI returned to the sites to perform field sampling activities during the period between June 19 and July 18, 1995.

As would be reasonably expected, some anticipated construction activities were not present when MRI returned to the sites in June and July. As a result, modifications to the sampling plans were sometimes necessary. The following paragraphs describe the sites selected as well as the construction activities that were in progress when MRI returned for sampling.[6]

Based on information learned during the April visits, three test sites were selected in the Las Vegas area. The first site selected (Site 1.1) was the Golden Triangle industrial park (Figure 1) being developed in North Las Vegas. Most large-scale

Table 2. Surveyed Construction Sites

Study area	Site	Type of construction	Construction activity levels		
			Observed during the April site survey	Projected to be present during June/July	Observed during June/July
Las Vegas	1.1	Industrial	Trenching and pipelaying, limited earthmoving	Construction of storm channel with concrete deliveries, other concrete work (e.g., sidewalks, etc.), road paving, trenching	Moderate activity including trenching, limited earthmoving, prepaving activities
	1.2	Residential	Scraper excavation in Unit 1, no activity in Units 2 or 3	General construction (pads, framing, etc.) Long haul of cut material from Unit 2 to Unit 3	Moderate activity (trenching) in Unit 1 Heavy activity (short-distance earthmoving, drilling/blasting, compaction) in Unit 2
	1.3	Residential	Construction not begun during April	Trenching, paving	None (trencher broken down during visit)
Coachella Valley	2.1	Residential	Construction not begun during April	Grading and paving of roads in Tract 27365 to start in mid-June	Moderate (trenching, prepaving) to heavy (trucking of road base)
	2.2	Residential	Trenching, road grading	General construction, with some trenching remaining. Chance of earthmoving	Low to moderate activity, including framing and landscaping
South Coast	3.1	Residential	Heavy earthmoving by scrapers	Heavy earthmoving with some long haul of cut material	Heavy activity (cut/fill with some limited stockpiling)
	3.2	Residential	Heavy earthmoving by scrapers (observed from off-site location)	Heavy earthmoving	Heavy earthmoving
San Joaquin Valley	5.2	Commercial	Site was not visited prior to sampling trip	Site was not visited prior to sampling trip	Moderate (trenching) to heavy activity (trucking of fill material)



[a] Taken from travel areas throughout site.

Figure 1. Site 1.1

earthmoving had been completed by the time of the July visits. A variety of activities were observed during the July return visit, including:

- trenching for sewers/utilities
- stockpiling of road base and other pre-paving operations
- scraper movement of spoils

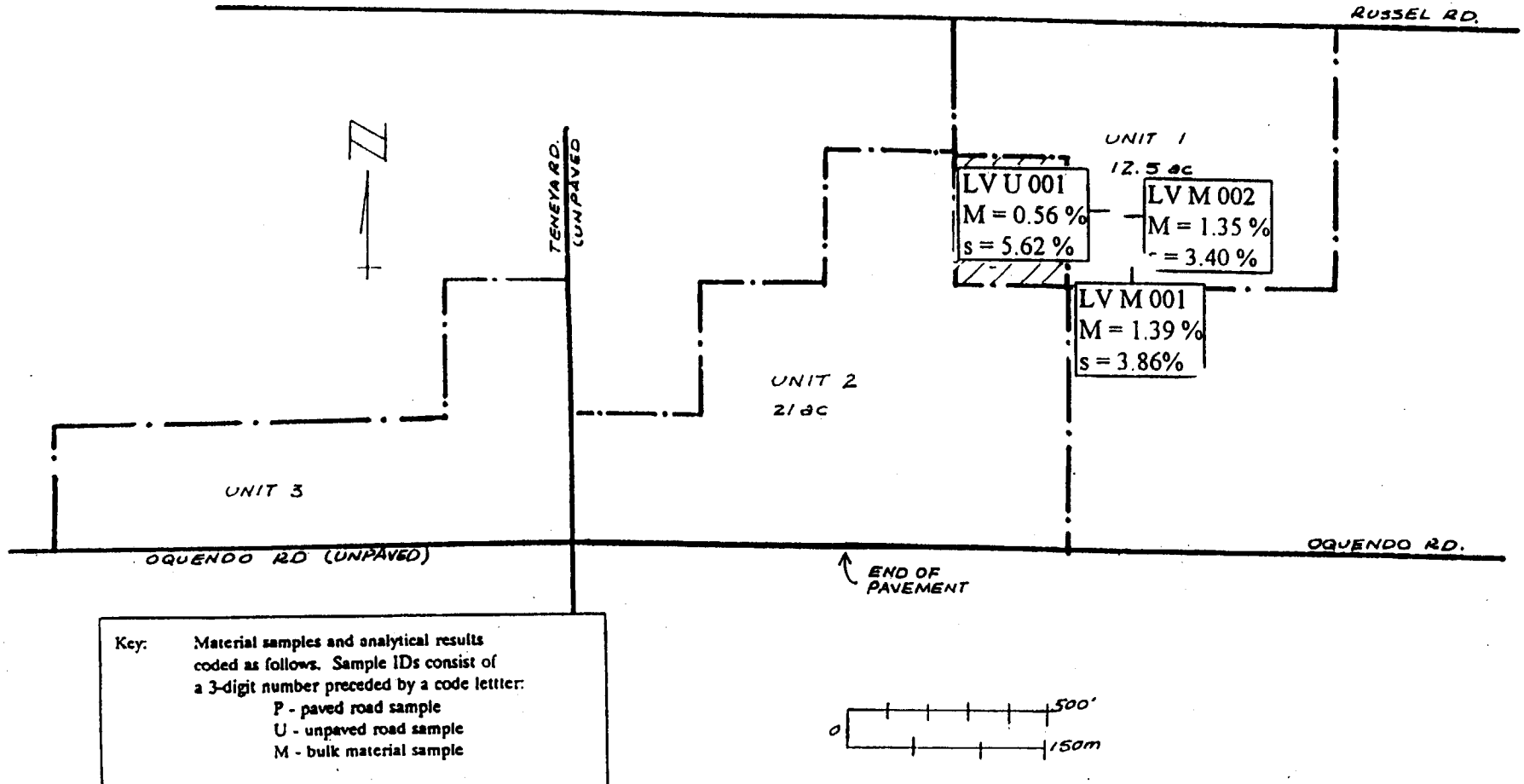
Site 1.2 was a residential construction site (Figure 2) in the southwestern part of metropolitan Las Vegas. The site was being developed near Russell and Rainbow Roads by Perma-Bilt Homes. Construction was planned for different phases, and Units 1, 2, and 3 were scheduled to be active during the summer of 1995. At the time of the April site surveys, it was expected that substantial earthmoving operations would occur during June with 80,000 cubic yards (cy) of material being moved from Unit 2 to Unit 3. Prior to arriving in June, however, MRI was informed that the long-haul movement was largely completed. During the return visit, MRI found mostly trenching activities in Unit 1 and fairly short-haul cut/fill operations in Unit 2.

The third site selected—Site 1.3—was another Perma-Bilt subdivision located near Maryland and Pebble roads in the southeastern portion of Las Vegas metropolitan area. In April, it was expected that grading activities would be completed before the return visit and that July activities would consist of trenching and general construction. During the return visit in July, however, no construction activity was present at this site because of equipment repairs.

Two residential sites were selected in the Coachella Valley. The first—Site 2.1—consisted of the Del Webb Sun City phased single- and multiple-family residential development (Figure 3) in Bermuda Dunes. In the northern tracts, houses were being "spot built" in areas with paved roads and utilities were already completed. The major construction activity anticipated during the April site surveys involved utility trenching and paving in Tract 27365, and blading of roads was scheduled to begin in mid-June.

Start-up of the Tract 17365 activities was delayed, however, until the second week of July. As a result, when MRI arrived at Site 2.1, the road base material had been delivered to Tract 27365. However, base material was delivered to an area farther to the north. This activity was observed and emissions estimated. Even though the activity occurred to the north, the estimated emissions were ascribed to the inventory for Tract 27365 to partially account for the importation of road base material that had occurred a few days earlier.

Site 2.2 in the Coachella Valley involved residential construction (Figure 4) in La Quinta. At this site near Miles Avenue and Dune Palms Road, Century Homes was building two "product lines" of homes. Construction was progressing from the corners toward the middle of the site.



Key: Material samples and analytical results coded as follows. Sample IDs consist of a 3-digit number preceded by a code lettter:

- P - paved road sample
- U - unpaved road sample
- M - bulk material sample

Analysis results are coded as follows:

- M - surface moisture content (%)
- s - silt content (%)
- sL - surface silt loading (g/m^2)

Figure 2. Site 1.2

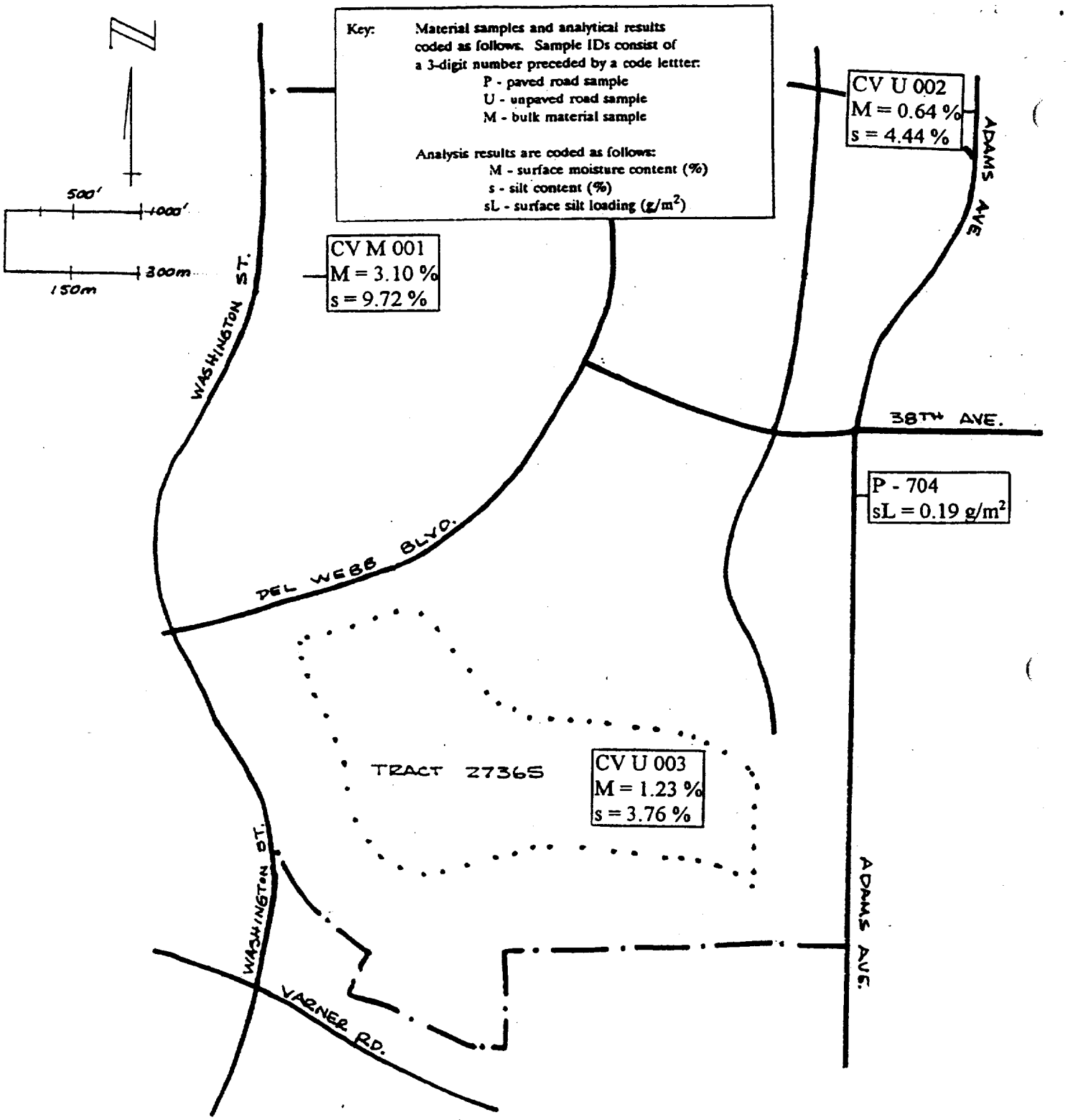


Figure 3. Site 2.1

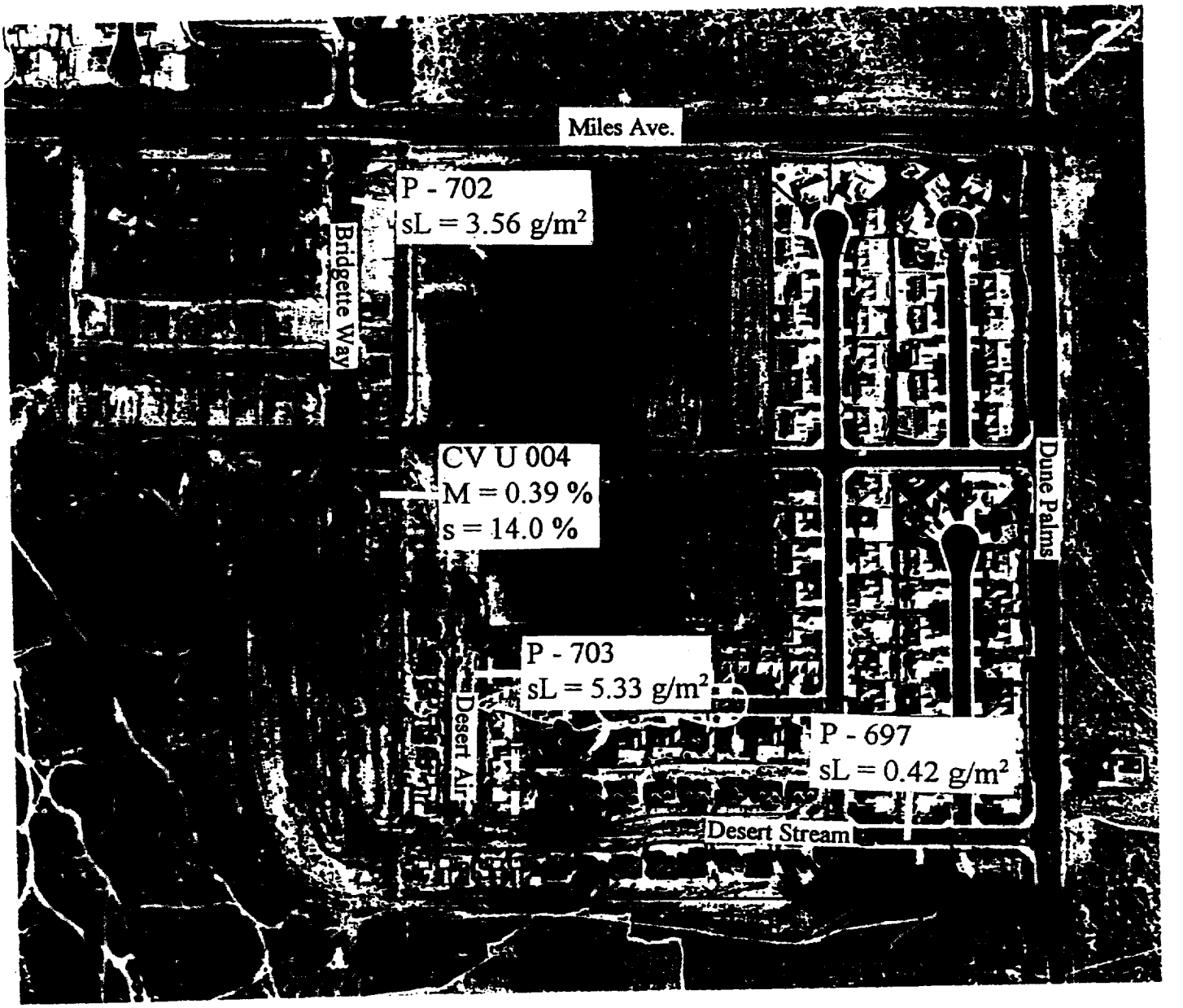


Figure 4. Site 2.2

Key: Material samples and analytical results coded as follows. Sample IDs consist of a 3-digit number preceded by a code lettter:

- P - paved road sample
- U - unpaved road sample
- M - bulk material sample

Analysis results are coded as follows:

- M - surface moisture content (%)
- s - silt content (%)
- sL - surface silt loading (g/m^2)

During the site survey, it was expected that trenching for utilities and flatwork/framing/finishing would occur during June and July, although some earthmoving (approximately 50,000 cy) might occur. During the return visit in July, only limited framing/finishing work was in progress.

Two large-scale earthmoving projects were selected based on the April survey visit to the South Coast area. Both projects were operated by SUKUT Construction. Site 3.1 concerned residential development in Newport Beach. This site involved cut/fill operations on a hillside to provide more ocean view lots. The project (Figure 5) involved the movement of 1,500,000 cy and was expected to run through June 1995. By the return visit in late June, most long routes had been completed although eight scrapers were still in daily cut/fill use. The other major activity observed was the construction of Loffel retaining walls along the eastern property line.

Site 3.2 (Figure 6) was another residential development ("Wishbone Hill"), located approximately 1 mile down the coast from Site 3.1. Earthmoving for this project also was expected to extend through June 1995. The site was unavailable for visiting during the April 1995 trip. At the time of the return visit in late June, eight scrapers were in daily use.

No sites were identified during the April visit to Bakersfield. During that visit, representatives of both the San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) and MRI met with Building Industry Association (BIA) personnel to discuss study objectives and desirable attributes of candidate sites. Attempts failed to locate suitable sites in the Bakersfield area. However, SJVUAPCD personnel identified two candidate sites in the Fresno area. Arrangements were made to visit these sites in late July and early August to conduct the demonstration studies.

Site 5.1 involved construction of Valley Children's Hospital in Madera County. Activities observed during the July 31 visit included scraper excavation for foundations and trenching for utilities. Because of difficulties in obtaining corporate approval, full access to the site was not possible and no demonstration studies could be conducted.

Site 5.2 (Figure 7) pertained to a commercial development (Market Place at River Park) in northern Fresno. Construction activities observed included scraper cut/fill, trenching for sewer/utility, and importation of fill material.

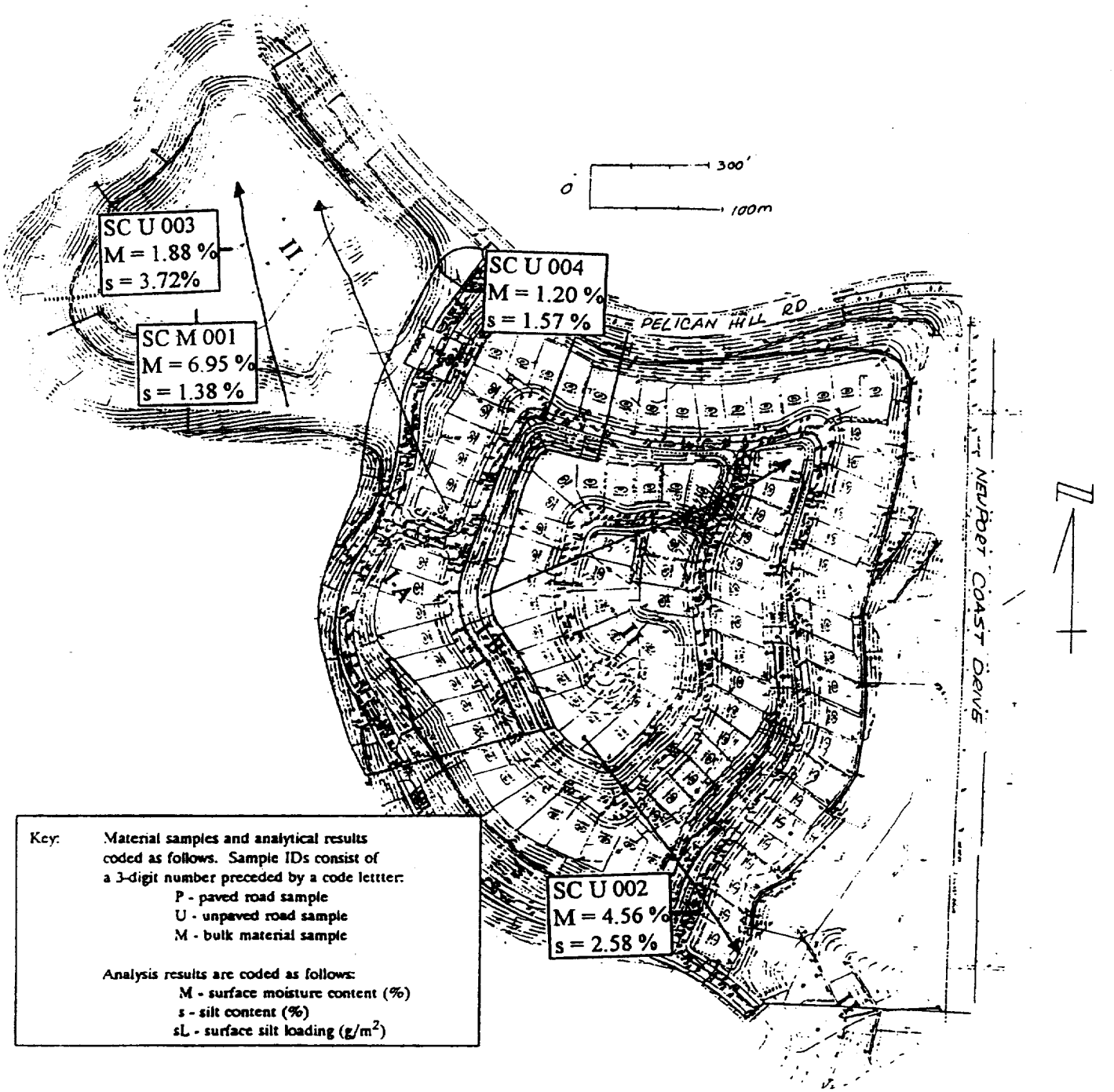


Figure 5. Site 3.1

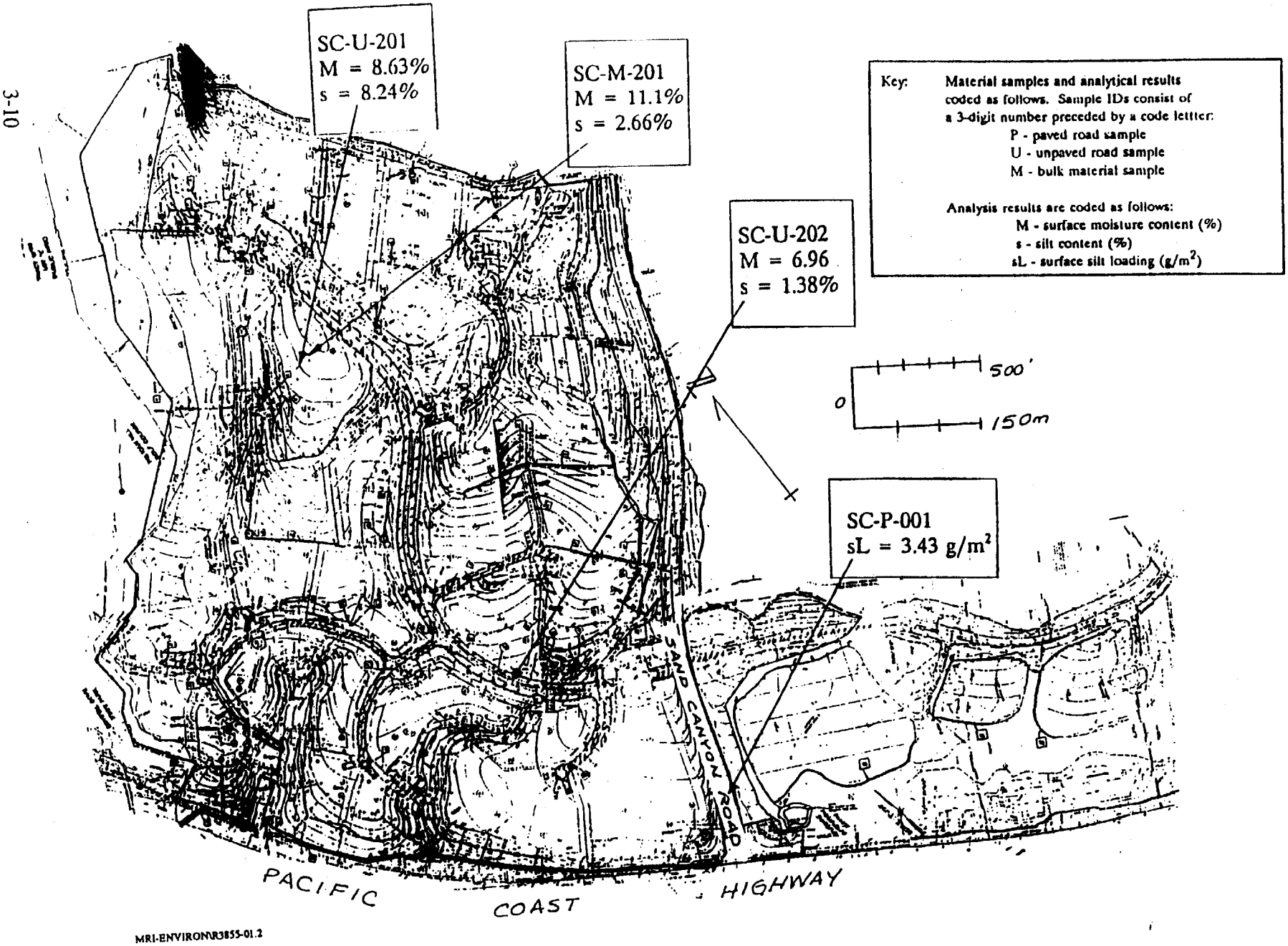
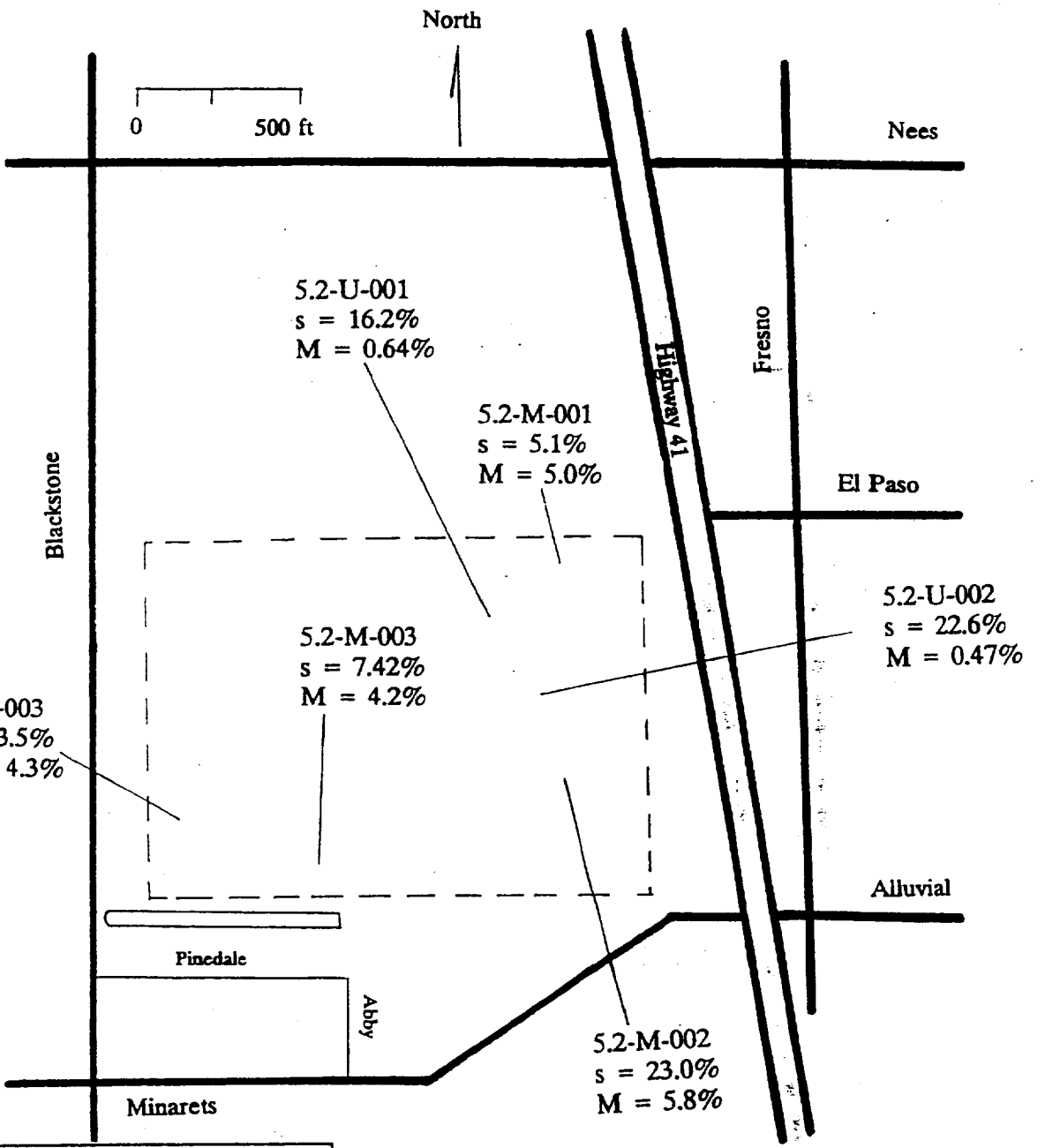


Figure 6. Site 3.2



Key: Material samples and analytical results coded as follows. Sample IDs consist of a 3-digit number preceded by a code lettter:

P - paved road sample
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Analysis results are coded as follows:

M - surface moisture content (%)
s - silt content (%)
sL - surface silt loading (g/m^2)

Figure 7. Site 5.2

MRI-ENVIRON\R3855-01.2

In summary, a total of seven construction sites were selected:

Site	Description\level of activity observed
1.1	Industrial park; moderate activity (trenching, prepaving, and small-scale earthmoving activities)
1.2	Residential construction; moderate activity (trenching) in Unit 1 and heavy activity (cut/fill) in Unit 2
2.1	Residential construction; moderate (trenching, prepaving) to heavy (trucking of road base) activity
2.2	Residential construction; low to moderate activity
3.1	Residential construction; heavy activity
3.2	Residential construction; heavy activity
5.2	Commercial development; moderate to heavy (trucking of fill material) activity

An eighth site (Site 1.3) was also visited; however, no major construction activity was in progress because trenching equipment was broken down. A copy of the field log is provided in Appendix A.

3.1.2 Demonstration Case Studies (Inventories)

At each site, a minimum of 2 days of observations were made. Separate observations were made in the morning and the afternoon, so there were a minimum of four observation periods for which inventories could be developed.

Both source activity and properties of the dust-emitting materials were needed to prepare the emission inventory. This required the collection of the following types of information:

- Traffic counts for primary haul routes on-site and access points to public roads
- Use counts for heavy equipment, such as bulldozers, graders, etc.
- Samples of:
  - Unpaved road surface material
  - Paved road surface material
  - Road base or other aggregate materials
  - Excavated materials (including that moved by scraper)

Material samples were analyzed for silt and moisture contents (as necessary) for use in the emission factors in Table 1.

As described in the test plan,[6] MRI used pneumatic traffic counters along the major travel routes and at main access point(s). To determine counter accuracy, 30-min visual observations of vehicle passes over each traffic counter were used. Observations were made both before and after the normal lunch break, and each observation period lasted at least 30 min.

For nonroad operations—such as scrapers, dozers, compactors, and excavators—and other operations that might damage a traffic counter hose, visual observations were used to determine cycle time and how many loads were completed. Note that, by selecting suitable vantage point(s), more than one set of visual observations could be recorded simultaneously.

Figures 1 through 7 also show the material samples collected at the sites. Sample collection followed the general procedures presented in Appendix C.1 in AP-42. Additional detail on sample collection and analysis are provided in the test plan.[6]

3.1.3 Focused Emission Measurements

Because few emission measurements had ever been collected specifically for construction sites, part of the field program was devoted to a second objective of collecting data to better define the applicability of "unit operation" emission factors to construction sites.

Preliminary planning called for testing to emphasize major on-site dust sources. The major sources could all be represented as line sources for the purpose of testing. Past studies indicated that the most important sources pertain to earthmoving (scrapers, graders, etc.) and truck haulage, with the handling of cut/fill and other materials representing a small fraction of total emissions.

Three sites—Sites 1.2, 2.1, and 3.1—were selected for the limited-scale emission testing. The sources tested were as follows:

Las Vegas Study Area

2 tests of scrapers traveling over an unwatered route at Site 1.2

South Coast Study Area

4 tests of scrapers traveling over an unwatered route at Site 3.1
2 tests of scrapers traveling over a watered route at Site 3.1

Coachella Valley Study Area

3 tests of captive light-duty vehicles traveling an unpaved route at Site 2.1

As discussed in the test plan,[6] the categories tested represent line sources and were evaluated using the exposure profiling method.

Emission testing employed the basic exposure profiling method. The technique uses a direct mass-balance calculation scheme similar to stack testing methods rather than relying on an uncalibrated dispersion model to indirectly back calculate an emission rate. Figure 8 shows equipment deployment for testing a line source such as traffic on an unpaved road or scraper movement. The sampling device was a high-volume ("hi-vol") air sampler fitted with a cyclone preseparator (Figure 9). The cyclone exhibits an effective 50% cutoff diameter of approximately 10 μmA when operated at a flow rate of 40 acfm (68 m^3/hr).[6] Samplers were fitted with volumetric flow controllers to maintain the desired flow rate and airborne particulate. Samples were collected on 8 in by 10 in glass fiber filters.

Additional detail on test methods, sample analysis, and data reduction are provided in the test plan.[6] In addition, the field logs in Appendix A describe the testing.

3.2 Paved Road Surface Silt Loading

The other major objective of the study was to provide a better paved road emission factor for use by BACM Working Group members. The AP-42 emission factor for paved roads depends on silt loading "sL," which represents mass of loose material less than 200 mesh present on the active road surface area. The magnitude of the silt loading, in turn, depends on numerous factors, including:

- The number, size, and speed of vehicles traveling the road
- Proximity to unpaved areas, such as parking lots, shoulders, and construction sites
- Degree to which the road is maintained
- Anthropogenic and naturally occurring consequences of weather (e.g., antiskid materials, and wind and water erosion)

The overall sampling scheme involved collection of eight sets of composite loading samples in each study area. The sets were broken down as follows. Roads in three zones were identified in conjunction with the study area liaison.

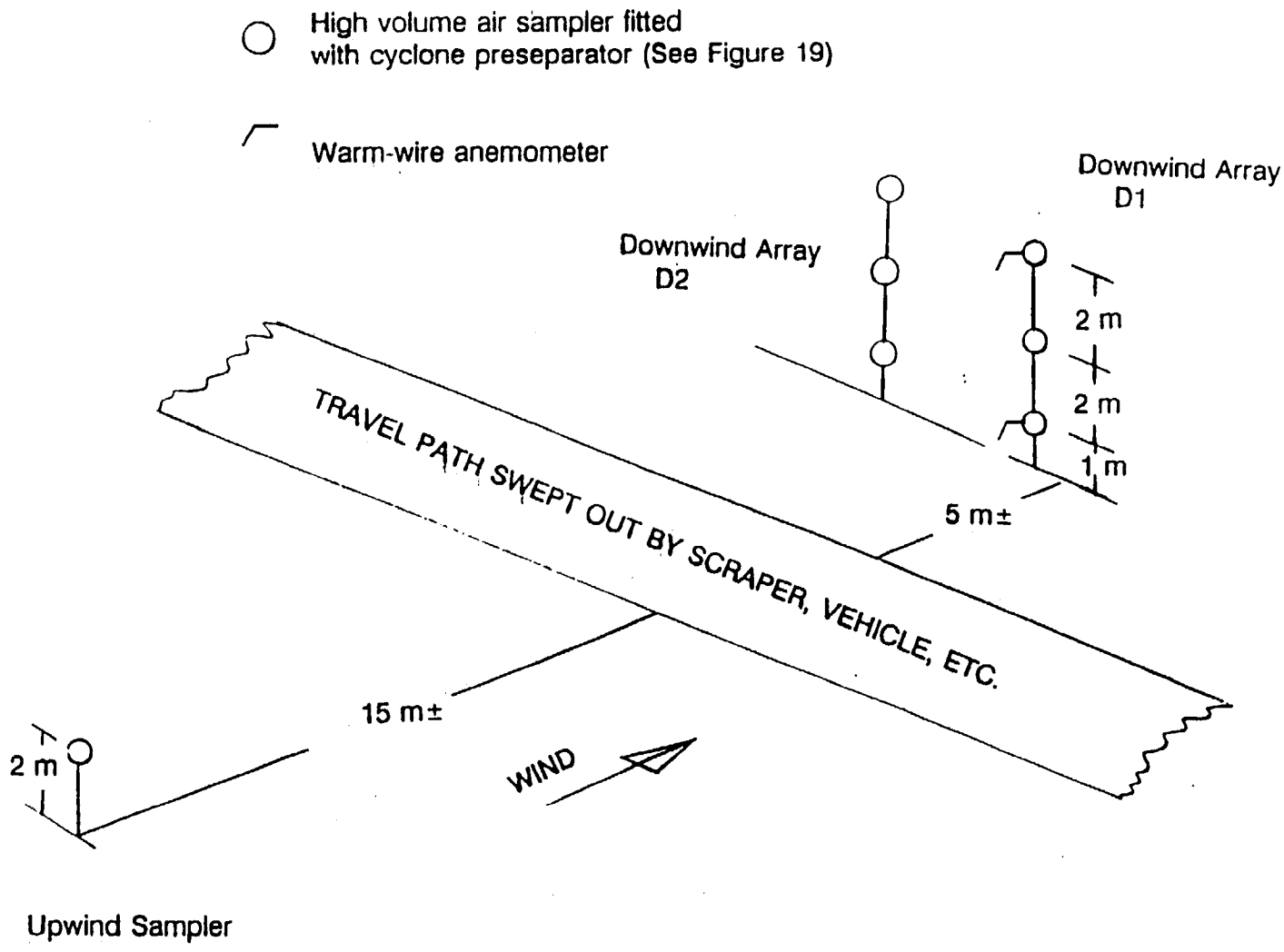

Figure 8. Equipment Deployment for Focused Emission Measurements

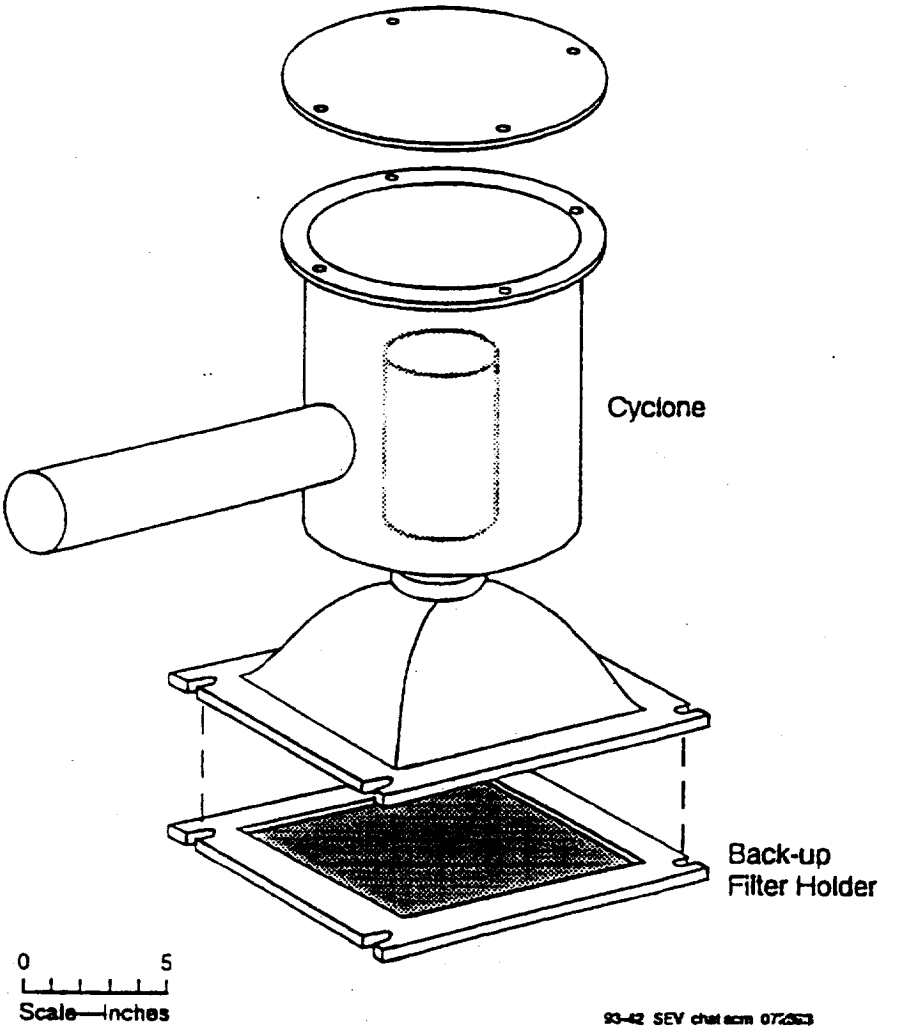

Figure 9. Cyclone Preseparator

Two zones were chosen to represent "nominal" conditions in the study area, while the third represented an area in which fairly extensive trackout from construction and other activities might be expected. The roads were classified as either high- or low-ADT.[c]

Recall that the objective of the sampling scheme was to provide a composite loading sample. In other words, a single silt-loading value would be determined for each zone/ADT combination from a series of sample increments taken of four to eight individual sites for each combination. Actual streets selected for sampling would provide reasonable geographic coverage, and actual sampling sites would be recorded on detailed street maps.

Sampling followed the procedures given in Appendix C.1 to AP-42.

During the April site visits, MRI collected two composite samples in each of the four study areas. The preliminary exercise allowed MRI to field-evaluate certain parameters, such as determining suitably sized areas for surface sampling and number of increments. Each preliminary composite sample consisted of four increments taken from a nominal (±5%) 200 ft^2 (18 m^2) area. Based on results from preliminary sampling, MRI modified its original plans so that roughly twice the total sample area (i.e., approximately 1,600 ft^2 [150 m^2]) was used.

The preliminary exercise also provided for a limited comparison of paved road surface-loading values at different times. The roads sampled in April in each area were resampled in June/July.

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[c] No strictly quantitative method was used to distinguish between "low" and "high" ADT roads. Rather, roads were selected on the basis of how they were depicted on either city street maps or on functional classification maps provided by the study area contact person. Note also that no effort was made to collect surface material samples from limited access or very high-ADT roads. The decision is based primarily on safety concerns for the field crew.

Section 4
Data Analysis

This section discusses how the field data were analyzed to recommend improved emission estimation methods for construction activities and paved roads.

4.1 Recommended Emission Factor for On-Site Construction Activities

As noted in Section 3, emission inventories were prepared for the construction activities observed at each site during the morning (before lunch break) and afternoon. Inventories made use of the emission factors given in Table 1 together with observations and other data collection activities. The inventories are presented in Appendix B, and the results for each site are summarized in Table 3. The table presents the range, mean, and standard deviation of the estimated hourly PM_{10} emission rate for on-site construction activities. In addition, the mean hourly rate is divided by the area of the construction site to develop an overall area-based PM_{10} emission factor of the same sort as the old former AP-42 emission factor that has been used in inventories since 1975.

Given the range in size and level of activity from one site to another, it is not surprising that the overall, area-based emission factors range over two orders of magnitude. The geometric mean of the emission factors is 0.11 ton/acre-month. Substitution of this value for the original AP-42 emission factor represents the simplest revision that can be recommended based on the present study.

It is important to recall certain features of the inventories and, by extension, of any revised emission factor based on the inventories. First, two potentially important dust sources have not been included—wind erosion and mud/dirt trackout.

Wind erosion of areas exposed at construction sites can result in substantial emissions of particulate matter. Wind erosion requires that two events occur: (a) the area first must be disturbed so that the mitigating effects of crusting and compaction are destroyed and then (b) wind gusts above a threshold wind speed must occur. For construction that is associated with a limited time period, there are fewer opportunities for both events to occur. Furthermore, intensive anthropogenic activity that disturbs larger surface areas is usually concentrated in a relatively short period of time at a construction site. Thus, wind erosion is typically less important for construction sites than it is for areas (landfills, storage yards and staging areas, off-highway recreation sites, etc.) that are exposed to the wind throughout the year.

Table 3. Summary of Uncontrolled PM_{10} Emission Rates Estimated for the Construction Sites

Site	Estimated uncontrolled PM_{10} emission rate (lb/hr)			Overall uncontrolled PM_{10} emission factor	
	Range	Mean ± S.D.	Site area (acre)	(lb/acre-work hr)	(ton/acre-month)[a]
1.1	82 - 150	116 ± 28	300	0.39	0.032
1.2	67 - 161	133 ± 44	14 (Unit 1) 21 (Unit 2)	3.8	0.32
2.1	18 - 146	82 ± 73	86	0.95	0.080
2.2	0.68 - 0.81	0.74 ± 0.065	16	0.046	0.0039
3.1	300 - 494	393 ± 80	82	4.8	0.40
3.2	560 - 793	712 ± 104	140	5.1	0.43
5.2	82 - 228	164 ± 74	40	4.1	0.34
				Geometric mean: 1.3 x/÷ 5.9	Geometric mean: 0.11 x/÷ 5.9

[a] Based on 168 work-hours per month.

To estimate emissions from wind erosion at a particular construction site, the procedure presented in References 7 and 8 should be followed. The procedure (which is essentially the same as that given in AP-42 Section 13.2.5) has been automated and is contained in the "WIND" model available from the EPA's OAQPS bulletin board (919-541-5472). Section 5.3 presents an example of how wind erosion can be estimated for a specific construction site.

In addition, this study did not quantitatively address track-out of material from the surveyed construction sites onto adjacent paved roads. This construction-related, but off-site, source can often represent very substantial emissions. MRI staff photographed the access points and neighboring roads at the sites and found a wide variety of track-out effects.[d]

Trackout affects emissions from another source category (paved roads) contained in large-scale emission inventories. Thus, inclusion of trackout in a construction emission factor introduces the possibility of "double counting" emissions. Should one desire to estimate the emissions due to trackout from a specific construction site, then the procedure given in earlier EPA guidance documents should be followed. This approach is illustrated in Section 5.3.

Because the original AP-42 emission factor was based on air quality monitoring over areas that were several square miles in extent, any localized wind erosion on trackout would have affected the monitors and hence the resulting factor. It is not clear how much wind erosion or mud/dirt trackout was included in the original factor.

Furthermore, the emission inventories referenced uncontrolled conditions, and any emission factor based on these results also will reflect uncontrolled conditions. Most of the sites visited had water trucks controlling travel routes and applying water to any cut/fill areas. Information on water truck usage is provided in the field logs in Appendix A. Note that no water truck usage was included in the inventories in Appendix B.[e]

The 0.11 ton/acre-month value discussed above represents a straightforward means of revising current inventories with the direct substitution of one emission factor for another. However, direct substitution retains the same problems associated with the generality of the original factor. For example, it is unclear how well the distribution of inventoried sites matches the characteristics of construction sites in general: Do the inventoried sites contain a disproportionally large amount of earthmoving (scraper)

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[d] For example, trenching along the northern boundary of Site 1.2 required the temporary blocking of one travel lane of a public road. This forced westbound traffic to travel several hundred feet over an unpaved shoulder. Both sites in Newport Beach area, on the other hand, showed very little sign of track-out onto the public streets.

[e] Note that some of the focused emission measurements addressed the control effectiveness of watering travel routes. This is discussed in Section 4.2.

emissions? To at least partially account for the higher emission rates found for sites with active large-scale earthmoving operations, the overall area-based emission factor for Sites 1.2 (Unit 2), 3.1, 3.2, and 5.2 can be considered separately. As shown in a footnote to Table 4, this yields a worst-case overall factor of 5.0 lb/acre-work hr (or 0.42 ton/acre-month).

To account for differences in activity levels in another way, a second level of aggregation was undertaken to develop an improved emission factor. This approach recognizes that operations related to scrapers and truck movement of cut/fill and other materials typically accounted for far more than half of emissions estimated for a site. In the second level of aggregation, emissions related to (1) scraper pickup, movement, and unloading, and (2) truck dumping and haulage of fill or road base material were removed from the site totals. Remaining emissions were averaged and normalized by the site's area. The remaining emission estimates were deemed "general construction" and are shown in Table 4 together with the original overall factor.

The truck and scraper emissions were themselves normalized by dividing the hourly emission rate (lb/hr) by the product of (a) tons handled per hour and (b) the round trip **on-site** distance. For example, if a scraper transported cut material 500 ft to a fill area, then the round trip on-site distance would be 1,000 ft. On the other hand, if a belly dump truck entered a site at one access point, traveled 300 ft to a fill area and thereafter traveled 500 ft to another exit point, then the on-site round trip distance would be 800 ft.

The "general" area-based emission factors in Table 4 exhibit far less variability than do the overall factors presented earlier, presumably because they isolate the effect of important source contributions. Furthermore, even though the calculated scraper and truck haulage emission factors range over an order of magnitude, the ranges are far "tighter" than that given for the overall, area-based emission factor presented above.

The area-based emission factor of 0.11 ton/acre-month (0.42 ton/acre-month under worst-case conditions) described above represents a "Level 1" emission estimate. To develop an emission estimate more refined than Level 1, the following approach was undertaken. First, the general construction factors in Table 4 for Sites 1.1. 1.2, 2.1 and 5.2 were geometrically averaged to obtain 0.14 lb/acre-work hr (0.011 ton/acre-month). This value was considered to represent emissions due to construction activities exclusive of earthmoving and other large-scale movement of material. (Note that Sites 3.1 and 3.2 were excluded in the averaging because these were exclusively earthmoving projects, and Site 2.2 was excluded because of the low activity level during the field visit.)

Table 4. Second Aggregation of Estimated Emissions

Site	Area-based emission factor (lb/acre-work hr)		Material haulage factor (lb/ton-mile)[a]	
	General construction[b]	Overall	Range	Geo. mean
1.1	0.11	0.39	0.12 - 1.2 0.75 - 0.78	0.25 0.75
1.2	0.19[c]	6.2[d,e]	0.11 - 0.27	0.22
2.1	0.072	0.95	0.13 - 0.13 0.23 - 0.23	0.13 0.23
2.2	0.046	0.046	–	–
3.1	0.051	4.8[e]	0.13 - 0.32	0.19
3.2	0.017	5.1[e]	0.22 - 0.26	0.25
5.2	0.24	4.1[e]	0.18 - 0.46 0.13 - 0.13	0.28 1.3
	Geometric mean[f] 0.14 lb/acre-work hr		Range over all sites 0.11 - 1.2 0.23 - 1.3	Geometric mean 0.21 x/+ 1.32 0.62 x/+ 2.42

[a] Source extent is product of (a) mass of material transported times, (b) round trip on-site travel distance. See discussion in text. Table lists scraper emission factors unless two entries are given. In that case, the first factor represents scrapers, and the second represents over-the-road trucks (such as belly dumps) that can travel public streets.

[b] Excluding on- and off-site material haulage and handling.

[c] Unit 1.

[d] Unit 2.

[e] Value included in obtaining geometric mean factor of 5.0 lb/acre-work hr (0.42 (ton/acre-month) for sites with active large-scale earthmoving.

[f] Average of Sites 1.1, 1.2, 2.1, and 5.2.

A more refined emission estimate would make use of the base emission factor of 0.011 ton/acre-month and would add an estimate for emissions from earthmoving or other large-scale movement of materials. To account for emissions from such operations, MRI first developed mean hourly emission factors for scrapers and over-the-road trucks hauling construction materials (e.g., fill, road base, etc.). Tables 5 and 6 show how these factors were developed. The inventoried hourly emission rates attributable to scrapers in Appendix B were divided by the number of working scrapers. These values were averaged over all periods at a site when scrapers were observed to be operating. To account for differences in the size of scraper, Table 5 breaks down factors by the nominal capacity.

As in Table 5, the hourly emission rates in Appendix B attributable to truck movement were averaged over all periods at a site when truck movement was observed. However, unlike the "per-scraper" factors in Table 5, the emission factors for truck haulage in Table 6 are based on the total truck fleet hauling material to/from the site. This approach (rather than a "per-vehicle" basis) was adopted because the number of trucks used varies with the distance of construction site from the source/disposal site for the material. For example, if the material to be transported is nearby, two or three trucks might be enough to maintain efficiency in loading/unloading cycle. On the other hand, if the source is several miles away, then additional trucks would be necessary to maintain efficiency because more time is spent in travel.

As mentioned above, the more refined emission estimates use the base factor (0.011 ton/acre-month) and add estimates for emissions from material movement. Perhaps the most straightforward use would involve examining construction plans for the amount of material to be transported and how far material is to be moved on-site. In this case, the material haulage factors in Tables 4, 5 and 6 could be used. *However, this type of approach would require extensive information which cannot reasonably be assumed to be available to air regulatory personnel interested in areawide emission inventories.*

On the other hand, it is reasonable to assume that regulators may have access to the amount of cut/fill at a construction project. For example, the amount of cut and fill is requested in the application for a Clark County Air Pollution Control Division dust control permit. Furthermore, by comparing the applicant's response for amount of cut with the response for amount of fill, one can determine whether all earthmoving occurs on site or if material is to be transported to/from the site. In developing a "Level 2" estimate, it was assumed that agency personnel have access to this type of information.

In Level 2, emission estimates for earthmoving are based on knowledge of the amount of cut/fill. For on-site movement, it is assumed that one 30-cy scraper can move 70,000 cy of earth monthly. The basis of this and other assumptions is given in Appendix C. Using the average scraper emission factor of 49 lb/hr from Table 5, then a total of 4.1 ton/month is estimated for a 168-hr month. When this is divided by the 70,000 cy/month of moved, an emission factor of 0.059 ton/(1,000 cy) is obtained for on-site movement.

Table 5. Mean Emission Rates for Scrapers

Site	Mean PM_{10} scraper emission rate (lb/scraper-hr) by nominal scraper capacity[a]			
	10 cu yd	20 cu yd	30 cu yd	45 cu yd
1.1		31.1		
1.2			51.3	
2.1	10.9			
2.2				
3.1			47.6	62.2
3.2				114
5.2	32.0	64.6		
Geometric Mean	19	45	49	84

[a] Capacities correspond to Caterpillar Models 613, 623, 631/637, and 657. In the absence of other information, assume that:
a. scrapers are of 30 cu yd capacity.
b. four (4) scrapers are in use.

Table 6. Mean Emission Rates for On-Road Trucks

Site	Mean truck PM_{10} emission factor (lb/work hr)
1.1	34.5
1.2	
2.1	130
2.2	
3.1	
3.2	
5.2	186
Geo. Mean	94 lb/work hr = 7.9 ton/month

Appendix C also describes the basis for the assumption that 35,000 cy can be transported to/from by truck per month. Based on the average truck factor of 7.9 ton/month in Table 6, an off-site factor of 0.22 ton/(1,000 cy) results.

Table 7 summarizes the recommended emission estimating procedure. *Level 1 corresponds to only information that is available in any current inventory based on the original AP-42 emission factor.* Level 2 is based on information that could be obtained through review of building or dust control permits. Development of the necessary information is discussed in Section 4.4.

Table 7 also presents Level 3 and Level 4. These correspond to the straightforward use of the emission factors in Tables 4 through 6. As mentioned earlier, Levels 3 and 4 require information on how and what types of equipment are used at the site. Level 4, in particular, requires detailed knowledge and probably represents a methodology that can only be used to generate site-specific rather than areawide emission estimates. *Although not intended for use in large-scale emission inventories,* these two levels may be useful estimation tools when specific construction sites are of interest.

4.2 Focused Emission Measurements

As discussed earlier, very limited data exist against which the performance of Table 1 emission factors can be assessed. The field program described in Section 3 developed independent data that can be used for this purpose. Testing parameters are given in Table 8. Table 9 presents the results of the limited-scale emission measurements, and Table 10 compares predicted and measured emission factors for the two source categories considered.

Measured uncontrolled scraper travel emission ranged over roughly one order of magnitude. The emission factor equation developed from tests at surface coal mines underpredicted emissions in Las Vegas but overpredicted emission levels in Newport Beach. On average, the equation overpredicted by approximately 30%.

Tests BA-8 and -9 suggest that watering can afford control efficiencies of 60% to 90% at construction sites.

The AP-42 unpaved road equation underpredicted emission factors measured in the focused emission tests. Underprediction is at least partially due to the unimproved (i.e., no base material or compaction) nature of the travel surface at Site 2.1. Previous tests also have shown that the unpaved road underestimates emissions from unimproved surfaces. In addition, the route did not appear to have been recently traveled. This is presumed to be the reason that the emission factor grew from one test period to another.

Table 7. Recommended Emission Estimation

Basis for emission factor	Recommended PM_{10} construction emission factor
Level 1—Only area and duration known	Apply 0.11 ton/acre-month (average conditions) 0.42 ton/acre-month (worst-case conditions)
Level 2—Area and amount of earthmoving known	Apply 0.011 ton/acre-month for each month of construction activity **Plus** 0.059 ton/1,000 $yard^3$ of on-site cut/fill 0.22 ton/1,000 $yard^3$ of off-site cut/fill These values are based on an assumption that one scraper can move 70,000 $yard^3$ of earth in one month and 35,000 $yard^3$ of material can be moved by truck in one month. If the on-/off-site fraction is not known, assume 100% on-site.
Level 3—More detailed information available on duration of earthmoving and other material movement.	Apply 0.13 lb/acre-work hr **plus** 49 lb/scraper-hr for on-site haulage[a] 94 lb/hr for off-site haulage[b]
Level 4—Detailed information on number of units and travel distances available	Apply 0.13 lb/acre-work hr **plus** 0.21 lb/ton-mile for on-site haulage 0.62 lb/ton-mile for off-site haulage[b]

[a] If the number of scrapers in use is not known, a default value of 4 may be used. In addition, if the actual capacity of earthmoving units is known,. use values given in Table 5.

[b] Factor for use with over-the-road trucks. If "off-highway" trucks are used haulage should be considered "on-site."

Table 8. Test Site Parameters for the Focused Emission Measurements

Run	Date	Site	Description	Start time	Stop time	No. of vehicle passes	Avg. temp. (°F)	Avg. B.P. (inHg)
BA-1	6/21/95	1.2	Scraper—uncontrolled	14:01	14:44	19	91	27.50
BA-2	6/21/95	1.2	Scraper—uncontrolled	14:53	15:15	12	91	27.50
BA-3	6/26/95	3.1	Scraper—uncontrolled	14:45	15:25	17	74	27.20
BA-4	6/26/95	3.1	Scraper—uncontrolled	14:45	15:25	17	74	27.20
BA-5	6/26/95	3.1	Scraper—uncontrolled	15:42	16:38	14	74	27.10
BA-6	6/26/95	3.1	Scraper—uncontrolled	15:42	16:38	16	74	27.10
BA-8	6/30/95	3.1	Scraper—controlled	11:16	11:29	42	70	26.30
BA-9	6/30/95	3.1	Scraper—controlled	13:15	13:31	74	70	26.30
BA-10	7/13/95	2.1	Light duty—uncontrolled	13:43	14:12	32	105	29.86
BA-11	7/13/95	2.1	Light-duty—uncontrolled	14:51	15:26	29	105	29.86
BA-12	7/13/95	2.1	Light duty—uncontrolled	15:53	16:21	31	105	29.85

Table 9. Measured PM_{10} Emission Factors

			Scrapers				All traffic			
Run	Silt (%)	Moisture (%)	Average speed (mph)	Average weight (ton)	Average wheels	Measured PM_{10} emission factor (lb/VMT)	Average speed (mph)	Average weight (ton)	Average wheels	Measured PM_{10} emission factor (lb/VMT)
BA-1	7.69	1.16	9.5	57.4	4.0	6.76	8.8	54.8	4.2	6.05
BA-2	7.69	1.16	9.5	58.5	4.0	11.1	9.5	58.5	4.0	11.1
BA-3	6.04	7.41	14	86.5	4.0	1.32	14	86.5	4.0	1.32
BA-4	6.04	7.41	14	86.5	4.0	0.578	14	86.5	4.0	0.578
BA-5	6.04	7.41	14	87.7	4.0	1.34	14	77.0	4.0	1.17
BA-6	6.04	7.41	14	87.7	4.0	0.635	14	77.0	4.0	0.553
BA-8	4.11	4.14	16	94.0	4.0	0.369	16	86.7	4.1	0.335
BA-9	3.35	5.69	16	87.1	4.0	0.101	16	79.6	4.1	0.0904
BA-10	15.54	0.27					25	2.8	4.3	3.33
BA-11	15.54	0.27					25	2.0	4.0	9.10
BA-12	15.54	0.27					25	2.0	4.1	12.5

Table 10. Comparison of Table 1 Emission Factors and Measurements

Source category	No. of tests	Mean predicted to measured ratio	
		Range	Mean
Scraper in travel mode			
Site 1.2	2	0.15 - 0.24	0.19
Site 3.1	4	2.42 - 5.52	3.61
Overall		0.15 - 5.52	1.35
Unpaved surface	3	0.14 - 0.68	0.26

Overall, the results from comparing limited field emission measurements to estimated values proved inconclusive, with no clear-cut tendency for over- or underprediction. As such, no changes were made to the emission factors presented in Table 1 for use in developing the construction site inventories.

4.3 Paved Road Emission Factors

Table 11 summarizes the spatially averaged silt and total loading values collected from the four study areas. As expected, all low ADT roads exhibited far higher sL values than did the high ADT roads in the same zone. In general, the low ADT roads had sL values 3 to 10 times higher.

As noted in Section 2, there are good reasons to suspect that the AP-42 sL database is skewed high. The results obtained here support those suspicions. Figures 10 and 11 compare the silt loadings obtained for high-ADT and low-ADT roads against the corresponding values in AP-42. As can be seen from the figures, median sL values measured in this study are roughly 5 to 10 times lower than in AP-42. In fact, some of the high-ADT roads were associated with sL values slightly lower than the AP-42 default value for limited access roads (i.e., 0.02 g/m^2).

Repeat sampling between the April and June/July visits led to the following summary statistics:

Study area	Road class	Range percent[a]
Las Vegas	Low ADT	14%
	High ADT	45%
South Coast	Low ADT	110%
	High ADT	4.5%
Bakersfield	Low ADT	93%
	High ADT	113%
Coachella Valley	Low ADT	132%[b]
	High ADT	31%

[a] Defined as (high - low)/(average) × 100%.
[b] Significant construction track-out observed during April sample.

Table 11. Paved Road Surface Sampling Results

Sampling location	Medium and heavy duty vehicle passes (% of total)[a]	Total loading (g/m^2)[b]	Silt loading (g/m^2)[b]
Las Vegas			
Repeat Low ADT—Spring Mountain, Pioneer, Desert Inn, Odette		1.68/1.46	0.084/0.097
Repeat High ADT—Rainbow, Jones, Tropicana, Charleston	9.9	1.88/0.90	0.052/0.033
Residential Low ADT—Edison, Phoenix, Surrey, Boca Grande		14.2	1.27
Residential High ADT—Russell, Sandhill, Pecos, Desert Inn	3.3	1.20	0.029
Industrial Low ADT—Harmon, Ali Baba, Saddletree, Red Oak		4.74	0.28
Industrial High ADT—Western, S. Highland, Industrial, Valley View	10.8	7.19	0.20
South Coast			
Repeat Low ADT—Maple, Simmons, Willowwood, Struck		1.49/0.90	0.184/0.054
Repeat High ADT—Crown Canyon, Golden Lantern, Moulton, Alicia	2.2	0.091/0.13	0.012/0.015
Orange County (C-5) Low ADT—Stewart, Walnut, Varsity, Palm		1.90	0.17
Orange County High ADT—Glassel, Katella, Main, Garden Grove	2.3	0.21	0.011
San Fernando Low ADT—Noble, Orion, Tupper, Gledhill		2.24	0.14
San Fernando High ADT—Nordhoff, Plummer, Woodman, Devonshire	1.0	0.69	0.046
Bakersfield			
Repeat Low ADT—Calloway, Seabeck, Pacheco, Winter Ridge		1.03/0.99	0.52/0.19
Repeat High ADT—H, Planz, Stine, Ashe	1.5	0.65/0.56	0.054/0.015
Northeast Residential Low ADT—St. Marys, Rampart, Wendy, Oakridge		16.5	0.94
Northeast Residential High ADT—Columbus, Fairfax, Panorama, Mt. Vernon	1.3	0.43	0.051
Industrial Low ADT—Inyo, Kentucky, Lincoln, Chico		8.94	0.41
Industrial High ADT—Truxton, Baker, Bernard, Monterey	0.5	0.38	0.039
Coachella Valley			
Repeat Low ADT—Miles, Dune Palms, Westward Ho, Desert Stream		22.4[c]/4.27	2.04[c]/0.42
Repeat High ADT—Dinah Shore, Ramon, Gene Autry, Sunrise	3.0	0.55/1.73	0.027/0.037
City of Coachella Low ADT—Frederick, Westerfield, Tripoli, Cypress		6.28	0.35
City of Coachella High ADT—Harrison, 52nd, Grapefruit, 50th	3.1	1.49	0.082
Palm Desert Low ADT—Desert Lily, Rutledge, Merle, Deep Canyon		3.07	0.20
Palm Desert High ADT—Fred Waring, Monterey, Country Club, El Paseo	4.4	0.87	0.030

[a] During the high ADT sampling periods in June/July, MRI began a count of 100 vehicles once a medium- or heavy-duty vehicle was observed. This method provides an average vehicle weight that is slightly high.
[b] If two values are given, the first is the result from the April visit and the second, the value from the June/July visits.
[c] These roads exhibited noticeable trackout from a construction area.

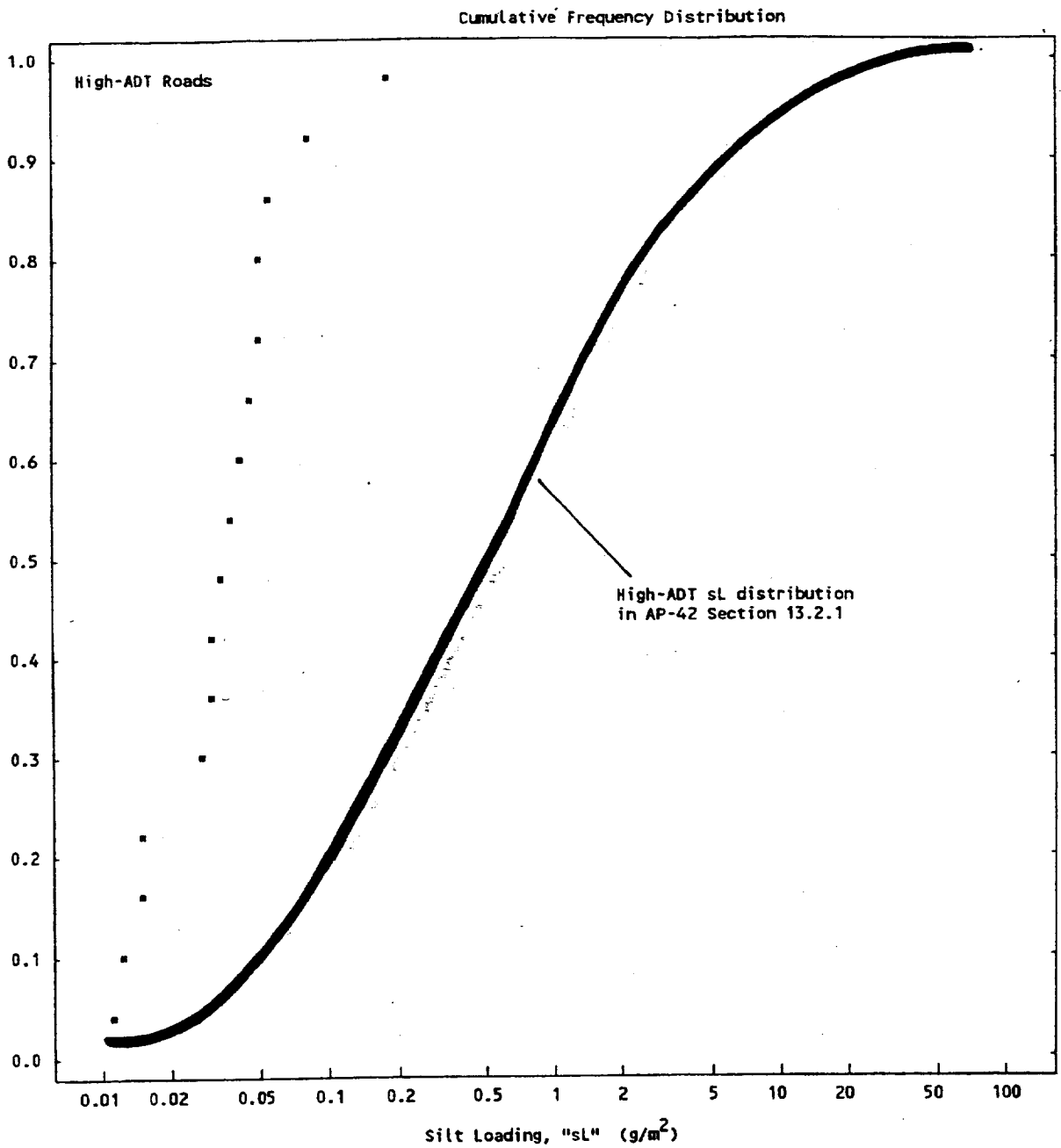

Figure 10. Comparison of Silt-Loading Values Obtained in This Study with AP-42 Database for High-ADT Roads

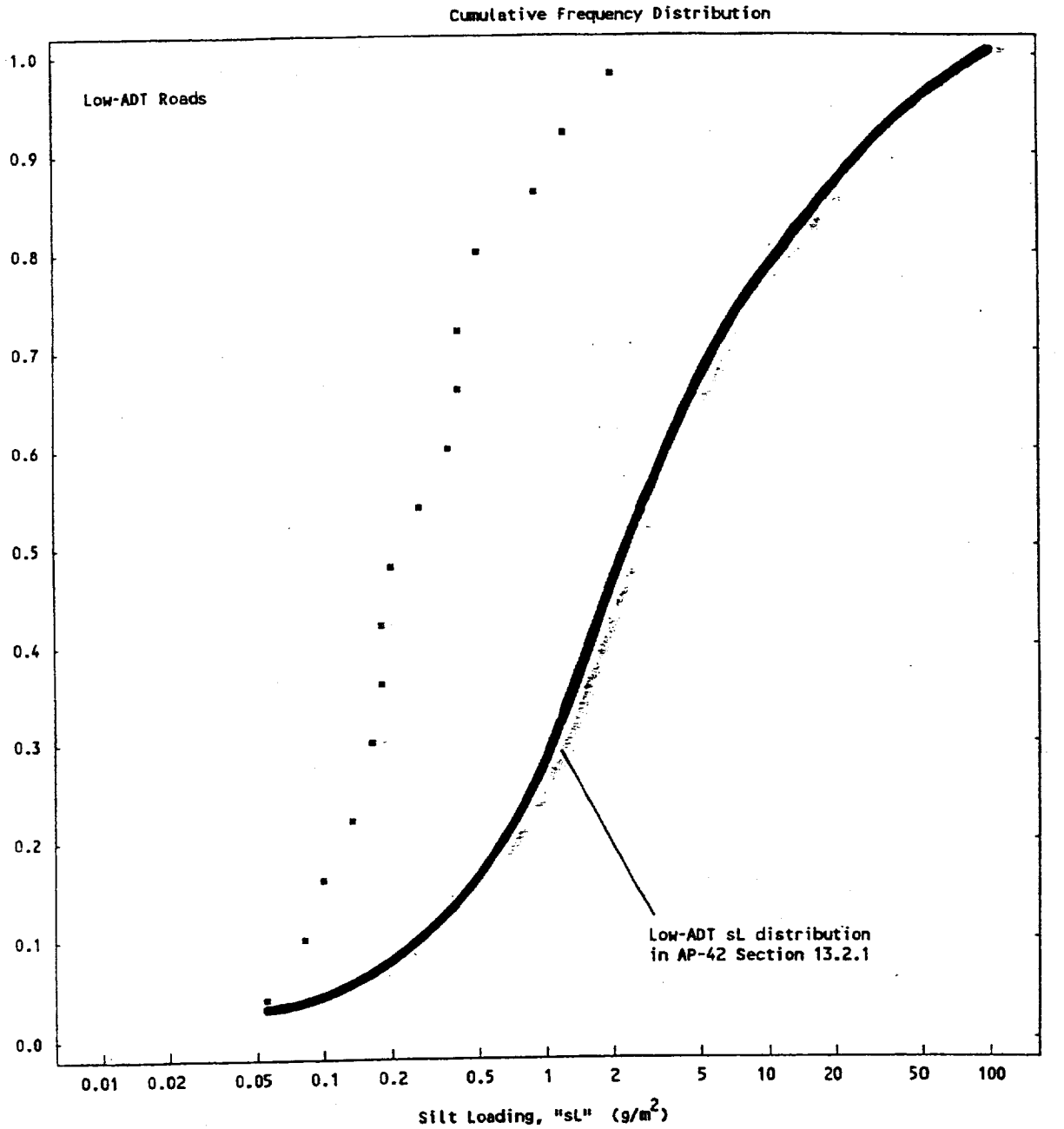

Figure 11. Comparison of Silt-Loading Values Obtained in This Study with AP-42 Database for Low-ADT Roads

The repeat sampling results suggest that sL values may vary substantially over time. However, because sL is raised to a power less than one in the AP-42 paved road equation, the resulting variation in the estimated emission factor is less pronounced. No seasonal trend was found in the samples. In comparing the eight repeat samples, five June/July sL were greater and three were lower than the corresponding April values.

Table 11 also presents non-light-duty fraction of vehicles observed during the road sampling program. The overall mean ratio is 2.5%, and the corresponding mean vehicle weight is conservatively estimated as 2.4 tons. Table 12 summarizes the paved road emission factors recommended for general use.

Table 12. Recommended Paved Road PM_{10} Emission Factors

	Emission factor (g/VMT)		
	High-ADT	Low-ADT	Average[a]
Average conditions[b]	0.37	1.3	0.81
Worst-case conditions[c]	0.64	3.9	2.1

[a] Based on 65% of high- and 35% of low-ADT sL value.
[b] Based on median value and 2.4 tons.
[c] Based on 90th percentile and 2.4 tons.

In addition, member agencies may choose to employ the individual sL and mean vehicle data in the same manner that AP-42 encourages readers to use the silt-loading values presented in AP-42. That is, AP-42 recognizes that end users of that document are the most capable of identifying which roads in the database are similar to roads of interest to them.

4.4 Collection of Information Needed for Construction Emission Factors

As noted in Section 4.1, progressively more detailed information is needed to employ the different levels of emission factors recommended in Table 7. Working Group member agencies are not expected to have the information readily available; however, collection of the information appears to be a relatively straightforward process. The following describes a questionnaire to collect the information and discusses how the data may be reduced.

For several years, the Clark County (Nevada) Department of Health has issued a permit to disturb topsoil. The application for that permit asks for the amount of cut and fill material at a particular site. Figures 12 and 13 show an example questionnaire (based on the Clark County application form) that requests the types of information needed to employ Levels 2 through 4 in Table 7. It is recommended that a member agency submit this questionnaire to major earthmoving contractors doing work within the agency's jurisdiction. A cover letter should ask that contractors complete the questionnaire (for example) for projects over 10 acres performed during the past 2 years. Alternately, an agency may ask a contractor to keep records for each successful bid in the coming year and submit the information to the agency at the end of that time.

Once the agency has assembled the responses, the data may be aggregated and analyzed in several ways. For example, an agency may choose to construct an estimate of the amount of cut/fill and other materials on the basis of a site's area and duration of the project. Summary statistics could be used to determine study area-specific default values (e.g., number of scrapers in use, vehicle capacity).

Name of Construction Project _____

Project Address _____

Project Acreage _____
(acres)

Amount of material used in Cut process _____ Amount of material used in Fill process _____
(banked cu yd) (compacted cu yd)

Please specify off-road equipment used in Cut/Fill process:

Equipment	No. of Units	Make/ Model No.	Capacity (cu yd)	Estimated haul distance (ft)[a]	No. of Months to be used at site
Scraper					
Off-highway truck					
Loading tool - Wheel Loader - Excavator					
Compactor					
Grader					

[a] Complete for scrapers and trucks only.

(over)

Figure 12. Front Page of Questionnaire

Please specify over-the-road equipment used in Cut/Fill process:

Equipment	No. of Units	Capacity (cu yd)	No. of Months to be used at site	Estimated total travel distance on-site (ft)
Belly dump trucks				
Rear dump trucks				
Other (specify)				

Please specify the amount of other major materials that will be trucked in (e.g., road base, concrete, etc.).

_____

_____

_____

Please specify the over-the-road vehicles that will be used to truck these materials to the site.

Equipment	Total Amount of Material	Capacity (cu yd)	No. of Months to be used at site	Estimated total travel distance on-site (ft)
Belly dump trucks				
Rear dump trucks				
Other (specify)[b]				

[b] NOTE: If any off-road vehicles will be used to move materials on-site, please include here.

Figure 13. Back Page of Questionnaire

Section 5
Example Use of the Factors Recommended for Construction

This section presents examples showing how to use the emission factors recommended for construction sites. The examples follow the same order as do the levels in Table 7 and illustrate how additional information is needed as one progresses from one level to the next. The additional information needed to employ the different levels is *underlined* at the time it is needed.

5.1 Site 3.1

The first example is based on Site 3.1 and concerns a 82 acre site with 1,500,000 cubic yards (cy) of on-site cut/fill activity over a 3-month period. The *Level 1 estimate makes use only of the site's area and the project duration*:

- 82 acres in size
- 3 month duration

Estimated PM_{10} Emissions = 0.11 ton/acre-month x 82 acre x 3 month
= 9.0 ton/month x 3 month
= 27 ton

A improved Level 1 ("Level 1a") estimate is possible because we *know that the site involves active earthmoving* and thus the worst-case value of 0.42 ton/acre-month can be used.

Estimated PM_{10} Emissions = 0.42 ton/acre-month x 82 acre x 3 month
= 34 ton/month x 3 month
= 100 ton

The Level 2 estimate requires additional information—namely, *the amount of cut/fill*:

- 82 acres in size
- 3 month duration
- Active earthmoving underway
- 1,500,000 cy of earth to be moved (all on-site)

Thus, emissions are estimated in Level 2 as

Estimated PM_{10} Emissions = 0.011 ton/acre-month x 82 acre x 3 month + (0.059 ton/1,000 cy) x 1,500 (1,000 cy)
= 0.90 ton/month x 3 month + 88 ton
= 91 ton

In Level 3, even more information is necessary. In this case, we know that *8 scrapers are used*, but we do not know how large the scrapers are:

- 82 acres in size
- 3 month duration
- Active earthmoving underway
- 1,500,000 cy of earth to be moved (all on-site)
- Eight scrapers in use, but size unknown (i.e., use default emission factor)

Thus, the Level 3 estimate (using the default scraper factor of 49 lb/scraper-hr) is given as

Estimated PM_{10} Emissions = 0.011 ton/acre-month x 82 acre x 3 month + (49 lb/scraper-hr) x 8 scraper x 3 month
= 0.90 ton/month x 3 month + 390 lb/hr x 168 hr/month x 3 month
= 2.7 ton + 98 ton
= 100 ton

A refined Level 3 ("Level 3a") estimate requires that we know the capacity of the equipment used. At site 3.1, *four 30-cy and four 45-cy scrapers were used, and size-specific scraper emission factors from Table 5 are be used*:

- 82 acres in size
- 3 month duration
- Active earthmoving underway
- 1,500,000 cy of earth to be moved (all on-site)
- Four 45-cy and four 30-cy scrapers

Estimated PM_{10} Emissions = 0.011 ton/acre-month x 82 acre x 3 month + (49 lb/scraper-hr) x 4 scraper x 3 month + (84 lb/scraper-hr) x 4 scraper x 3 month
= 0.90 ton/month x 3 month + 190 lb/hr x 168 hr/month x 3 month + 340 lb/hr x 168 hr/month x 3 month
= 2.7 ton + 134 ton
= 140 ton

Under Level 4, even more detailed information is needed about the *length of the average (round-trip) distance traveled and the density of the material*:

- 82 acres in size
- 3 month duration
- Active earthmoving underway
- 1,500,000 cy of earth to be moved (all on-site)
- Four 45-cy and four 30-cy scrapers in use
- Average haul distance ~ 3,000 ft
- Earth density 1.4 ton/cy

Estimated PM_{10} Emissions = 0.011 ton/acre-month x 82 acre x 3 month + 0.21 lb/ton-mile x 1,500,000 cy x 1.4 ton/cy x 3,000 ft
= 0.90 ton/month x 3 month + 125 ton
= 130 ton

The following table compares the different estimates with the results from the mean inventoried emissions from the demonstration study:

Level	Estimated PM_{10} emissions (tons)	Area-normalized emissions (ton/acre-month)
1	27	0.11
1a	100	0.42
2	91	0.37
3	100	0.41
3a	140	0.56
4	130	0.52
Average inventory result based on values in Table 3	99 ± 20	0.40 ± 0.081

5.2 Site 3.2

A second example is based on Site 3.2. Here, 3,000,000 cy of earth are to be cut/filled over a 6-month period. The site is 140 acres in size. The *Level 1 estimate makes use only of the site's area and the project duration*:

- 140 acres in size
- 6 month duration

Estimated PM_{10} Emissions = 0.11 ton/acre-month x 140 acre x 6 month
= 92 ton

The Level 1a estimate makes use of the worst-case factor because we know that *the site contains large-scale active earthmoving*:

Estimated PM_{10} Emissions = 0.42 ton/acre-month x 140 acre x 6 month
= 350 ton

Use of Level 2 that we supply information on *the amount of cut/fill*:

- 140 acres in size
- 6 month duration
- Active earthmoving underway
- 3,000,000 cy of earth to be moved (all on-site)

Thus the Level 2 estimate is given by

Estimated PM_{10} Emissions = 0.011 ton/acre-month x 140 acre x 6 month + (0.059 ton/1000 cy) x 3,000 (1,000 cy)
= 186 ton

In Level 3, even more information is necessary. In this case we know that *8 scrapers are used*, but we do not know how large the scrapers are:

- 140 acres in size
- 6 month duration
- Active earthmoving underway
- 3,000,000 cy of earth to be moved (all on-site)
- Eight scrapers in use, but size unknown (i.e., use default emission factor)

Under Level 3 (with the default scraper factor of 49 lb/scraper-hr), the emissions are estimated as

Estimated PM_{10} Emissions = 0.011 ton/acre-month x 140 acre x 6 month + (49 lb/scraper-hr) x 8 scraper x 6 month
= 207 ton

A refined Level 3 ("Level 3a") estimate requires that we know *size of the actual equipment in use* at the site. At Site 3.2, all 8 scrapers are 45 cy in capacity, and the size-specific scraper factor from Table 5 is used:

- 140 acres in size
- 6 month duration
- Active earthmoving underway
- 3,000,000 cy of earth to be moved (all on-site)
- Eight 45-cy scrapers in use

Estimated PM_{10} Emissions = 0.011 ton/acre-month x 140 acre x 6 month + (84 lb/scraper-hr) x 8 scraper x 6 month
= 348 ton

Level 4 requires detailed information on the *length of the average (round-trip) haul distance and the material density*:

- 140 acres in size
- 6 month duration
- Active earthmoving underway
- 3,000,000 cy of earth to be moved (all on-site)
- 845-cy scrapers in use
- Average haul distance ~ 3,000 ft
- Earth density 1.4 ton/cy

Estimated PM_{10} Emissions = 0.011 ton/acre-month x 140 acre x 6 month + 0.21 lb/ton-mile x 3,000,000 cy x 1.4 ton/cy x 3,000 ft
= 343 ton

The following table compares estimates from the different levels with the mean inventoried value:

Level	Estimated PM_{10} emissions (tons)	Area-normalized emissions (ton/acre-month)
1	92	0.11
1a	350	0.42
2	186	0.22
3	207	0.25
3a	348	0.41
4	343	
Average inventory result based on values in Table 3	360 ± 52	0.43 ± 0.063

5.3 Estimates of Wind Erosion and Mud/Dirt Trackout

As discussed earlier, the estimation methods recommended in Table 7 do not include emissions due to wind erosion and trackout. This section presents examples of how to estimate emissions from those two emission sources. The examples are based on Site 3.1.

5.3.1 Wind Erosion

Wind erosion was estimated using the procedure contained in the "WIND" model available through the OAQPS bulletin board (919 541-5472). The procedure is identical to that presented in References 7 and 8, and closely parallels the approach given in AP-42 Section 13.2.5, "Industrial Wind Erosion."

Figure 14 presents the output from the WIND model run using the data for Site 3.1. Several items should be noted:

1. Approximately 10 acres at the 80-acre site were considered erodible. This corresponds to the open area used for equipment storage and the roadways. Both are disturbed daily and are open to the wind.

2. The estimation procedure requires that one year of daily fastest miles of wind be available. The meteorological file used here was the example file "LCDXMPL.MET" which is supplied with the WIND program.

```
                    Spreadsheet as of 11:53:56  on 03-25-1996

Input Filename: openare.ef
Inventory area: Example - Site 3.1,2
Source ID: open area  Filename: c:\windaxay\files\openare.EF

Emissions estimate year:      1995
Based on wind data year:      1990
Fastest mile filename:     lcdxmpl.met
System of units:     English
Source life (inclusive days of year)
     Start day: 1
       End day:  30
F=flat area, PC=conical pile, PO=oval pile:     F
 Area (acres):      1
Material description:     Surface material
Percent moisture content:     5
Percent  silt content:
Threshold friction velocity, U*t, (cm/sec):      77.70894
Roughness height (cm):     1
Mode (mm) of size distribution       .59      (# denotes calculated value)
Lc value (cf. Fig. 6-3 of reference manual):      .01


Frequency of disturbance information :
 Us/Ur =  1 -- subarea #  1       -- 100 % of regime disturbed every 1 day(s)


Total emissions emitted over the period:  13480.15 g


Threshold velocity =  77.70894  cm/s
Control:  Effective windspeed ratio =  1

-----------------------------------------------
Us/Ur =  1     Disturbance interval = 1  days

Period  5 - 6  high on  6   .7915031  m/s  753.5366  g emitted
Period  6 - 7  high on  7   .8187963  m/s  2313.998  g emitted
Period  7 - 8  high on  7   .8187963  m/s  2313.998  g emitted
Period  10 - 11  high on  11   .8460895  m/s  4049.311  g emitted
Period  11 - 12  high on  11   .8460895  m/s  4049.311  g emitted

Summary for Us/Ur =  1       Disturbance Interval =  1
 13480.15  Total g emitted over  1  -  30
-------------------------------------------------------------------
Summary for entire source:  13480.15   g emitted over period  1  -  30
NOTE: For a variety of reasons given in the user manual, the erosion estimates
      presented above may be considered as CONSERVATIVELY HIGH.  See the
      user manual for more information.
```

Figure 14. Output from WIND Model

3. The threshold wind speed was based on the mode of the particle size distribution of the sample (Sample number SC U 003 in Figure 5) collected from the open area used for equipment storage. The largest fraction of material was caught between the 20 and 40 mesh screens. The size distribution mode was taken as equal to 0.59 mm, which is the geometric mean of 20 and 40 mesh openings (0.833 and 0.417 mm, respectively).

4. The mode of 0.59 mm was used by the model to estimate a threshold friction velocity of approximately 78 cm/sec. A roughness height of 1 cm was assumed for the surrounding area.

5. The area was modeled as a flat 1-acre site. Furthermore, only one month was considered in the example calculation, for the purposes of illustration. In this case, total PM_{10} wind erosion emissions are estimated as 13,500 g (29.7 lb). To obtain total emissions for the approximately 10 acres considered erodible over the 3-month-long period that the site is active, one must multiply the that result by 30 to obtain 890 lb.

5.3.2 Mud/Dirt Trackout

The EPA guidance document "Control of Open Fugitive Dust Sources" (EPA-450/3-88-008) presents a means to estimate PM_{10} emissions from mud/dirt trackout. For an individual access point from a paved road to a construction/demolition site, the PM_{10} emission increase ΔE (in g/day) is estimated as

$$\Delta E = e\ M$$

where: e = unit emission increase (equals 5.5 g/vehicle if fewer than 25 vehicles enter or leave the site daily and equals 13 g/vehicle otherwise)

M = number of vehicle passes per day on the adjacent public paved road

At Site 3.1, more than 25 vehicles entered or left the site each day. Assuming that approximately 1,000 vehicles pass the access point on Pelican Hill Road (see Figure 5), then the daily emission increase is

$$\Delta E = 13 \text{ g/vehicle} \times 1{,}000 \text{ vehicle/day}$$
$$= 13 \text{ kg/day}$$

Over the 3-month (90 day) period, a total of 1,200 kg (2,600) is estimated as being emitted due to trackout. Note that this estimate reflects uncontrolled conditions whereas the access point Site 3.1 was cleaned at least twice per day.

Section 6
Conclusions and Recommendations

Based on information presented in the report, the following conclusions and recommendations can be made.

1. It is recommended that BACM working group members substitute the revised construction emission factor of 0.11 ton/acre-month in place of the original AP-42 factor. The new factor references PM_{10} rather than TSP emissions.

2. MRI recommends that member agencies consider developing information needed to be used with Levels 2 and 3 in Table 7. For some agencies, such as Clark County, a database could be constructed relatively easily by combining permit application information with default values for scraper capacities, etc. Other agencies may find it necessary to develop information "from scratch." It is recommended that agencies consider collecting one or two years of data using a survey instrument such as that presented in Section 4.4.

3. It is recommended that member agencies refrain from using default values presented in AP-42 Section 13.2.1 and other EPA guidance documents when preparing emission inventories for public paved roads within their jurisdictions. Based on data collected in this study, road surface silt loadings are roughly an order of magnitude lower than the defaults.

4. The focused emission measurement results were inconclusive in establishing how well emission factors developed for other industries predict emissions from construction operations. On average, agreement was fairly acceptable. However, this reflected balancing of substantial overprediction at one site with underprediction at a second site. Additional field tests will be necessary to provide better answers to questions involving the applicability of Table 1 emission factors to construction activities.

5. It is recommended that any future field tests of emissions from earthmoving activities be closely coordinated with a long-term earthmoving project and that tests be conducted as early as practical. In this way, longer haul distances will be available and there will be less wind interference from cut/fill areas and stockpiles.

Section 7
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Determining Minimum Habitat Areas and Habitat Corridors for Cougars

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Abstract: *I simulated population dynamics of cougars to predict the minimum areas and levels of immigration needed to avoid population extinction caused by demographic and environmental stochasticity for a period of 100 years. Under most plausible parameter values, the model predicted very low extinction risk in areas as small as 2200 km², and (in the absence of immigration) increasing risk as area decreased below 2200 km². If as few as one to four animals per decade could immigrate into a small population, the probability of population persistence increased markedly. Thus a corridor for immigration will benefit a small population in an area where further loss of habitat will occur.*

The model was applied to the cougar population in the Santa Ana Mountain Range of southern California (2070 km², with about 20 adults). Field data support the model's conclusion that this population is demographically unstable. There will be a high risk of extinction if the habitat is reduced to currently protected and connected areas (1114 km²). A movement corridor allowing immigration from the adjacent population and intra-range corridors would greatly enhance the prognosis. However, the last corridor for immigration has been degraded by recent human activity. Within the mountain range, cougars recently became extinct in a 75-km² habitat fragment recently isolated by development, and cougars will become extinct in another 150-km² of habitat if a proposed housing project occludes a critical corridor. Radio tracking has confirmed use of this and other important corridors.

Neither the model nor the field data alone would have much influence in the face of development pressure; together they have stimulated interest in restoring and protecting critical corridors in this range. Nonetheless, the long-term prognosis for this population is bleak, because 22 local governments review potential impact on a case-by-case basis.

Determinando áreas mínimas de hábitat y hábitat en corredes para pumas

Resumen: *Simulé la dinámica de la población de pumas para predecir áreas mínimas y niveles de inmigración necesarios para evitar la extinción de la población debido a estocasticidad demográfica y ambiental por un período de 100 años. Usando los parámetros más viables, el modelo predice riesgos de extinción muy bajos en áreas tan pequeñas como 2200 km², y (en ausencia de inmigración) un riesgo creciente a medida que el área decrece por debajo de 2200 km². Si tan solo 1–4 animales por década pudiesen inmigrar a una pequeña población, la probabilidad de persistencia se incrementaría marcádamente. Por consiguiente, un corredor para la inmigración puede beneficiar una pequeña población en un área dónde ocurrirá una mayor pérdida del hábitat.*

El modelo fue aplicado a la población de pumas en la cadena Montañosa de Santa Ana, al Sur de California (2070 km², con unos 20 adultos aproximádamente). Datos de campo apoyan las conclusiones del modelo, que indican una población demográficamente inestable. Si el hábitat es reducido a las actuales áreas protegidas y conectadas (1114 km²) habría un alto riesgo de extinción. La prognosis se podría mejorar ampliamente con un corredor de movimiento que permitiera la inmigración desde poblaciones en áreas adyacentes y corredores dentro del área de distribución. Sin embargo, el último corredor para la inmigración ha sido degradado por el reciente impacto humano. Dentro de la cadena montañosa, los pumas se han extinguido recientemente en un fragmento de hábitat de 75 km² aislado a causa del desarrollo; los pumas se extinguirían en otros 150 km² de hábitat si un proyecto de viviendas propuesto obstruye un corredor crítico. El uso de este y otros importantes corredores ha sido confirmado a través de telemetría.

Ni el modelo ni los datos de campo por si solos tendrían mucho impacto ante la presión por el desarrollo; juntos han estimulado el interés en restaurar y proteger corredores que son críticos en esta cadena. A pesar de todo, la prognosis a

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Paper submitted September 3, 1991; revised manuscript accepted February 12, 1992.

Effective land-use planning must be spatially explicit and regional in scope. Because cougars need corridors and because telemetered cougars can quickly identify movement corridors, cougar research is an efficient and appropriate way to inject biological data into such planning efforts.

largo plazo para esta población es yerma ya que 22 gobiernos locales revisaron los impactos potenciales caso por caso. Una efectiva planificación del uso de la tierra debe ser explícita espacialmente y regional en extensión. La investigación sobre pumas es una vía eficiente y apropiada de introducir datos biológicos en los esfuerzos de planificación. Esto es así porque los pumas necesitan corredores y al estar marcados telemétricamente permiten identificar rápidamente los corredores de movimiento.

Introduction

As landscapes are fragmented into ever-smaller patches of habitat isolated by high-speed barriers (Harris & Gallagher 1989), it has become important to determine the minimum area needed to preserve functioning ecosystems. Because there are no methods to determine the minimum areas of reserves with reference only to ecosystem properties, biologists are forced to conduct viability analyses for a few "indicator" or "umbrella" species as an efficient way to address the viability of the whole system (Soulé 1987*a*:8; Noss 1991).

Species such as the grizzly bear (*Ursus arctos horribilis*), the wolf (*Canis lupus*), and the cougar or mountain lion (*Felis concolor*) make ideal candidates for such analysis because they exist at low density and require large areas. Of these, only the cougar plays a significant ecological role in much of the lower forty-eight states. Therefore, viability analysis for this species would have widespread utility. Shaffer (1983) presented an analysis for the grizzly bear. In this paper, I present such an analysis for the cougar.

I focus solely on the issue of identifying the minimum area and immigration rate needed to avoid extinction caused by demographic and environmental stochasticity, ignoring inbreeding effects. Previous analyses have shown that the areas needed to avoid inbreeding depression in the long term are so large "that the only recourse in most situations will be to establish the species in several sites since there won't be enough space in any given site" (Soulé 1987*b*:177). My analyses address the issue of how large each of these "several sites" must be so that management intervention can be limited to that needed to maintain genetic variability.

Simulation models are superior to analytic models when addressing a particular species, because the analytic calculations are possible only for unduly simplified models (Ewens et al. 1987:67). But there are pitfalls to the simulation approach, especially with small populations. For example, most simulation models account only for females and make no allowance for an "Allee effect" whereby animals at low density may have difficulty finding mates. This creates an inverse density-dependence in fecundity when numbers of one sex are very low (Begon & Mortimer 1981:30), which has been documented in a cougar population (Padley 1990). Another problem is that most subroutines for incorporating stochastic variation in survival rates introduce crucial errors when simulated populations become small (see Methods section). Most important, even though "habitat fragmentation ... is the primary cause of the present extinction crisis" (Wilcox & Murphy 1985: 884), few simulation models allow analysis of the effects of movement corridors; such analysis requires explicitly modeling various levels of immigration.

In this paper I describe a model that realistically simulates the population dynamics of small populations of cougars. My goal was to predict the conditions under which a cougar population can avoid extinction in the short term (100 years), ignoring inbreeding effects. My main conditions of interest were those that humans can control, namely, area of habitat (controlled by restrictions on human development) and the amount of immigration into the population (controlled via provision for wildlife movement corridors to adjacent populations). In addition, I examined how estimates of extinction risk depends on estimates of life history parameters, many of which vary geographically or are difficult to measure.

Finally, I apply the model to the cougar population in the Santa Ana Mountains of southern California, which I have studied since 1988, and I summarize some of the relevant field observations from that study. This real-world application illustrates that model results have little impact on land-use decisions unless they are supplemented by field study to identify actual or potential movement corridors. My goals in this illustration are to promote the use of data from telemetered cougars to identify and protect wildlife corridors, and to advocate that regional planning efforts based on geographic information systems (GIS) replace current piecemeal approaches.

Methods

Simulation Model

The simulation model used standard Leslie-matrix computations, with subroutines that controlled immigration

and adjusted survival and fecundity rates for density-dependence, demographic and environmental stochasticity, and an Allee effect. For each combination of input conditions, the population dynamics were simulated 100 times; each simulation was 100 years in duration. In each case, the initial number of adults (animals 2 or more years of age) was set equal to the carrying capacity and evenly distributed among age classes. Initial numbers of 0-year-olds and 1-year-olds were set at a half and a quarter, respectively, of the number of adult females.

The question of what constitutes preservation is "the most crucial and least addressed" issue in conservation biology: "Does a 95% probability of persistence for 100 years make extinction sufficiently remote or all too immanent?" (Shaffer 1987:81,84). I advocate planning for an extinction risk of less than 1%, and I label "significant" any extinction risk 2% or more.

For each set of 100 runs, the program recorded the population trajectory by sex and age class, the number of runs on which the population went extinct, mean population size in year 100, and other summary statistics.

INPUT CONDITIONS

The main factors of concern were area of habitat and level of immigration. Simulations were run with habitat areas as small as 200 km^2 and in increments of 200 km^2 until extinction risk declined to less than 2%. Four levels of immigration were considered. The first level depicted no wildlife movement corridor (no immigration). The second and third levels reflected a marginal corridor, allowing immigration of one or two males per decade, respectively. The fourth level of immigration was three males plus one female per decade. These levels reflect the finding that about 80% of juvenile males, but only about 25% of juvenile females, dispersed out of their natal mountain range, often crossing inhospitable desert habitat to reach another range (Ashman et al. 1983).

For each combination of habitat area and level of immigration, simulations were run under many combinations of estimates for life history and environmental attributes (Table 1). We have poor estimates for some of these parameters (for example, male and female equilibrium densities, juvenile survival rates) and some parameters may vary geographically, so I used many combinations initially. A smaller subset was obtained by dropping values that produced unrealistic outcomes and variables that did not influence the results.

Litter size. Mean litter size (Table 1) was based on reports of Robinette et al. (1961), Ashman et al. (1983), and Anderson's (1983:34) compilation of data from 407 litters. In the simulations, up to 40% of the 2-year-old females bred each year and no kittens or yearling females bore young, based on minimum and mean ages of primiparous females of 25 and 32 months (Ashman et al. 1983). Because the mean interval between births (except when a litter dies) is usually about 24 months (Hornocker 1970:16, Robinette et al. 1961:215), the model excluded from breeding those females with surviving litters from the previous year. The model assumed that a female whose litter dies comes into estrus and breeds the next year (Hornocker 1970:16; Seidensticker et al. 1973:56; Eaton & Velander 1977:65).

Juvenile survival rates. There are few estimates of survival of 0-year-olds. Comparing mean litter sizes near birth and at 12 months (not the same litters followed through time) Ashman et al. (1983) suggested a value of 0.78. Similar data in Robinette et al. (1961:213, inferring age from weight) suggested a survival rate of 0.73. To the extent that entire litters died, this is a high estimate (Robinette et al. 1961:213); it is also higher than the adult survival rate reported by Lindzey et al. (1988). Survival rates of African felid cubs (lion, cheetah) are about 0.50 (Schaller 1972:191,300). Preliminary analy-

Table 1. Input states for biological parameters used in simulating population dynamics of cougars.

Parameter	*Possible States*
Mean litter size	2.4[a]
	2.8
	3.2[b]
Juvenile[c] survival	0.55 (0.50)[d]
	0.65 (0.60)
	0.75 (0.70)
Adult[e] survival	0.65[a]
	0.75
	0.85
Carrying capacity (breeding adults per 100 km^2)	Sex ratio of 2 femles per male:
	0.4 females, 0.2 males
	0.6 females, 0.3 males
	0.8 females, 0.4 males
	1.0 females, 0.5 males
	1.2 females, 0.6 males
	Sex ratio of 3–4 females per male:
	0.8 females, 0.2 males
	1.2 females, 0.4 males
	Sex ratio near unity:
	0.4 females, 0.4 males
	0.8 females, 0.6 males
	None (constant carrying capacity)
Severity of catastrophe (loss of carrying capacity)	20% in years 25–27, 50–53, 75–77
	40% in years 25–27, 50–53, 75–77[f]

[a] *This value was dismissed because it produced unrealistically low population sizes even when used in concert with optimistic estimates for other variables. See first section of Results.*
[b] *This value was dismissed because it produced extinction probabilities that did not differ from those under a mean litter size of 2.8, and this value is best supported by field studies. See first section of Results.*
[c] *0- and 1-year olds of both sexes, and 2-year-old males.*
[d] *Survival of 1-year-old males indicated in parentheses.*
[e] *Females ≥2 years old and males ≥3 years old.*
[f] *This value was dismissed because extinction probabilities varied only trivially from the 20% case. See first section of Results.*

sis of 172 cougar-months of telemetry data (0- and 1-year-olds combined) suggests an annual survival rate for cougar cubs of 0.48 (Beier, unpublished data). Hemker et al. (1986) reported a survival rate of 72% for cubs between 3 and 10 months of age in an area of extremely low cougar density (gross density of 0.5 cougars per 100 km^2); this rate may reflect density-dependent enhancement of survival rates at low density. In any event, if additional mortality during 0–3 months of age is considered, 0.75 is probably a high estimate and was used as the highest estimate in the simulations.

There are no published estimates of survival of 1-year-olds. Hemker et al. (1986) reported a survival rate of 92% for cubs from 10 months to dispersal at 16–19 months, from the same low-density population. This figure ignores higher post-dispersal mortality (Hornocker 1970:18). Lacking better evidence, I set yearling survival rates equal to 0-year-old survival rates. In the simulations kittens died when orphaned in the year of birth, but kittens orphaned in the year after birth had the same survival rate as nonorphans.

Adult survival rate. I used adult survival rates of 65% (Robinette et al. 1977:123, Ashman et al. 1983), 75% (Lindzey et al. 1988), and 85% (Anderson et al. 1989).

Longevity. A maximum longevity of 12 years was used in all simulations. The longest lifespan reported for a wild cougar is 13–15 years (Hopkins 1989:23); I found no other reports of wild cougars living past 12 years of age. Extreme longevities for captive cougars are 12, 15, and 18 years (Young 1946:59), and 12 and 19 years (Eaton & Velander 1977:56). My preliminary analyses showed that risk of extinction decreased only slightly as maximum longevity increased past 12 years, especially in the critical right tail (Figs. 3–6) of the extinction curve.

Carrying capacity. Although they are not territorial, social intolerance among adult females is thought to regulate their density, whereas territoriality among males separately regulates male density (Seidensticker et al. 1973). Apparently female density is calibrated to vegetation, topography, and prey availability, whereas males compete for access to females (Seidensticker et al. 1973:59,56). To model density-dependent survival rates, separate estimates of carrying capacity for males and females were needed.

Estimates of densities for male and female adult cougars vary widely (Hornocker 1970; Seidensticker et al. 1973; Sitton & Wallen 1976; Currier et al. 1977; Shaw 1977; Hemker et al. 1984; Logan et al. 1986; Neal et al. 1987; Hopkins 1989). Because many study sites were selected because of expected high cougar density, some reported densities are atypically high. Also, not all studies reported how many of these adults were nonbreeding transients as described by Hornocker (1970) and Seidensticker et al. (1973).

In light of these uncertainties, I ran the model under a variety of carrying capacities (Table 1). Because most studies (excluding male-biased summaries of hunting returns) report a 2:1 ratio of breeding adults (females: males) (Seidensticker et al. 1973:17, first 3 years; Currier et al. 1977; Ashman et al. 1983; Murphy 1983; Hemker et al.1984; Logan et al. 1986; Neal et al. 1987; Hopkins 1989:23), most simulations used this ratio between carrying capacities for males and females. However, other adult sex ratios have been reported, for example, 3:1 (Currier et al. 1977; Shaw 1977; Quigley et al. 1989; M. Jalkotzy and I. Ross, Calgary, Alberta, unpublished data), 1.3:1 (Hornocker 1970:15), and 1:1 (Seidensticker et al. 1973:17, last 3 years; Hopkins 1981). Therefore I also used similar ratios (Table 1).

I excluded high densities due to winter concentration. The markedly lower gross density of 0.4/100 km^2 reported by Hemker et al. (1984) and the markedly higher adult density of 3/100 km^2 reported by Neal et al. (1987) were also excluded as outliers which may deviate from the actual long-term carrying capacity.

Catastrophic reductions in carrying capacity. On each run, simulated carrying capacity decreased by either 0%, 20%, or 40% during years 26–28, years 51–53, and years 76–78. This modeled prey die-offs due to droughts or severe winters.

DENSITY-DEPENDENCE IN FECUNDITY

Because the gestation period is only 92 days and neonates weigh only 500 grams (Anderson 1983:33–34), cougar pregnancy is relatively cheap; therefore simulated litter sizes were independent of density and maternal age. When the simulated number of adult females was less than carrying capacity, all females over 2 years old (except those with a surviving litter from the previous year) and 40% of 2-year-old females (Ashman et al. 1983) bore litters. The program allowed females in excess of carrying capacity to breed with probability equal to 0.20, and assigned the youngest females to nonbreeding status, reflecting the inhibition of reproduction in young females until home range establishment (Seidensticker et al. 1973).

The probability of a female breeding was inversely density-dependent when numbers of breeding males were below the carrying capacity for adult males. When there were vacant male territories, the proportion of adult females that were bred was reduced by a factor of

$$\frac{KM - \#AdM}{KM} \cdot 1.15^{KM - \#AdM},$$

where KM = carrying capacity for breeding males and #AdM = number of adult males. Under this expression, each adult male increases his home range size by 15% for each "deficit male"; thus the effect is very mild ex-

cept at very small population sizes; for example, when KM = 5 and #AdM = 4, 92% (not 80%) of the females are bred.

DENSITY DEPENDENCE IN SURVIVAL RATES

In preliminary analyses, some simulations were run without any density dependence in survival rates; resulting extinction rates were about ten times higher than those produced using density-dependent survival rates for all ages. Other simulations were run with mild density dependence in juvenile survival rates (Fig. 1, curve A) and density independent adult survival rates, producing extinction rates about five times higher than when survival rates for all ages were density-dependent. In simulations lacking density-dependent survival rates, the mean number of adults in year 100 (in surviving populations) far exceeded carrying capacity. Because density independence produced such unrealistic ending population sizes, I ran all remaining simulations with density-dependent survival rates (Fig. 1, Table 2).

In the model, density dependence operated most strongly on 0- and 1-year-olds, whose survival rates depended on the number of adult females; survival of 1-year-old males also varied with the number of adult

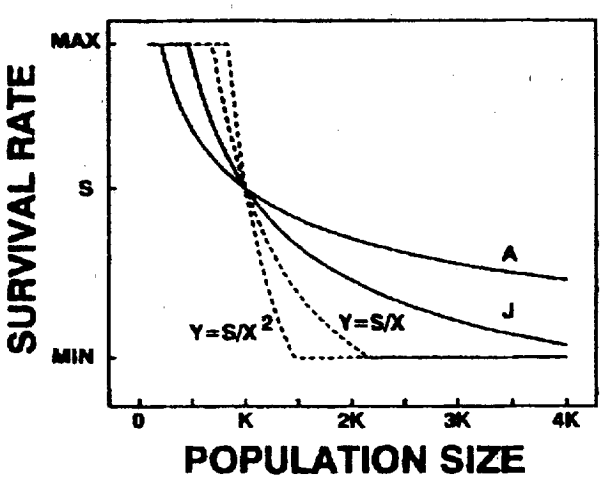

Figure 1. Density-dependent functions relating survival rates to population density. Lines A and J, respectively, illustrate the adult and juvenile survival functions (Table 2) used in all simulations illustrated in Figures 3–7. Simulations using stronger density-dependent functions (dashed lines) did not change the risk of extinction. In all simulations the juvenile survival function was one line steeper than the adult survival function. K = Carrying capacity for the appropriate sex. Max = 0.95 (adults) or 0.9 (juveniles). Min = 0.5 (adults) or 0.3 (juveniles). S = Survival rate at carrying capacity.

Table 2. Equations used to create density-dependence in cougar survival rates. S = the 12-month survival rate at carrying capacity; KF and KM = carrying capacity for breeding females and males respectively; #AdFemales and #AdMales = number of ≥2-year-old females and males, respectively.

Age	Sex	*Expression for Density-Dependent Survival Rate*[a]
0	both	$S * (KF/\#AdFemales)^{0.5}$
1	F	$S * (KF/\#AdFemales)^{0.5}$
	M	Minimum of: $S * (KF/\#AdFemales)^{0.5}$ or $S * (KF/\#AdFemales)^{0.5} * (KM/\#AdMales)^{0.5}$
2	F	$S * (KF/\#AdFemales)^{0.5}$
	M	$S * (KM/\#AdMales)^{0.5}$
3+	F	$S * (KF/\#AdFemales)^{0.25}$
	M	$S * (KM/\#AdMales)^{0.25}$

[a] *To avoid unrealistic results that the above expressions yield under certain conditions (such as when a divisor approaches or equals zero), the program truncated all survival rates to values between 0.3 and 0.9 for animals under 3 years of age, and between 0.5 and 0.95 for adults.*

males, reflecting density-dependent mortality of young males during dispersal. Density-dependence was relatively mild for animals less than 2 years old. There is no empirical data to support these particular functions (Table 2); they were chosen for computational simplicity. In light of the markedly changed outcomes when density dependence was added to the model (above), I tested the model using more severe density-dependent functions. Neither risk of extinction nor ending population size varied among the functions illustrated in Figure 1.

STOCHASTIC VARIATION

Most simulation models introduce stochastic variation into survival rates by randomly selecting a rate from a normal distribution and then multiplying this rate by the number of individuals in an age-sex class. When there are only one or two animals in a sex-age class, this approach introduces rounding errors that increase the survival rate to near 100% and, ironically, eliminate stochastic variation (Beier, unpublished data). To avoid this problem, the model applied the appropriate probability to each individual animal in the population. For example, if the survival rate for yearling males was 0.60 and there were two yearling males in a given year, all outcomes (2, 1, or 0 survivors) were possible (with binomial probabilities 0.36, 0.48, and 0.16, respectively) in a biologically realistic manner.

Similar procedures introduced stochasticity into primary sex ratio, litter sizes, and immigration rates. Each newborn had a 50% chance of being male. Each litter had two, three, or four cubs with probabilities appropriate to the specified mean value. Each year one male or one female immigrated with the appropriate probability, and the immigrant was assigned to the 1-year,

2-year, or 3-year age class with probability equal to 0.3, 0.5, and 0.2, respectively.

Field Work in the Santa Ana Mountains

The cougar population in the Santa Ana Mountain Range of southern California consists of about twenty adults on about 2070 km^2 of habitat (Fig. 2) (Beier & Barrett 1992*b*). The surrounding urban areas do not offer even marginal cougar habitat. About 1270 km^2 of this habitat (61%) is protected from urban uses, primarily within lands owned by the U.S. Forest Service and U.S. Navy (Table 3). Of the protected land, about 1114 km^2 forms a contiguous block; if all private lands were developed,

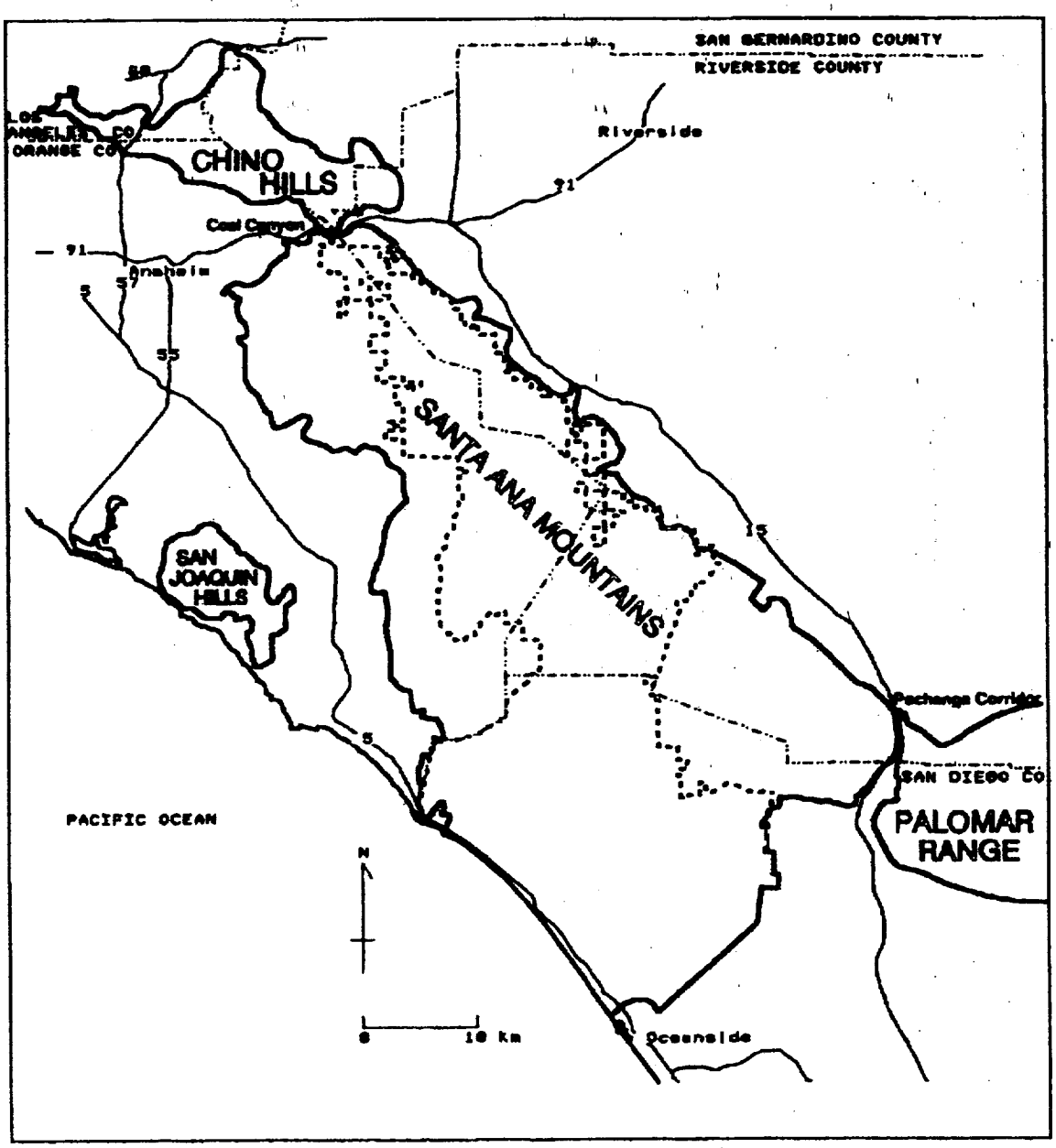

Figure 2. The heavy solid line encloses three areas: 2070 km^2 of cougar habitat in the Santa Ana Mountain Range (including the Chino Hills); 75 km^2 of suitable habitat in the San Joaquin Hills (recently extinct); and (east of Highway 15) a portion of the habitat in the adjacent Palomar Range. The heavy dashed line encloses 1114 km^2 of protected and connected parcels (Table 3). All roads shown are 6- to 10-lane freeways.

Table 3. Area in hectares of protected lands contained within cougar habitat in the Santa Ana Mountain Range, California.

Ownership and Parcel Name	*Areas Forming a Large Contiguous Block*	*Areas Surrounded by Unprotected Land*
Federal		
Cleveland National Forest	53,604[a]	
Cleveland National Forest (6 parcels)		626
Camp Pendleton	49,292[b]	
Fallbrook Naval Weapons Station	3,099	
Bureau of Land Management (7 parcels)		550
Bureau of Land Management (1 parcel)	364	
State		
Chino Hills State Park		5,059
San Diego State University Field Station		1,805[c]
Dept Fish & Game Coal Canyon Preserve	385	
Orange County Parks		
Caspers	3,085	
Limestone Canyon		2,169[d]
O'Neill		805
Whiting Ranch		632
Irvine		193
Wagon Wheel		178
Santiago Oaks		142
Private Reserves		
Santa Rosa Plateau Preserve		2,803[e]
National Audubon Society Starr Ranch	1,578	
Rancho Mission Viejo Conservancy		486
Total	111,407	15,448

[a] *Excludes private inholdings.*
[b] *Includes land leased to San Onofre Beach State Park; excludes 1700 hectares in urban use and airfield; includes some severely affected bombing ranges that may not be suitable habitat.*
[c] *Includes 510 hectares of Bureau of Land Management land administered by the field station.*
[d] *Expected to be transferred to county from private ownership.*
[e] *Administered by The Nature Conservancy (TNC); includes lands owned by TNC, State of California, and Riverside County.*

the other 154 km^2 of protected land would be isolated into fragments unusable by cougars.

The six counties of southern California contain 5% of the U.S. human population. The human population of the eastern half of Orange County and the western sixth of Riverside County is projected to grow from 1.15 million in 1987 to 2.09 million by 2010 (Anonymous 1989). Most of this growth is expected to occur in tract homes built in privately-owned open spaces, including most of the best cougar habitat. In addition to outright habitat destruction, some wildlands are lost to the cougar population because they become isolated by freeways and other development. For example, after urbanization isolated a 75-km^2 fragment of cougar habitat (Fig. 2, San Joaquin Hills) in the late 1970s, cougars became extinct there by June 1990 (Beier & Barrett 1990*a*).

In early 1988, field work began in the southern half of the range, focusing on seven telemetered adult females. In January 1988, one such female had 3-month-old triplets and a second had a single yearling cub at heel. After the death of a mature male cougar in February 1988, there was no additional reproductive activity and no sign of a breeding male for over 12 months (Padley 1990:40–43). When two young males established themselves as breeders in early 1989, their tracks and vocalizations were obvious. In April 1989 we heard copulatory vocalizations involving four telemetered females, and that summer six of the seven females bore cubs (Padley 1990). The presumed sires of these litters (two adult males subsequently captured and radio-tagged) were both 2 years old at the time they became breeders. Therefore, all evidence suggests that there was no adult male and no reproduction in the southern half of the range for a full year.

In 1989 the study expanded to include the entire mountain range. We intensified our efforts to collar predispersing animals, and four times per month we selected a focal animal whose location was determined every 15 minutes from 1 hour before sunset until 1 hour after sunrise. This research has focused on (1) identification of existing or potential corridors for immigration into the population as a whole; (2) identification of lands within the mountain range that connect nearly-isolated patches of habitat; and (3) documentation of the travel paths used by cougars, especially dispersing animals, and especially paths between areas designated as permanent open space. If protected, such paths can be expected to become corridors as future human activities affect the adjacent habitat.

Results

Rejection of Unrealistic or Uninformative Parameter Values

To reduce the results to a digestible mass, I first rejected parameter values that produced unrealistic outcomes or that did not influence the results. For example, the mean number of adults in year 100 was 70–80% of carrying capacity whenever adult survivorship equalled 0.65, even with a habitat area of 3000 km^2 and the highest estimates for juvenile survival rate, mean litter size, and carrying capacity. If carrying capacity is ever to be observable in nature, it should be so under these conditions, so I excluded the adult survival rate of 0.65 from consideration.

Similarly, because a mean litter size of 2.4 tended to produce ending population sizes about 15% below carrying capacity, this litter size was excluded. Extinction rates decreased only trivially when mean litter size increased from 2.8 to 3.2. Because available data best support a mean litter size of 2.8, the mean litter size of 3.2 was also excluded from further consideration. Finally, extinction risk increased only trivially as the severity of the catastrophe (temporary loss of carrying capacity) increased from 0% to 20% to 40%. All results reported herein used the 20% reduction.

Influence of Habitat Area and Level of Immigration

The main factors of interest were those under human control, i.e., area of habitat and the presence (or absence) of a corridor allowing various levels of immigration. As expected, both factors influenced the probability of extinction (Figs. 3–5).

Despite variation in model predictions due to uncertainty in biological parameters, 98% or more of simulated populations persisted for 100 years when there was 2200 km^2 or more of habitat available, except under the most pessimistic estimates of biological parameters (carrying capacity of 0.4 or fewer adult females and 0.2 adult males per 100 km^2, in concert with adult survivorship of 0.75 or less).

As expected, the probability of extinction increased as area of habitat decreased. With only 1000 km^2 of habitat and no immigration, simulated populations had 98% persistence only under the most optimistic estimates of biological parameters (carrying capacities of 1.0 or more adult females and 0.5 adult males per 100 km^2, in concert with adult survivorship of 0.85 or more and juvenile survivorship of 0.65 or more). In the absence of an immigration corridor, therefore, the critically small habitat area lies between 1000 and 2200 km^2. Within this range, the critical size depends on demographic parameters (next section).

Immigration improved the probability of survival at surprisingly low levels—as low as one male per decade. For any given combination of biological parameter estimates, the critical habitat area was 200–600 km^2 smaller with an immigration corridor than without. Immigration had no influence on the mean size of the adult population in year 100 for populations that survived.

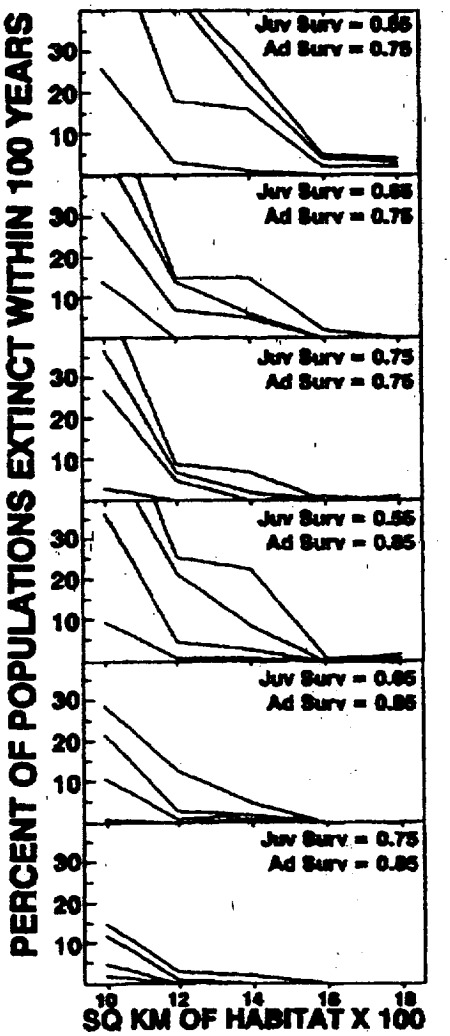

Figure 3. Effect of habitat area and immigration on cougar population persistence, given a carrying capacity of 0.6 breeding adult females and 0.3 breeding adult males per 100 km^2. In each graph the top through bottom lines give the percent of simulated populations that went extinct within 100 years when the numbers of immigrants per decade were 0, 1 male, 2 males, or 3 males and 1 female, respectively. Juv Surv (juvenile survival rate) and Ad Surv (adult survival rate) are defined in Table 1.

Influence of Biological Parameters

Predictions were sensitive to all of the biological parameters, especially the estimates of carrying capacity (Figs.

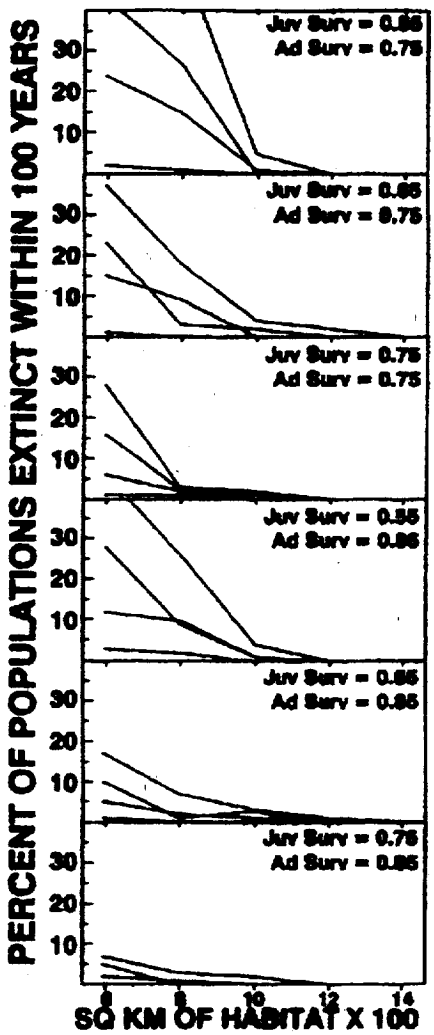

Figure 4. Effect of habitat area and immigration on cougar population persistence, given a carrying capacity of 1.2 breeding adult females and 0.4 breeding adult males per 100 km². In each graph the top through bottom lines give the percent of simulated populations that went extinct within 100 years when the numbers of immigrants per decade were 0, 1 male, 2 males, or 3 males and 1 female, respectively. Juv Surv (juvenile survival rate) and Ad Surv (adult survival rate) are defined in Table 1.

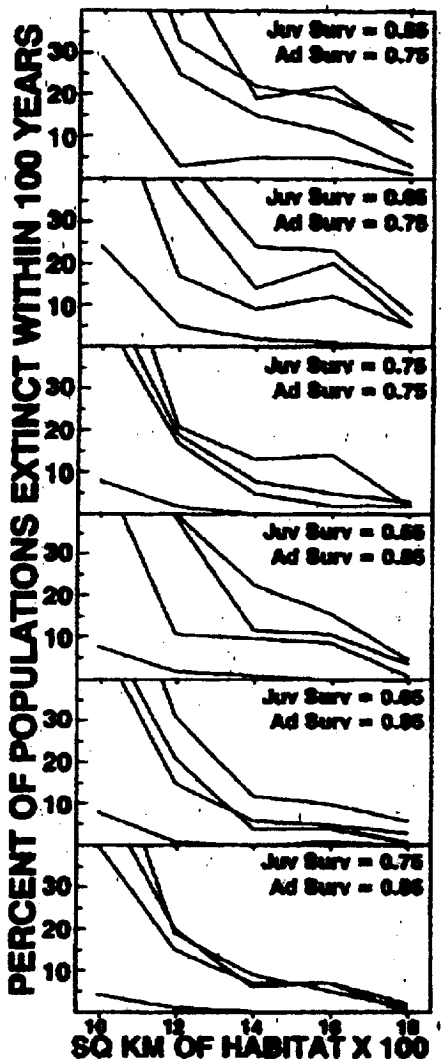

Figure 5. Effect of habitat area and immigration on cougar population persistence, given a carrying capacity of 0.4 breeding adult females and 0.4 breeding adult males per 100 km². In each graph the top through bottom lines give the percent of simulated populations that went extinct within 100 years when the numbers of immigrants per decade were 0, 1 male, 2 males, or 3 males and 1 female, respectively. Juv Surv (juvenile survival rate) and Ad Surv (adult survival rate) are defined in Table 1.

3–5; graphs for carrying capacities listed in Table 1 but not illustrated herein are available on request). Both juvenile and adult survivorship values also had important influences on model results (Figs. 3–5).

The adult sex ratio (the ratio of carrying capacity for females to that for males) was also important. When the adult sex ratio was skewed toward females (Figs. 3–4), immigration of one or two males per decade had the most pronounced rescue effects. This was most evident with a highly skewed sex ratio (Fig. 4). In contrast, immigration of one or two males had a relatively muted rescue effect on populations with equal sex ratios. These populations, however, benefited dramatically from a corridor that allowed four immigrants (including one female) per decade (Fig. 5).

Population Trajectory

For populations with low extinction risk, the population trajectory on a run of 100 years fluctuated near carrying capacity (for example, see Fig. 6A). Despite this relative stability, the age and sex composition of the simulated population showed considerable variation, even when smoothed by taking 5-year running means (Fig. 6B). Surprisingly, most trajectories showed no response to the simulated "catastrophes," despite 20–40% reductions in carrying capacity in years 26–28, 51–53, and 76–78 (see Fig. 6A).

Populations at greater risk of extinction showed even greater demographic instability (Fig. 6C). When the sex ratio was skewed toward females, the most common extinction scenario was loss of breeding males at a time when no male cubs survived.

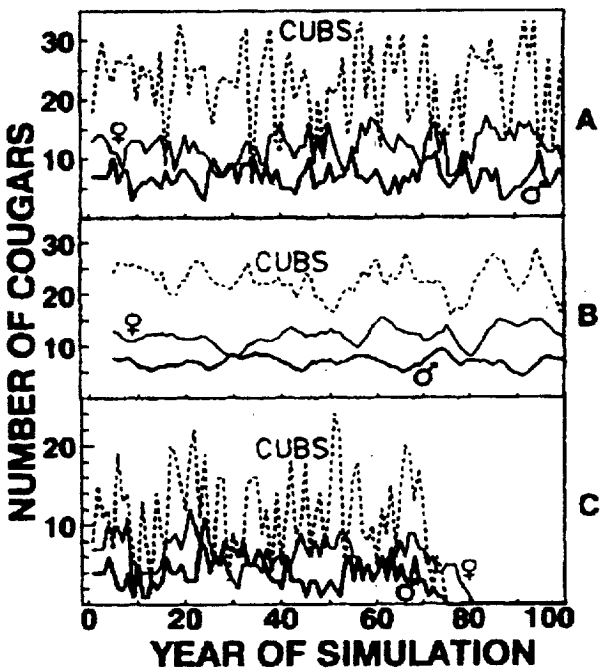

Figure 6. Trajectories of simulated cougar populations with juvenile survivorship = 0.55, adult survivorship = 0.85, carrying capacity = 0.6 female and 0.3 male adults/100 km², no immigration, and a 20% loss of carrying capacity lasting 3 years every 25 years. A. With 2200 km² of habitat, all populations persisted. As in this typical trajectory, age and sex composition of the population varied markedly over time. B. Five-year running means from panel A, showing that even with five years of observation, population demographics varied considerably. C. With 1200 km² of habitat, demographic instability increased and 25% of the simulated populations went extinct. As in this typical trajectory, extinction was usually initiated by loss of adult males.

Applying the Population Model in the Santa Ana Mountains

Given the best local estimates for survivorship rates and carrying capacity, the model predicted that the cougar population in the Santa Ana Mountains is clearly endangered. Although there is less than 3% risk of extinction in the next 100 years with the current 2070 km² of habitat and no immigration, every parcel of habitat lost increases the risk of extinction (Fig. 7). If the population is confined to the 1114-km² block of contiguous protected lands, extinction risk rises to about 33%; an immigration corridor, necessarily including some lands now in private ownership, would greatly improve the prognosis.

Inter-Range Corridor

The only population that can potentially supply immigrants to the cougar population in the Santa Ana Mountain Range is that in the Palomar Range. Interstate Highway 15 and the urban developments along it present the most formidable barrier to wildlife movements between these ranges. A bridged river provides the only safe undercrossing of Highway 15, and there is only one potential corridor between the Palomar range and this un-

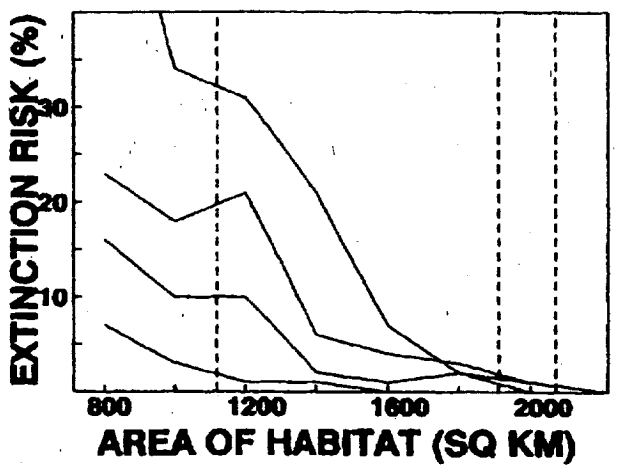

Figure 7. Extinction risk for the cougar population in the Santa Ana Mountains. The top through bottom lines give the percent of simulated populations that went extinct within 100 years when the numbers of immigrants per decade were 0, 1 male, 2 males, or 3 males and 1 female, respectively. From right to left, the vertical lines indicate total available habitat in 1992, total available habitat if the Chino Hills is lost, and total area of the protected and interconnected habitat block. Simulations were run with the following estimates: carrying capacity = 0.7 adult females and 0.35 breeding adult males/100 km², juvenile survivorship = 0.50, and adult survivorship = 0.80.

derpass (Beier & Barrett 1990*b*, 1992*b*). The potential corridor is about 4.5 km long and follows an intermitent watercourse (Pechanga Creek) and the wooded ridges south of this creek (Fig. 2: Pechanga Corridor). Although creeks tend to be natural travel corridors, the utility of lower Pechanga Creek as a corridor is compromised by night lighting from adjacent tract homes, streambed degradation by recent construction, a concrete embankment on portions of the north bank, and removal of woody vegetation for golf courses on the south bank. There are also several residences, an abandoned quarry, a two-lane paved road, and a golf course in the wooded ridges south of the creek.

Although no single one of these obstacles occludes the corridor, collectively they probably prevent immigration by mountain lions into the Santa Ana Range. Field evidence suggests that the corridor *almost* works. On 3 August 1990, a dispersing male mountain lion failed to negotiate the corridor, wandering into a rural residential area where he was captured by wardens. On 29 October 1990, another cougar was killed on I-15 just south of the bridged underpass. On 21 January 1992, a telemetered dispersing male successfully used the corridor to emigrate from the Santa Ana Mountains to the Palomar Range. However, he avoided the bridged undercrossing and the lower 4 kilometers of Pechanga Creek, and was lucky not to have been struck crossing I-15. The pattern of topography and habitat degradation makes it even less likely that a west-bound immigrant would successfully find the undercrossing (Beier & Barrett 1992*b*).

Intra-Range Corridors and Travel Paths

Our data on cougar travel paths (including detailed observations on dispersal routes) have identified specific areas that now prevent intra-range fragmentation. The most threatened link is that connecting the Chino Hills (about 150 km^2 of cougar habitat, including a 57-km^2 state park) to the rest of the mountain range (Fig. 2: Coal Canyon Corridor). State Route 91 and adjacent developments present the greatest obstacle to movement between these areas. The Coal Canyon corridor provides an excellent natural travel route to the freeway and two usable passageways under it (Beier & Barrett 1990*a*, 1991). At least two (probably three) cougars successfully used the Coal Canyon corridor and its underpasses to cross Route 91 into the Chino Hills. In addition, one telemetered cougar was struck by a vehicle attempting to cross the freeway at the mouth of Coal Canyon. One telemetered male dispersed from over 60 kilometers away to establish a home range that now straddles Route 91; he has used the Coal Canyon corridor to cross the freeway at least 16 times during May–December 1991. A pending proposal to build 1500 homes on a 150-ha parcel in Coal Canyon would sever this link, eliminating cougars from the Chino Hills.

Discussion

Population Model

In the absence of immigration, a habitat area of 1000–2200 km^2 (depending on the demographics of a particular population) is needed to support a cougar population with a 98% or more probability of persistence for 100 years; these minimum areas would hold about 15–20 adult cougars. These areas are far smaller than the area assumed necessary to support a population of large carnivores for several centuries without loss of genetic variability (Franklin 1980). It must therefore be stressed that provision of the minimum areas suggested by this model will not guarantee long-term survival of a population. In cases where no immigration corridor is provided, populations confined to such small areas will require monitoring and perhaps periodic intervention—such as introduction of new genetic material through translocation.

The attempt to eliminate some of the values for biological parameters (Table 1) yielded two biological insights. First, natural catastrophes of moderate severity (up to 40% loss of carrying capacity), frequency (every 25 years), and duration (3 years) appear unimportant to cougar population persistence. Shaffer (1983) similarly concluded that catastrophes were relatively unimportant to the population dynamics of grizzly bears. Future modeling efforts can investigate whether this surprising result also holds for disturbances of greater severity and frequency. Second, because adult survivorship of 0.65 or less prevented simulated populations from reaching carrying capacity, management of small populations should include attempts to control factors—such as depredation permits, construction of road undercrossings—that might influence adult survival rate.

These minimum areas and the number of cougars present therein are comparable to the minimum area and number suggested by Shaffer (1983) for grizzly bears. Both my model and Shaffer's incorporated density dependence and produced minimum areas and populations much smaller than predicted by analytic models (see Belovsky 1987) or simulation models lacking density dependence (Captive Breeding Specialists Group 1989; Ginzburg et al. 1990; this paper, Methods).

Ginzburg et al. (1990) advocated use of density-independent models to generate conservative estimates of extinction risk when it is highly sensitive to the shape of the density-dependent function (assuming the true function is unknown). However, to the extent that a density-independent analysis misclassifies viable populations as "hopelessly" small, it can be a *less* conservative approach. Furthermore, extinction risk in my model was not sensitive to the shape of the density-dependent function (Fig. 1). Therefore I chose a density dependent model because it is more realistic. In general, "all natural populations are . . . influenced by density-dependent

processes" (Begon & Mortimer 1981:162). For cougars in particular, long-term observation in Idaho (Hornocker 1970; Seidensticker et al. 1973; Quigley et al. 1989) and the Ruby Mountains of Nevada (Ashman et al. 1983) show the stability characteristic of populations with density-dependent regulation. The data of Quigley et al. (1989) also suggest that cougar numbers track major long-term changes in carrying capacity (prey abundance). Finally, simulated populations with density-independent survival rates (when they persisted) often had unrealistically high ending densities (see Methods, Density-Dependence in Survival Rates).

If a wildlife movement corridor is available to allow immigration of up to three males and one female per decade, an area as small as 600–1600 km^2 (depending on the demographics of a particular population) can support a cougar population without significant extinction risk in 100 years. Doubtless higher levels of immigration would allow even smaller areas to support cougars. Thus, in areas where isolation or fragmentation of a cougar population appears imminent, protection and enhancement of any remaining corridor is valuable.

The model predicts that south Florida, with 8800 km^2 of occupied range and an adult density of about 0.6 adults per 100 km^2 (Maehr 1990) has adequate habitat for demographic persistence. Captive Breeding Specialists Group (1989), also using a simulation approach, concluded that the Florida population faced a high risk of extinction. These predictions do not necessarily conflict, however, because the CBSG model included extinctions caused by inbreeding effects and excluded enhancement of survival rates when populations were below carrying capacity. In any event, the best panther habitat in Florida is privately owned (Maehr 1990), and rapid agricultural and urban development could soon fragment this habitat into dangerously small parcels. The aggressive protection of habitat and movement corridors is essential to ensure the persistence of Florida panthers.

Two Caveats in Applying this Model

Two caveats apply to this model. First, the model is sensitive to the estimates for carrying capacities for adult males and females. Uncritical use of estimates from a different area or habitat type should be avoided. Because cougars are K-selected, it is probably reasonable to estimate carrying capacity from locally observed densities. However, the great variation in sex and age composition in simulated populations suggests that at least five years of study are needed for reliable estimates (Fig. 6A–B). Also, the carrying capacities used in this model must be estimated by numbers of breeding adult males and females, excluding the pool of nonbreeding male and female transients that characterize most populations (Seidensticker et al. 1973). Categorizing all individuals over 1 year of age as adult breeders would lead to overly optimistic predictions.

Second, survival rates observed for a population occupying a large area will probably decrease as area decreases and degree of isolation increases, due to increased highway mortality (Beier & Barrett 1992*a*) and decreased dispersal success. A conservative approach necessitates use of lower-than-observed survival rates in making projections for a population that has not yet been fragmented or isolated.

Application to the Santa Ana Mountain Range: Site-Specific Data along with Model Conclusions Can Save Land

If survival of this population is a goal, the model yields several clear conclusions (Fig. 7). Developments that isolate or destroy large tracts of habitat should be avoided. A corridor for immigration is of paramount importance. Within the mountain range, corridors are also needed to interconnect the protected parcels (Table 3).

Unfortunately, these conclusions alone have little power to save land in the prodevelopment political climate of southern California. For example, although the admonition to "avoid destroying large tracts" can be implemented without additional data, few planning decisions involve tracts that are "large" relative to the habitat needed to support a cougar population. The other conclusions cannot be heeded without additional data, especially on the location of movement corridors.

Field data suggest that habitat degradation probably prevents any regular inflow via the last potential corridor for immigration (Fig. 2: Pechanga Corridor). Except for the 15-year-old freeway, the obstacles to the Pechanga Corridor are less than 5 years old. If a regional, spatially-explicit land-use plan had been in place in 1986, the importance of this corridor would have been obvious and the obstacles preventable. Strict protection of the remaining habitat and additional habitat modification and restoration will now be necessary if the Pechanga Corridor is to function (Beier & Barrett 1992*b*). The Nature Conservancy is actively interested in taking such steps but faces an uphill struggle.

Our work has also spotlighted a critical corridor necessary to prevent intra-range fragmentation (Fig. 2: Coal Canyon). The City of Anaheim is now considering approval of a housing project that would destroy this corridor. Our documentation of both the importance and use of this corridor should result in a scaled-back project that leaves the corridor intact. The population model convincingly predicts that loss of this corridor would guarantee the extinction of cougars from the 150 km^2 of habitat north of the freeway, reducing by 7.5% the total habitat available to our population and pushing the population leftward to the steeply rising part of the risk curve (Fig. 7). The field work shows that the corridor is in fact used. Thus the model and the field work

together may provide sufficient documentation to protect this corridor; certainly neither could do so alone.

In another application, the model and complementary fieldwork are having limited success in mitigating the effects of a planned freeway; its proposed route slices through a pristine area with no human residents along its 21-kilometer length (Anonymous 1990). This freeway would affect wildlife movement between the bulk of habitat on one side of the road and five smaller areas of dedicated open space on the other side. By all-night radio-tracking of individual focal animals, we have learned the actual routes by which cougars travel among these areas. Although these routes now traverse pristine open space, they will become corridors (at best) as freeway-induced growth removes the adjacent habitat. The transportation agency has responded to this information by planning bridged undercrossings at the five most important crossing points. Previously, the agency had planned on only one of these bridges, and the location was based on geological rather than biological considerations.

Unfortunately, preserving a corridor is not as simple as building a bridge at one point along the corridor. The road-building agency has acknowledged that the freeway, by providing "critical infrastructure to large expanses of open space," will induce massive urban growth (Anonymous 1990:5.13); such growth could sever all of the wildlife corridors, rendering the underpasses pointless. The agency has refused requests to purchase easements to the three most important corridors as mitigation for this induced growth, and it currently faces a lawsuit on this issue.

Conclusions

The cougar is an ideal species for identification of movement corridors for two reasons. First, cougars are an area-sensitive species; therefore a corridor identified on the basis of cougar use will benefit at least one species. Second, a hunting cougar travels an average of 5.5 miles per night (Beier, unpublished data) and thus generates a lot of corridor data in a short time. Collection of comparable data for a less wide-ranging species may take years or generations.

I do not advocate using cougars as a proxy for all species of concern. However, management decisions will not await the conclusion of long-term studies on more sedentary species. In western North America, use of data from telemetered cougars may be the most expedient way to interject biological facts into the analysis of environmental impact and mitigation related to movement corridors. It is certainly a big step above current practices, which include (1) looking at aerial photos in an office and guessing where a corridor ought to be; or (2) labeling the leftover shards of habitat, or the bridge built according to geological constraints, as the "wildlife corridor."

Effective protection of wildlife corridors requires *putting them on the map*. Unfortunately, the current mechanism for such protection is for concerned citizens to detect and force mitigation on each proposed project that threatens the corridor. For the cougar population in the Santa Ana Mountains, this requires monitoring and being prepared to litigate decisions made by five county governments, seventeen municipal governments, two transportation authorities, and the world's largest water district. Because a corridor is only as strong as its weakest link, a single oversight or failure on the part of conservationist volunteers is sufficient to lose the linkage.

Putting wildlife corridors and critical habitat on a planner's map can best be done through a geographic information system covering a *regional* landscape. Although General Plans are mandated for each county in California, such plans are rarely site-specific in any recommendations and are almost never tied to a GIS. Furthermore, as the present case illustrates, a single population or wildland may span several counties, and land-use planning is nonexistent at the regional level.

A spatially-explicit planning tool such as a GIS is essential because it provides the only efficient means of addressing cumulative impact and an accessible forum on which developers, conservationists, and other citizens express their vision of the regional landscape at build-out. Scott et al. (1990) describe a GIS-based approach that would admirably serve a regional plan, and Hollings (1978) gives practical advice that should inspire such planning.

Acknowledgments

This paper is dedicated to agency personnel and biological consultants who risk their jobs to share information that their superiors or clients want to suppress. I thank Dave Bontrager, who first nudged me toward this research in 1989. Field work was supported by California Agricultural Experiment Station Project 4326-MS, California Department of Fish and Game, the County of Orange, and the U.S. Marine Corps. Donna Krucki, Doug Padley, and Duggins Wroe were invaluable in the field. R. H. Barrett of the University of California and T. M. Mansfield of the California Department of Fish and Game provided logistic and moral support that kept the project alive. I thank Reed Noss, David Ehrenfeld, and an anonymous reviewer for constructive comments on the manuscript. I will send a diskette with the simulation program and the Pascal source code for cost of media (IBM-compatible) and postage.

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South Coast Missing Linkages: restoring connectivity to wildlands in the largest metropolitan area in the United States

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This is aDRAFT pre-print of a book chapter that will appear in 2005 In KR Crooks and MA Sanjayan, editors. Connectivity and Conservation. Cambridge University Press

INTRODUCTION

The South Coast Ecoregion encompasses 3.4 million hectares or roughly 8% of California. Lying west of the Sonoran and Mohave deserts and south of the Santa Ynez and Transverse Ranges, the ecoregion extends about 320 km south into Baja California, Mexico (Figure 1). California's most populated ecoregion, it has the dubious distinction of being the most threatened hotspot of biodiversity in the United States, with over 400 species of plants and animals considered at risk by government agencies and conservation groups (Hunter 1999). Despite a human population of over 19 million (2000 census), the South Coast Ecoregion has many large wildland areas, mostly in more rugged and higher-elevation habitats within the Los Padres, Angeles, San Bernardino, and Cleveland National Forests, Santa Monica Mountains National Recreation Area, Marine Corps Base Camp Pendleton, and several State Parks. Although each wildland core area would benefit from expansion, increased protection, and restoration, each enjoys some degree of protection from urban expansion, and few if any major new wildland areas are likely to be designated. Therefore we focus on the previously neglected portion of a wildland network, namely the linkages between core areas.

Although numerous conservation efforts are underway, such as California's Natural Communities Conservation Plans (NCCP) (Polak 2001), these efforts do not span the ecoregion, and do not conserve ecosystem processes and functions that operate over grand scales—such as top-down regulation by large predators or gene flow between core areas lying in different planning jurisdictions. To address these gaps, each of us has worked on independent projects to conserve and connect large wildland areas where large-scale processes can operate in a semblance of their natural rhythms. Since 2000, we have worked together on an ecosystem-wide effort--the South Coast Missing Linkages project (SCML).

SCML began with a statewide workshop in November 2000, sponsored by The Nature Conservancy, U. S. Geological Survey, California State Parks, California Wilderness Coalition, and San Diego Zoo. Over 200 land managers and biologists from throughout California identified 232 actual or potential linkages needed to sustain ecosystem processes in protected wildlands. South Coast Wildlands was formed in early 2001 with an Executive Director, a Board, a team of Science Advisors, and the goal of conserving essential linkages throughout the South Coast Ecoregion. South Coast Wildlands brought together under the umbrella of SCML a variety of agencies and organizations already engaged in various linkage conservation efforts. We worked with these partners to develop a standardized set of methods for conserving a network of protected wildlands for the region.

Widespread and increasing urbanization in most linkage planning areas constrained conservation options and added urgency to the planning process. We experienced an understandable urge to use expert opinion to quickly map conservation targets – a "seat of the pants" approach (Noss and Daly, this volume). However, three ideas compelled us to develop a set of scientific rule-based procedures for delineating what we call our Linkage Design. First, despite our confidence that maps based on expert opinion would lead to sound conservation decisions, when we experimented with more formal methods, we discovered some options that we had overlooked (see also Cowling et al. 2003). Second, a model is transparent. Landowners, developers, conservation investors, and decision-makers demand strong support for recommendations to conserve particular areas. If they doubt one or more assumptions, parameter estimates, data layers, or decision rules, they can re-run the model and see if it makes a difference. Finally, rule-based procedures allow formal sensitivity analysis, a valuable tool for conservation planning.

In this chapter, we describe SCML's science-based, collaborative approach to linkage planning in the largest urban area in the United States. Our goal is to provide one promising recipe for designing plans that conserve and restore connectivity in real landscapes. These methods were developed predominantly by the authors and incorporate a variety of GIS methods developed by others. Significant elements have been incorporated from conservation efforts by our partners, most notably, the workshop-based approach developed by the San Diego State University Field Station Programs.

This chapter is a broad overview to be supplemented by additional papers on the mechanics and results of prioritization, permeability, and habitat analyses. Because our focus is on a science-based approach, we ignore important considerations of history and organizational theory; future papers will describe false starts, historical lessons, and the interplay among biological foundations, conservation design, and conservation delivery. We have already achieved a number of successes with this approach, but acknowledge that it is a work in progress. We adamantly hope that others will improve on our efforts.

The following sections are numbered and titled as prescriptions, because we hope others will use them as an outline for future efforts. Steps 2 through 7 correspond to the six steps in linkage design suggested by Beier and Loe (1992), which have proven rather discrete and chronological in practice as well as in concept. We add a new Step 1 – coalition building – which is logically first and permeates all other steps.

STEP 1: BUILD A COALITION

Key elements in developing a coalition for SCML include serving as a catalyst, engaging partners, holding organizational meetings, forming a steering committee, and developing an inclusive workshop-based approach to conservation planning.

Serving as a catalyst: Conserving a wildland network on a regional scale requires strong collaboration among land management agencies, conservation groups, transportation and resources agencies, sovereign Native American tribes, and others. As the smallest of these entities, South Coast Wildlands serves as a catalyst – an agent that develops synergy among various larger partners. We believe that a small group like South Coast Wildlands can best fill this role because implementing the vision of a connected ecoregional wildland network is our sole focus and raison d'être, rather than one of many priorities vying for attention. Furthermore, most other agencies have internal priorities that would favor some linkages (e.g., linkages that serve lands owned or managed by the agency) that could make them an inappropriate lead agency for a regional effort.

Engaging partners: The statewide Missing Linkages workshop had 5 major sponsors (above). By organizing this successful conference, the nascent South Coast Wildlands earned the respect of these partners. More important, it became

obvious at the workshop that all of the management and conservation agencies considered the workshop simply a first step in linkage conservation. The idea had become mainstream and could command enormous energy if an effective plan were in place. The workshop report (Penrod et al. 2001) – with the logos of these sponsors on the cover – was distributed to most agencies and consulting firms in California and received front-page coverage in most California daily newspapers during its August 2001 release. Ten days later, capitalizing on this publicity, South Coast Wildlands convened a meeting among the original sponsors, plus other organizations potentially interested in linkage conservation in the South Coast Ecoregion. At that meeting, we outlined the proposal, distributed a brief concept paper, asked for feedback, and solicited and received commitments of time and funding to the effort. From the outset, this was presented as a collaboration, not as a project of South Coast Wildlands with others as junior partners.

Partners now include scientific and educational agencies (Conservation Biology Institute, San Diego State University Field Station Programs, San Diego Zoo, U. S. Geological Survey), federal land management agencies (National Park Service, U. S. Forest Service), state agencies (California State Parks, Department of Fish and Game, Resources Agency, Santa Monica Mountains Conservancy), and conservation NGO's (California State Parks Foundation, California Wilderness Coalition, The Nature Conservancy, The Wildlands Conservancy). Each partner allows use of the organization's name and logo on reports and in publicity events, and provides some form of support (not always funding). In addition, we have excellent working relationships with entities that are not yet partners, including Native American tribes, county planning departments, local land conservancies, Bureau of Land Management, the California Department of Transportation, Pronatura (Mexican conservation NGO) and Conabio (Mexico's federal *Comisión nacional para el conocimiento y uso de la biodiversidad*).

Steering Committee: In August 2001, we formed a steering committee with representatives from each major partner. The steering committee holds monthly conference calls to ensure that SCML is integrated with other efforts, most notably the Natural Communities Conservation Plans being developed by the Resources Agency. The steering committee has averted potentially serious misunderstandings and has kept the project on-track and visible to participating groups and agencies.

Workshops: As described below, we used workshops to engage partners in many aspects of linkage planning. By including developers and their consulting biologists, as well as our natural allies, we demonstrated that our process is transparent, inclusive, and honest. When participants saw that their input is genuinely sought and used, they tended to adopt the effort as their own. We have involved partners in every aspect of the process because the plan will not succeed if South Coast Wildlands simply asks partners to implement its plan. Only by collaborating from start to finish will all players fully engage in implementation.

As with any collaboration, our partnership has faced difficulties. Dwindling resources and staff time have prevented some partners from providing resources necessary to conduct some analyses. Perhaps the most problematic issue has been the rare plea to dispense with time-consuming science and get our products out faster. However, we have managed to keep our focus on the big picture and these distractions have not disrupted our working relationships nor changed our commitment to a scientific approach.

STEP 2: SELECT CORE AREAS AND PRIORITIZE LINKAGES

We initiated Beier and Loe's (1992) first step in science-based connectivity planning – identifying cores in need of linkages – at the November 2000 Missing Linkages workshop. A core area was defined as a large wildland with reasonable prospect for retaining its wild character for the foreseeable future, including large military installations, but excluding sovereign tribal lands.

The process was minimally selective; all proposed linkages in California were accepted as long as core areas were identified. For Mexico, where no large protected areas occur within 100 km of the international border but many large wildlands still exist, the nearest areas of natural habitat > 2,000 km^2 were used as core areas. In Mexico, Pronatura and Conabio have enthusiastically greeted our initiative, shared their plans and data, and are working to ensure that cross-border linkages will connect to protected areas in Mexico. Conservation Biology Institute (linkage manager for the cross-border linkages) is our primary liaison with Mexico.

Realizing that resources were insufficient to take immediate, effective action on all 60 linkages in the ecoregion and 9 additional linkages connecting to wildlands in other ecoregions, we proposed 12 linkages for conservation action. Almost immediately, advocates for particular wildlands not directly served by those 12 linkages lobbied to have the list changed or expanded. Obviously, a defensible prioritization process was needed, and only a transparent process open to all partners would suffice.

Following a process inspired by Pressey et al. (1994), Pressey and Taffs (2001) and Noss et al. (2002), South Coast Wildlands invited all partners to send representatives to a prioritization workshop, at which each linkage was scored in two dimensions – biological importance and vulnerability. Participants assigned highest priority to linkages that fell in the upper right quadrant (most important, highest threat). Seven criteria were used to assess biological importance: sizes of the two core areas (35% weighting), the degree to which the linkage facilitated connection to other ecoregions, or was essential to the utility of "downstream" linkages (20%), habitat quality in the smaller core area (20%), existing width and habitat quality in the linkage (10%), the degree to which the linkage connects the ocean to salmonid nursery habitat, or would reduce contaminants, sediment, and insolation of riverine habitat (8%), and the degree to which the linkage might allow for seasonal migration or facilitate range shifts in response to climate change (7%). The seventh criterion was a debit of 10 points for each riverine linkage that lacked upland habitat, was over 10 km long, and had an average width narrower than 200 m. This debit distinguished between true landscape-level linkages and those linkages that, while technically "connecting" large core areas, would not facilitate movement of wide-ranging carnivores or other upland vertebrates due to frequent road crossings, severe edge effects (noise and light pollution, garbage-dumping and other disturbance, conflicts with pets), and low diversity and integrity of natural habitats.

The weighting among scores reflects an emphasis on ecosystem processes and top carnivores, and thus area was more important than the particular habitats or habitat quality in core areas. The full 35 points for size of core areas was awarded to linkages that would connect two large (>2,000 km^2 each) wildlands. We assigned lower scores for a linkage between large and medium-sized (60 to 2,000 km^2) wildlands, or between large and small (<60 km^2) wildlands, down to a low of 0 points for a linkage between two small wildlands. The 2,000 km^2 and 600 km^2 thresholds correspond to the minimum areas required to support puma (Beier 1993) or bobcats (*Felis rufus* – Crooks 2002), respectively, over the short term. In addition to being among the most area-sensitive species in the ecoregion, these high-level carnivores are important regulators of ecosystem function (Terborgh et al. 1999). In addition, one or both of these 2 species occurred in all core areas, and were thus more appropriate than species such as peninsular bighorn (*Ovis canadensis cremnobates*) that were present only in some core areas.

The relatively low weight given to current habitat conditions reflected our optimism that if we could avoid urbanization of large degraded wildlands, we would conserve at least the opportunity to confront the restoration challenges. The relatively low weight for response to climate change was hotly debated. All participants agreed that global change will have profound impact on biodiversity. However there was considerable scientific uncertainty about the direction, seasonality, and magnitude of changes in temperature and

precipitation expected in our ecoregion, with corresponding uncertainty as to which linkages would best facilitate range shifts. To earn the 7 points for this criterion, a linkage had to span an elevation gradient > 650m (2,000 ft) or two major life zones.

At the November 2000 conference, persons describing each linkage had rated the severity of each of several types of threat to the linkage on a scale of 1 (low) to 5 (high). For our assessment of vulnerability, we used the higher of the threat scores for urbanization or roads. We ignored other threats, such as off-road vehicle use or agricultural conversion, on the grounds that these threats are relatively reversible compared to urbanization and roads.

Determining the criteria and scoring system was an iterative process during which participants gradually reached consensus on the conceptual underpinnings of the gestalt ratings that each person held at the start of the process. Scoring the 69 linkages went quite quickly once these issues were resolved. The biological importance scores were clustered in 2 groups, with 22 linkages scoring as most important. Twelve of these 22 priority linkages had high vulnerability ratings (≥ 4), and thus emerged as conservation priorities. In addition, we added 3 linkages with moderate (3) vulnerability scores in areas where our partners had already begun conservation planning. We offer several related justifications for this departure from our prioritization scheme. First, the importance-vulnerability algorithm is not responsive to real-world opportunities, and should be used to inform, but not dictate, conservation decisions (Noss et al. 2002). These opportunities related not only to the particular linkages involved, but also to maintaining and strengthening the coalition needed to conserve these linkages. Finally, in one case, acquisition efforts were half complete, and we reasoned that a quick victory would help maintain partner enthusiasm for the full program.

These 15 linkages are the focus of our current efforts (Figure 1). They include 9 linkages within the South Coast Ecoregion and 6 linkages between ecoregions (including Baja California as an ecoregion). The core areas served by these linkages include all the obvious major wildlands in and adjacent to the ecoregion, such as the San Gabriel Mountains, San Bernardino Mountains, San Jacinto Mountains, Anza-Borrego desert lands, and Santa Monica Mountains. The smallest core area is the Otay Mountain area of southern San Diego County (~150 km^2). The longest linkage spans over 80 km of the privately-owned Tehachapi Mountains to connect the large protected wildlands in the Sierra Madre to those in the Sierra Nevada. The 2 shortest linkages serve core areas separated only by a freeway and a few small private parcels. For other linkages, the edges of the two protected cores are 6 to 24 km apart.

Each linkage was adopted by a partner organization to serve as its "linkage manager," or the entity most responsible for planning that linkage. South Coast Wildlands, San Diego State University Field Station Programs, National Park Service, The Nature Conservancy, California State Parks, US Forest Service, and Conservation Biology Institute serve as linkage managers or co-managers.

STEP 3: SELECT FOCAL SPECIES FOR EACH LINKAGE

Although our ultimate goal is to conserve ecosystem function, we designed linkages to serve the needs of particular focal species. We used a focal species approach for the practical reason that we do not know how to conduct permeability analysis or design a linkage (Step 4) in a way that directly conserves ecosystem processes in the core areas. We acknowledge that our approach could result in linkages that allow movement of focal species between core areas, but that might fail to conserve natural patterns and mechanisms of gene flow, pollination, seed-dispersal, interspecific interactions, energy flow, and nutrient cycling. We do not take this risk lightly. However, given the pace of urbanization, we cannot wait for answers to these questions. We can immediately exploit the focal species approach, which has the further advantage that species-based management

is accepted and supported by managers, decision-makers, and public opinion (Lambeck 1997, Miller et al. 1999, Carroll et al. 2001, Bani et al. 2002, Noss and Daly, this volume).

To minimize the disconnect between focal species and ecosystem processes (Ricketts et al, this volume), we sought a variety of focal species for each linkage, including species that are closely related to ecosystem function or sensitive to linkage loss, such as indicator species, keystone species, area-sensitive species, and umbrella species (Miller et al. 1999, Coppolillo et al. 2004). For instance, a linkage that serves focal species such as puma (*Puma concolor*) conserves one necessary condition for top-down trophic regulation. Similarly, we hope that a linkage designed to serve a plant species with limited seed dispersal will conserve that process for less dispersal-limited species.

Our suite of focal species also included a few "orthogonal" species, i.e., a species that occurs within the linkage but not necessarily in the core areas. Planning for such species can help ensure that linkages maintain ecological integrity and are not sterile gauntlets through which other species must pass. Thus, although most of our focal species were "species that need the linkage" (to pass between core areas), the orthogonal taxa represented "species the linkage needs" (to ensure its integrity). For example the little pocket mouse (*Perognathus longimembris*) occurs on fine sandy soils in arid valleys between major mountain ranges, but not in the mountains themselves. Its sensitivity to human barriers, such as roads and concrete ditches, made it a good focal species for ensuring linkage integrity between the mountainous uplands.

We did not give rare or threatened species special priority as focal species, although some, such as San Joaquin kit fox (*Vulpes macrotis mutica*), were chosen because they met other criteria. Rarity in itself does not make a species a good keystone, umbrella, or indicator species.

Focal species were selected by participants in five workshops, each organized around 1 to 4 linkages in geographic proximity. Participants included land managers, planners, consulting biologists, California Department of Fish and Game staff, and experts on species, habitats, and conservation plans in the linkage area. Selected taxonomic experts gave presentations on what was known about various species habitat connectivity requirements and suggested some initial candidate focal species. Participants then sorted into taxonomic workgroups to select focal species. South Coast Wildlands and the collaborating linkage manager provided detailed instructions on how to select focal species and emphasized how these species would be used to design and justify the linkage, and to serve as indicators of linkage function over time.

Participants were asked to select species that (a) require inter-core dispersal at the scale of *this* landscape for metapopulation persistence, (b) have a localized distribution at the spatial scale of this landscape, (c) have short or habitat-restricted dispersal movements, (d) represent a surrogate for an important ecological process (e.g., predation, pollination, fire regime), (e) need connectivity to avoid genetic divergence of a now-continuous population, (f) might change from being ecologically dominant to ecologically trivial if connectivity were lost, (g) is an important pollinator or seed disperser, or would suffer reproductive failure if it lost the service of a fragmentation-sensitive pollinator or seed disperser, or (h) is reluctant to traverse barriers (e.g., culverts under roads) and would be a useful umbrella for other species sharing this trait. Workgroups tried to include focal species that varied with respect to habitat specialization and dispersal distances, but were asked to limit the number of species chosen to < 6 per taxonomic group. Workgroups reviewed the lists of other workgroups to eliminate redundant species, i.e., species that seemed unlikely to add to the linkage design in light of other included species. In deciding which of two species to consider, we retained the species whose habitat needs and local distribution were better known.

A total of 109 species were identified in all 15 linkages, including 26 plants, 25 invertebrates, 18 amphibians and reptiles, 4 fish, 20 birds, and 16 mammals. Although some species (usually plants or invertebrates) were selected for a single linkage, the average focal species appeared on lists of 2.7 linkages (range 1 to 15 linkages). Puma, mule deer (*Odocoileus hemionus*), and badger (*Taxidea taxus*) each appeared on lists for 14-15 linkages. Steelhead (*Oncorhynchus mykiss*), western pond turtle (*Clemmys marmorata*), and western toad (*Bufo boreas*) each appeared on 9 or more lists. On average 19 focal species were identified per linkage (range 14 to 32).

STEP 4: CREATE A DETAILED LINKAGE DESIGN

We developed a multi-stage procedure for identifying priority lands for conservation in each linkage. The first three stages (A-C below) reflect the different types of focal species and the considerable variation in ecological knowledge available for each. For appropriate species (A), we used least cost corridor analysis (B) to identify lands likely to facilitate movement. Patch size and configuration analysis (C) was then used to evaluate whether each focal species could persist and move through the union of least-cost paths, and to expand that union as needed. The final stage (D) added a buffer to accommodate edge effects, ecological uncertainty, metapopulation dynamics, and processes and species omitted from the analysis.

A. Determine whether least-cost corridor analysis is appropriate to identify lands that best facilitate movement of each focal species, or their genes, between the two core areas.

Least cost corridor analysis (LCCA) is a GIS-based method of estimating the optimal location of a landscape linkage between core protected areas based on estimates or assumptions about how a focal species responds to various landscape features that can be reflected in digital map layers (Singleton et al. 2002, Theobald, this volume). Because least cost *corridor* analysis identifies all pixels with low travel costs, it produces a swath that can include >1 alternative path, and is thus superior to least cost *path* analysis, which yields a single path one pixel in width for its entire length (Theobald, this volume). Other alternative approaches to LCCA are presented by Bani et al. (2002), Carroll (this volume), Clevenger and Wierzchowski (this volume), Fagan (this volume), Noss & Daly (this volume), and Tracey (this volume). We chose LCCA because we lacked detailed data needed for the more sophisticated alternatives (such as movement of radio-tagged animals, or parameter estimates for spatially explicit population viability models).

Although the most quantitative and flashy tool in our toolbox, LCCA is the most data-demanding. It is also inappropriate for some focal species. To guard against inappropriate use of this tool, we used it only for species that met all three of the following criteria: First, we must know enough about the movement of the species, or the movement of its obligate pollinators and seed dispersers, to estimate cost-weighted distance using the data layers available to us. For example, although steelhead and arroyo chub (*Gila orcutti*) are confined to streams, the GIS stream layer is not detailed enough to indicate which stream stretches have aboveground flow (most blue-line streams in the area do not), or what barriers might exist to movements. Second, the species must occur, or have historically occurred, in both core areas to be linked, such that restoration is feasible, and the species or its genes must be capable of moving between the cores (although not necessarily within a single generation). This excluded the orthogonal species from LCCA. Third, the time scale of the species' gene flow between core areas must be shorter than, or not much longer than, the time scale at which currently mapped vegetation layers are likely to be replaced by disturbance events and other environmental variation. This condition excluded focal species such as Engelmann oak (*Quercus engelmannii*), for which gene flow would only occur over many hundreds of years. This criterion would not be needed for a LCCA that included

dynamic vegetation maps reflecting vegetation response to disturbance or climate change.

In each linkage, about half of the focal species (including reptiles, amphibians, birds, and mammals, but no fish, invertebrates, or plants) met our criteria for conducting LCCA. We considered the needs of the other species via habitat suitability analysis (Section C, below).

B. For appropriate focal species, conduct least cost corridor analysis (LCCA)

We conducted LCCA using four GIS data layers that were readily available and likely to influence movement of many animals: vegetation/land use, topographic feature (ridge, canyon bottom, flat, or slope), elevation (classes defined by each species expert), and road density (km of paved road per km^2). Land use (urban, agriculture, disturbed) and paved road density are intended to encompass all the human activities that affect suitability of linkage habitat. Although other measures (densities of humans, livestock, pets, off-road vehicles) seem attractive, most of these are probably highly correlated with urban land uses or paved road density, and none are readily available in GIS format.

For each focal species subject to LCCA, we asked a biologist studying that species or a closely related species to estimate the relative importance of each factor for habitat use by the animal. Recognizing that it is impossible to disentangle the influence of vegetation from that of topography and elevation, we instructed the rater to think of vegetation as the factor that integrates the influence of topography and elevation in a way that is most important to the species. We also stressed the priority of vegetation because there is a much larger literature on selection of vegetation types than on responses to the other factors. Thus the weights for elevation, topography, and roads reflected only their *additional* influence on animal habitat preference; in some cases this resulted in 0% weights for these factors.

The biologist also scored the various vegetation/land-use classes, elevation classes, topographic classes, and road-density classes with respect to animal preference on a scale of 1 (highest preference) to 10 (strongest avoidance). Because Clevenger et al. (2002) found that expert-based models that did not include a literature review performed significantly worse than literature-based expert models, we asked raters to first assemble the literature on habitat selection by the focal species and closely-related species, and we offered assistance in gathering those papers.

Although these scores (weights in the equations below) were used to parameterize a LCCA, we asked raters for habitat preference scores rather than *permeability* or *travel cost* scores. We made this decision because experts are much more consistent in rating habitat suitability than in rating ability to move through a habitat (B. McRae and P. Beier, unpublished data on ratings of habitat suitability and permeability provided by 6 puma experts). Furthermore, there is a large literature on habitat use and preference, but almost no literature on permeability or travel cost in various habitats.

We used California Fire and Resource Assessment Program (FRAP) land cover/land use data as the source for our vegetation layer, USGS 30-meter digital elevation models (DEM) for our elevation layer, and a topographic feature layer derived from elevation and slope models using Weiss' (2000) topographic position and landform algorithm. Because our field work showed that the only widely available digital road layer (TIGER Line files - Census 2000) failed to differentiate between unimproved roads and paved roads, we used road data from Thomas Brothers, Inc. and 1-meter aerial imagery to modify these files to create a paved road density layer. We did not distinguish among types of paved roads (e.g., freeway versus 2-lane highway) nor among roads with differing traffic volumes.

Our LCCA was similar to that of Singleton (2002) except that we used an additive model rather than a multiplicative one. (We do not claim superiority for our additive model; we are currently assessing whether the two approaches produce different

maps.) Pixel size was 0.09 ha (30-m grid) in each linkage except one in which data availability forced us to use 1-ha cells. For each species, each pixel was assigned a travel cost,

$$C = \sum_{i=1}^{4} w_i \bullet s_j ,$$

where w_i = the weight assigned to factor i (e.g., vegetation type or road density), and s_j = the score assigned to class j (e.g., to the particular vegetation type or road-density class in that pixel). To estimate the cost of movement from the edge of one core area, we assigned each pixel a cost-weighted distance,

$$D = \min \sum_{i=1}^{k} C_i ,$$

where k = the number of pixels along a path from the focal cell to the largest block of suitable habitat (as defined by California Department of Fish and Game 2002) within one core area. Superimposing (adding) the cost-weighted distances from the 2 core areas produced a map depicting, for all pixels in the linkage area, the average cost-weighted distances from the two core areas (Figure 2; see also Theobald, this volume). We tentatively accepted the lowest percentile that formed a continuous swath between cores (usually 1% or 2%, maximum 5%).

The least-cost corridor for each species was sent to one or more species experts and persons familiar with the landscape, who reviewed the model structure and outputs, and recommended a percentile (e.g., the most permeable 2% of pixels) that would allow movement of the focal species (Quinby et al. 1999). Although this recommended percentile sometimes was higher than the lowest percentile that produced a continuous swath, the Linkage Design (which reflected needs of additional species and a minimum width) always encompassed the expert-recommended minimum. If needed, we would have expanded the Linkage Design to accommodate an individual focal species, but our multiple-species approach made it unnecessary to engage in this subjective process (Quinby et al. 1999).

We combined the maps of all species to produce a union of least cost corridors (ULCC) that encompassed the entire least cost corridor of each species. We decided not to map the ULCC using different tones to indicate the number of species served by different parts of the ULCC, on the grounds that this would not promote our policy of "No species left behind." In most cases, the ULCC formed a single band between the core areas.

LCCA will always produce a least-cost corridor, even if the "best" corridor crosses a freeway, aqueduct, or other obvious barrier to movement of focal species. To address this, any competent practitioner will conduct fieldwork to identify such barriers and recommend appropriate restoration or mitigation. However, we caution practitioners about a more subtle pitfall. A transportation agency or developer may be tempted to use LCCA to simulate the impact of adding a road or a golf course to the heart of a linkage area. It is important to understand that LCCA will almost certainly produce the same map – complete with the road or golf course within the best 1% – because this area will still be more permeable than the adjacent housing tract or reservoir. Because someone would inevitably misinterpret such a result as indicating "no impact on connectivity," it is best to avoid such abuse of LCCA altogether. Put another way, LCCA should not be used to evaluate scenarios about landscape features (such as a particular highway) that occur at a finer scale than the inputs into the analysis (such as road density, which is only crudely related to any particular road).

C. Conduct habitat suitability analysis

A least-cost corridor does not necessarily encompass habitat patches large enough to support viable populations, nor are such patches necessarily within the dispersal distance of the focal species. To evaluate the effectiveness of each ULCC to provide connectivity for all focal

species (including orthogonal species and other species for which LCCA was not conducted), we mapped the distribution and size of suitable habitat patches for each focal species. We used suitability scores provided by experts, or extracted from literature review or the California Wildlife-Habitat Relationships database (California Department of Fish and Game 2002) to identify suitable habitat in the planning area. We considered a cluster of pixels large enough to support 50 individuals as a *potential population center*; rounding up to the nearest order of magnitude in hectares (e.g., we rounded 2 ha to 10 ha, and 650 ha to 1000 ha). This rounding avoids belabored inferences from published estimates of home range size or density. Similarly we considered a smaller cluster of suitable pixels large enough to support >2 individuals (again rounded to the nearest order of magnitude) as a *potential habitat patch* if it was within twice the species' mean dispersal distance from a potential population center. We chose twice the mean dispersal distance because estimates of dispersal distance are based on small samples (thus missing extreme events) and are biased low (because researchers lose track of individuals that move beyond the researcher's search radius – Barrowclough 1978). The rare dispersals longer than the known mean can be responsible for significant gene flow or demographic rescue (Brown and Kodric-Brown 1977). Thus using the mean would cause potentially important patches to be considered "useless". When data were lacking, we used the home range size and dispersal distances for other species in the same genus or family from studies in the most similar ecoregion.

Using this map of potential population centers and habitat patches for each species relative to the ULCC, we evaluated whether adding potential centers or patches would enhance the distribution of habitat already captured in the ULCC. If the focal species could fly across urban or agricultural areas, the patch was added as a disjunct stepping-stone. For other species, we added pixels of native vegetation (or agricultural land if insufficient native vegetation was present) to allow the species to connect the area to the ULCC.

D. Impose minimum widths on each ULCC.

Portions of some linkages were narrow due to the distribution of urbanized or agricultural lands. We expanded any constriction points along the ULCC to a width of 2 km by adding pixels of natural vegetation, or, when there was insufficient natural vegetation, agricultural land (on which natural vegetation should be restored). We did not add pixels of urbanized land, however, and this often precluded expansion to 2 km. When possible we used additions to increase the diversity of topographic elevation and aspect within the linkage, reasoning that this would increase the utility of the linkage during future climate changes.

There are many reasons why linkages should be wide. (1) Many smaller animals, such as salamanders and lizards, will take dozens of generations to cross between core areas, and thus need enough area to support resident metapopulations over time. (2) For species whose needs are not well represented by our focal species, a wide area will help ensure availability of appropriate habitat or habitat elements (e.g., host plants, pollinators, roosting sites). (3) Contaminants, sediments, and nutrients can reach streams from distances > 1 km (Maret and MacCoy 2002, Scott 2002, Naicker et al. 2003), and fish, amphibians, and aquatic invertebrates often are more sensitive to land use at the watershed scale than at the scale of narrow riparian buffers (Goforth 2000, Fitzpatrick et al. 2001, Stewart et al. 2001, Wang et al. 2001, Scott 2002, Willson and Dorcas 2003). (4) A wide linkage buffers against edge effects (pets, lighting, noise, nest predation, nest parasitism). (5) Fire is a natural disturbance factor in the South Coast Ecoregion, and a wide linkage allows for a semblance of a natural fire regime to operate with minimal constraints from adjacent urban areas. (6) A wide linkage enhances the ability of the biota to respond to climate change. (7) Harrison (1992) suggests that a linkage for a species that needs to

live in (as opposed to move through) the corridor should be approximately the square root of half an individual home range area.

Harrison's (1992) reasoning provides an attractive argument for a width of 1 to 2.5 km to accommodate badgers, coyotes, or bobcats (home range sizes reported by Goodrich and Buskirk 1998, Riley et al. 2003). However, these species probably could use a linkage 6-24 km long (i.e., the lengths of most of our linkages) that provided a combination of live-in and pass-through habitat. None of these arguments provide rigorous support for 2 km (or any other value) as a minimum width. We chose 2 km as a reasonable width that probably achieves 5 of these 7 goals, although it may be too narrow to allow a fire regime that simulates natural conditions (#5) or enable biotic response to climate change (#7).

The Linkage Design

For each linkage, we use the term *Linkage Design* for the map depicting the buffered ULCC. In most of our linkages, the Linkage Design was a relatively narrow swath 6-24 km long and 2-3 km wide along most of its length, with occasionally constrictions to accommodate existing urban development. But several Linkage Designs encompassed broader areas for part of their length, including large patches that can function as stepping stones or even core areas for even the most area-demanding focal species.

A narrative accompanying the Linkage Design map described the extent to which the Linkage Design serves the needs of each focal species. Although the Linkage Design offers the best chance of facilitating movement of each species, we have to admit that our best may not be good enough for some focal species in some linkages. For example, grasslands have been almost entirely lost to development in several linkage areas, making it difficult to create a corridor for badgers. For the remaining focal species, we hypothesize that, even after urbanization of areas outside the Linkage Design, focal species or their genes would move between core areas in a way that ensures species viability. In non-scientific parlance, this hypothesis can be expressed as "If we build it, they will come." For orthogonal species, we hypothesize that the species would persist within the Linkage Design after urban build-out. We discuss testing these hypotheses in Step 7.

STEP 5: SPECIFY RESTORATION OPPORTUNITIES AND MANAGEMENT NEEDS

Linkage managers used high-resolution aerial photos and fieldwork to identify restoration opportunities and management needs (e.g., road and aquatic barriers, land use patterns) for each Linkage Design. The fieldwork was especially valuable. For instance, high-resolution air photos suggested that an oil refinery was blocking a potential linkage, but fieldwork showed the facility to be abandoned and posted for sale. In another case, lush riparian vegetation on the air photo proved to be thickets dominated by the invasive exotics tamarisk (*Tamarix ramosissima)* and giant reed (*Arundo donax)*. Biologists walked each aquatic linkage and photographed and measured dams, siphons, and encroachments. Highway edges were photographed, and existing crossing structures measured. Sites where improved road crossings could be constructed were identified. In rural areas, biologists noted the local styles in fencing, outdoor recreation, lighting, livestock husbandry, and pet control. Locations of important features were recorded with GPS. We provided a narrative and accompanying photos to document these existing conditions.

The narrative also included recommendations regarding land use, domestic livestock, pets, off-road vehicles, artificial night lighting, and recreational activities. As appropriate, we proposed restoration of native vegetation, removal of aquatic barriers, rehabilitation of mined areas, and, most especially, improvement of permeability across major roads. High traffic volumes on Southern California freeways for the last 30-50 years have made these roads into especially formidable barriers. For example, in a

study of genetic structure of pumas throughout California (Ernest et al. 2003), constricted gene flow was apparent where Interstate 15 crosses between the Santa Ana and Palomar Mountains, where Interstate 80 crosses between the Central Coast and North Coast Ecoregions, and where Interstate 5 passes between the Sierra Nevada and Transverse ranges. These discontinuities were almost as pronounced as those across the Central Valley (converted to agriculture 150 years ago), or across the rock and ice of the Sierra Nevada crest.

Thirteen of the 15 linkages were crossed by freeways up to 10 lanes wide. Only two of these 13 freeway segments had crossing structures that facilitate movement of terrestrial species. Our LCCA and habitat suitability analyses deliberately ignored the location and quality of existing freeway crossing structures, none of which had been located or built to facilitate wildlife movement. Because such structures are easier to create, re-locate, and improve than native vegetation, topography, and urban areas, we viewed them as landscape elements that should respond to animal movement patterns, rather than vice versa. We caution conservationists undertaking similar efforts not to let locations of existing road-crossing structures channelize their thought processes and skew their recommendations away from biological optima (Clevenger and Wierzchowski, this volume).

Where >1 biological optimum was apparent, we considered existing culverts and crossing structures within the Linkage Design as places where improved structures could be constructed at lower cost (Figure 3A). Anecdotal information (e.g., road kills, game trails, animal sign) also helped suggest locations for crossing structures. In some locations, we recommended vegetated overpasses (Figure 3B), or converting vehicle underpasses into wildlife underpasses (Figure 4). Where a highway crosses a linkage for several kilometers, we recommended multiple crossing structures spaced as close as 2 km apart (Clevenger and Wierzchowski, this volume).

We made bold recommendations for maintenance, enhancement, and construction of wildlife crossing structures, but in discussions with transportation agencies, we did not ask for immediate construction of major improvements. Instead we emphasized the opportunity for the agency to implement meaningful mitigation measures when they next add lanes or otherwise upgrade these freeway segments. Although improvements may not occur for a decade or more, we hope that once connectivity is restored, genomes of all affected species will rapidly recover.

STEP 6: PARCEL LEVEL MAPS AND IMPLEMENTATION

Throughout our reports and meetings, we have emphasized the importance of connecting two core areas for the sake of biodiversity in all its dimensions. We have to remind even our most sympathetic friends that this is not just an effort "to get the puma across the road." Although roads emerged as the most important potential barrier in every linkage, the best-designed crossing structures only make sense if they are appropriately sited, and if the wildlands between the road and each core area are conserved. Although pumas are an important focal species, whatever linkages we conserve over the next decade will provide all the connectivity any species will enjoy for the next century or more.

To promote this broad view, our written reports described the likely biodiversity consequences of losing the linkage and the conservation investments in the core areas that would lose or gain ecological value due to success or failure of this project. The value of state and regional parks, National Forest land, and private reserves in these areas reaches in the billions of dollars, and a relatively modest investment in connective habitats can help ensure their continued value. We also described how linkage protection would advance other conservation efforts in the area.

Although conservation decisions, such as purchases of easements or land, or changes in zoning, will be made at the parcel level, our

printed reports offered no recommendations more site-specific than the Linkage Design map and descriptions of improved highway crossing structures. We made a strategic decision to exclude from our published reports any parcel maps and any data on size, value, zoning, or ownership of parcels. We believe that publishing such data could be counterproductive because media, developers, landowners and others are likely to focus on the parcel map. Arguments about individual parcels would distract from the scientific and conservation message embodied in the Linkage Design.

Our partners are currently in the process of translating the Linkage Design into priority parcels for conservation action. Partners select priority parcels, and discuss appropriate conservation measures, at small workshops at which politically sensitive discussions can take place. For instance, partners can discuss the biological and economic tradeoffs of omitting specific parcels from the conservation plan, or of allowing trophy home development on a few key parcels in the Linkage Design, or whether easements, purchase, or zoning would be the most appropriate tool for conserving the linkage value of a particular parcel. These compromises are sometimes disconcerting, but we recognize that decisions to make conservation investments lie with the investors rather than the scientists, and that conservation delivery involves an expanded set of skills compared to conservation design (See Casterline et al, this volume).

The role of science, and of South Coast Wildlands, will not terminate with the release of the 15 Linkage Conservation Plans for the South Coast Ecoregion. We envision a series of implementation meetings at which partners will interactively build scenarios using South Coast Wildlands' biological expertise, photo-documented descriptions of potential barriers, and GIS layers (including 1-m resolution air photos, parcels, zoning, and administrative boundaries). Immediate feedback from scientists on the likely biological consequences of various decisions will help the conservation community make scientifically sound decisions.

On-going conservation activities with linkage managers have provided opportunities for enhancing and supporting linkage conservation. For example, the South Coast Conservation Forum, a coalition of county, state, and federal agencies, universities, and NGOs was recently formed to advise the Department of Defense on reducing urban encroachment and conflicts with military training maneuvers on Marine Corps Base Camp Pendleton. On the basis of information we provided, Department of Defense recognized the linkage as an important mitigator of long-term impacts to sensitive species in this planning area. This effort may effectively protect the western third of the Santa Ana-Palomar Mountains linkage, one of the 15 priority linkages. Similarly, South Coast Wildlands collaborated with other conservation groups to suggest reconfigurations of the proposed reserve system for the Western Riverside County Multiple Species Habitat Conservation Plan. That plan offered better species protection at less cost. Riverside County has incorporated some of our recommendations, which may help secure two of our linkages.

Public outreach is also an important part of implementation. Our interim products are of interest and utility not only to partners, but also to citizens, media, and conservation educators. These materials include maps of conservation designs, biological attributes, and restoration opportunities. We make these available as rapidly and as widely as possible through our website and on CD-ROM. We have also prepared two types of visual journey through each linkage: (1) a flyover animation consisting of color aerial photographs draped over a digital elevation map, and (2) an interactive USGS 1:24000 topographic map of the Linkage Design hyperlinked to digital photographs taken from the ground to simulate a walk through the linkage.

STEP 7: DESIGN AND IMPLEMENT A MONITORING PROGRAM

As described in Step 4, each Linkage Design map, with accompanying recommendations for management and restoration, embodies one or

more testable hypotheses regarding focal species. To advance the science of linkage planning, we intend to design monitoring programs that address these hypotheses. Design of a monitoring program must address several related challenges, including formulating testable predictions, securing long-term funding, implementing improvements (e.g., a new crossing structure, restoring vegetation), and collecting data.

Deriving testable predictions from the vague hypothesis that "the Linkage Design benefits focal species" first requires selecting an appropriate dependent variable, such as numbers of linkage passages by individual animals, or demographic or genetic traits of the populations in the core areas (Beier and Loe 1992, Beier and Noss 1998). Movement studies should attempt to confirm whether movements between core areas occur often enough to influence population viability, and that in a landscape without linkages such movements would occur too rarely to benefit the population. Beier and Noss (1998) recommended a Before-After-Control-Impact-Pairs design to maximize strength of inference from these minimally replicated landscape experiments. Two types of control sites are feasible. For example if we are restoring a linkage between two core areas that are apparently isolated from each other, the control site could be either two well-connected core areas or another pair of disjunct cores for which no restoration is planned. We believe the strongest inferences would flow from having both types of controls, but finding suitably matched sites in this rapidly changing landscape will not be easy.

Peculiar funding issues arise because pre- and post-treatment data may need to be collected over the course of many years. Any ecologist who has undertaken studies on vertebrate response to forest treatments can attest to the agony of collecting pre-treatment data and waiting years for well-intentioned management agencies to start and complete treatments. Research on linkage function will be a similar waiting game. Recruiting researchers to conduct independent research on plant and animal populations in linkages with an eye for repeating these studies in 10 to 20 years may be one solution. Finally, interpreting the results of a monitoring program will be complicated by inevitable differences (due to compromise and errors) between planned treatments and treatments as implemented. We do not view any of these problems as insurmountable, and we hope to design a monitoring framework that is rigorous, robust to these difficulties, and relevant to implementing biotic linkages in a real landscape.

Although the long-term (decades to centuries) effectiveness of each linkage is the most important response variable for adaptive management, we also recommend research to document indicators of short-term (months to years) success of each linkage. In most cases, this will involve documenting animal use via camera traps, tracks, scats, trapping, or other surveys. For instance, if adjacent habitat is suitable, a new highway-crossing structure should start to be used by focal species within 1-3 years after construction (N. Dodd, Arizona Game and Fish Department, unpublished data from SR-260 study). Failure to observe such use would indicate that either the design of the structure, or that some other element in the linkage, is defective. Such information should promptly inform improvements in other linkages.

Conclusions

The remaining large wildlands of the South Coast Ecoregion form an archipelago of natural open space within one of the world's largest metropolitan areas. Until the recent dramatic surge in human domination of this landscape, these wild areas formed one ecological system. We envision a future interconnected system of natural space, and we offer our approach as a biologically defensible and repeatable procedure to design conservation linkages.

Hallmarks of the SCML project have been the development of rigorous quantitative methods to prescribe linkage conservation needs and the highly collaborative nature of the planning effort. This approach (1) spans jurisdictional boundaries and promotes the partnerships needed to implement landscape connectivity at this scale, (2)

garners greater visibility from agencies and focuses disparate conservation efforts on a coordinated regional plan that appeals to the public and to the agencies, (3) increases the effectiveness of partners working at local scales, (4) increases rigor and objectivity and provides products that are defensible in touchy political and social arenas, and (5) enhances communication by providing beautiful and easily comprehensible graphic outputs for agencies and the public.

We trust that our approach will be copied, tweaked, and improved by others. Arizona has initiated a similar effort with two promising innovations. First, the Federal Highway Administration (FHWA) and Arizona Department of Transportation (ADOT) were involved as lead agencies from the start. Because these agencies are such a critical part of implementing any solution, having them involved in a meaningful way (developing the agenda and providing web-hosting and GIS support for the initial workshop) augurs well for the Arizona effort. Second, at Arizona's initial statewide workshop, participants were asked to provide the data needed for prioritization, as well as list focal species for each linkage. Obtaining data on biological importance has enabled Arizona to prioritize linkages more rapidly. Although the lists of focal species obtained at the initial workshop are less comprehensive than those developed in California, Arizona may be able to select additional focal species for the priority linkages more quickly, perhaps by an e-mail appeal to knowledgeable persons, followed by dialogs between experts (either 1 at a time or via conference call) and a highly skilled staff person. Thus Arizona consolidated Steps 2 and 3, and jump-started Step 4.

Arizona's effort is led by a coalition of agencies (chiefly Arizona Game and Fish Department, ADOT, FHWA, and US Forest Service) rather than an NGO. This has advantages (prominent roles for and buy-in from the transportation agencies, more financial stability than a tiny NGO), but we do see a risk in having no analog to South Coast Wildlands. Not one person in Arizona goes to work each day with the sole goal of advancing connectivity in the state. Although the commitment of each transportation agency has been genuine and impressive, will it be sustained as political administrations change, or when key players must pay attention to other priorities? An excellent step toward minimizing this risk has been proposed for the next reauthorization of the US Transportation Efficiency Act. If enacted, the law would require FHWA and state transportation agencies using federal dollars to consult with state wildlife agencies at the initial stages of project planning. It would also make federal dollars available to pay the salary of a state liaison. This could ensure that each state would have a staff person in their conservation agency whose primary job is to be engaged in consulting with transportation agencies.

We cannot overemphasize the importance of investing in building and maintaining relationships. Development of technical plans to overcome barriers to animal movement must be matched by efforts to build and maintain linkages among all the players. We advise similar efforts to budget ample time to engage partners, especially including extra time and effort for relationships that span sovereign boundaries. It is not sufficient to e-mail invitations to Mexican and Native American tribal agencies. International travel can be difficult and relatively expensive. Tribal sovereignty and ways of doing business must be respected.

Our effort has received considerable publicity, virtually all of it positive. We believe media exposure has been helpful and urge other efforts to use public-relation specialists in partner agencies to generate and sustain positive publicity. Participants in a workshop get positive reinforcement when they see a news story on the event or on the release of the workshop report several months later. Agencies (such as a transportation agency) gain confidence about moving in a new, "greener" direction when they are publicly praised for their action; it is especially useful if high-ranking officials are featured in press releases. Reporters tend to be

sympathetic filters, especially in the early stage of identifying pairs of core areas in need of connectivity (with connective areas only vaguely defined). Developing rapport with reporters, partners, and the public at this time can help set a positive tone for later stories about specific implementation measures.

Although insects, plants, and birds need connectivity, the large four-legged furred creatures will probably be the first to suffer when connectivity is lost, and they are often the best flagships to "sell" a linkage design. We urge practitioners to emphasize the needs of flagships (including reptiles and other non-mammals) to garner public support.

Large mammals also tend to lend themselves to least-cost corridor analysis (LCCA). Because LCCA produces crisp and persuasive GIS outputs, it is tempting to use LCCA for all focal species. However, we advise careful matching of analytical tools to the species natural history and the data available for each species. For example, a pixel-to-pixel permeability analysis for most birds would not pass the "laugh test" for either scientific or lay audiences, both of which know that most birds can fly over dozens of pixels of inappropriate habitat. We offer patch size and configuration analysis (Step 4C) as a way to meaningfully consider the needs of diverse species, including those for which LCCA is not appropriate.

Finally, in an ecoregion less urbanized than the South Coast of California, we advise that the Linkage Design (Step 4) should rarely be a narrow hard-line corridor. Simberloff et al. (1992) suggested that connectivity could best be obtained by managing "the entire landscape... as a matrix supporting the entire biotic community." Although massive urbanization in our landscape precluded this option in many of our linkages, we did pursue this option in those portions of those linkages where it was feasible. We envy those who have the luxury of managing broad swaths for permeability throughout their ecoregion.

The United States' largest metropolitan area has a human infrastructure without equal on the planet. People, water, information, electric power, gas, automobiles, and trains move across this landscape with remarkable efficiency (Figure 5). Our goal is to create a "green infrastructure" that is commensurate with these other types of infrastructure. We pray that the quality of our effort befits this global hotspot of biodiversity.

Acknowledgments

We acknowledge all of our partners in SCML for working to develop meaningful outputs that are useful products in conservation planning. We thank workshop participants and other experts for their time in providing valuable information on focal species. This effort would not have been possible without funding from The Wildlands Conservancy, The State Resources Agency, US Forest Service, California State Parks Foundation, Environment Now, and in-kind support from Zoological Society of San Diego, The Nature Conservancy, SDSU Field Station Programs, and Conservation Biology Institute. We thank Sedra Shapiro, Executive Director SDSU Field Station Programs, for her work in developing the format for the workshop-based planning approach and application of planning results.

We give special thanks to the steering committee for the South Coast Missing Linkages Project: Madelyn Glickfeld (The Resources Agency California Legacy Project), Gail Presley (California Department of Fish and Game), Therese O'Rourke (U.S. Fish & Wildlife Service), Rick Rayburn (California State Parks), Ray Sauvajot (National Park Service), and Tom White (U.S. Forest Service). Finally, we recognize our partners on the South Coast Missing Linkages Project: The Wildlands Conservancy, The Resources Agency, U.S. Forest Service, California State Parks, California State Parks Foundation, National Park Service, San Diego State University Field Stations Program, Environment Now, The Nature Conservancy, Conservation Biology Institute, Santa Monica Mountains Conservancy, California Wilderness

Coalition, Wildlands Project, Zoological Society of San Diego Center for Reproduction of Endangered Species, Pronatura, Conabio, and Universidad Autonoma de Baja California.

Data sheets used in workshops and spreadsheets used in prioritizing linkages in California and Arizona are available from the authors on request.

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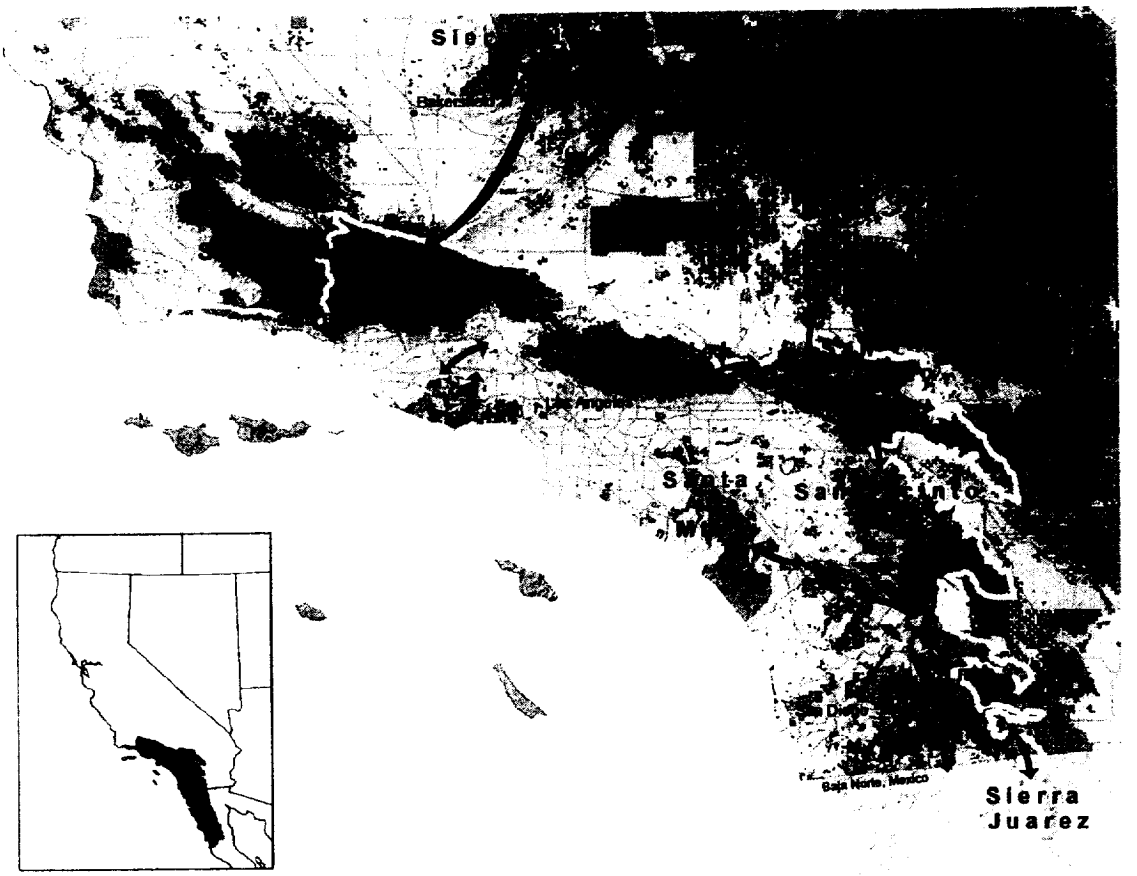


Figure 1. Map of the South Coast Ecoregion (inset) and the 15 priority linkages for South Coast Missing Linkages.

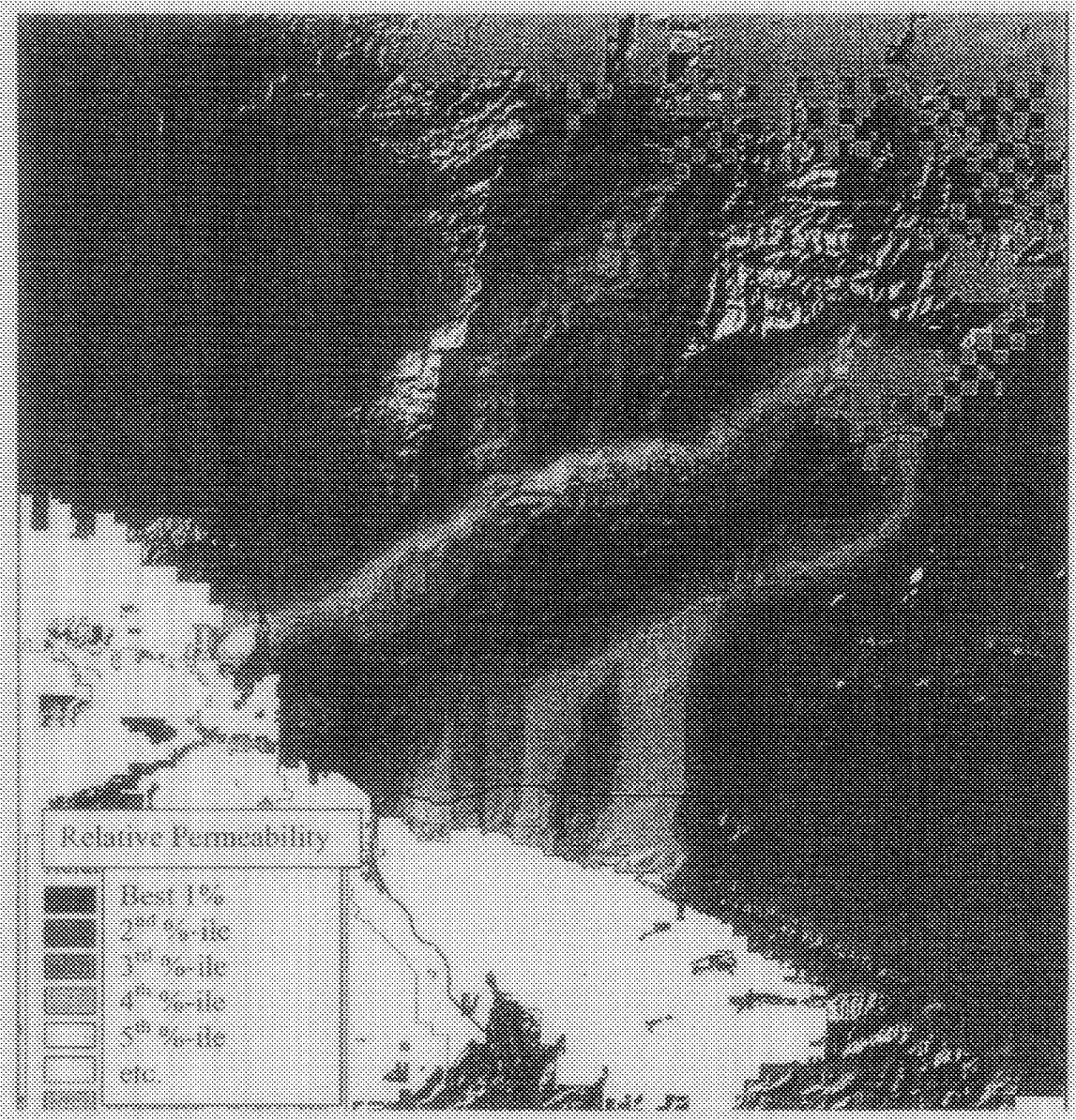
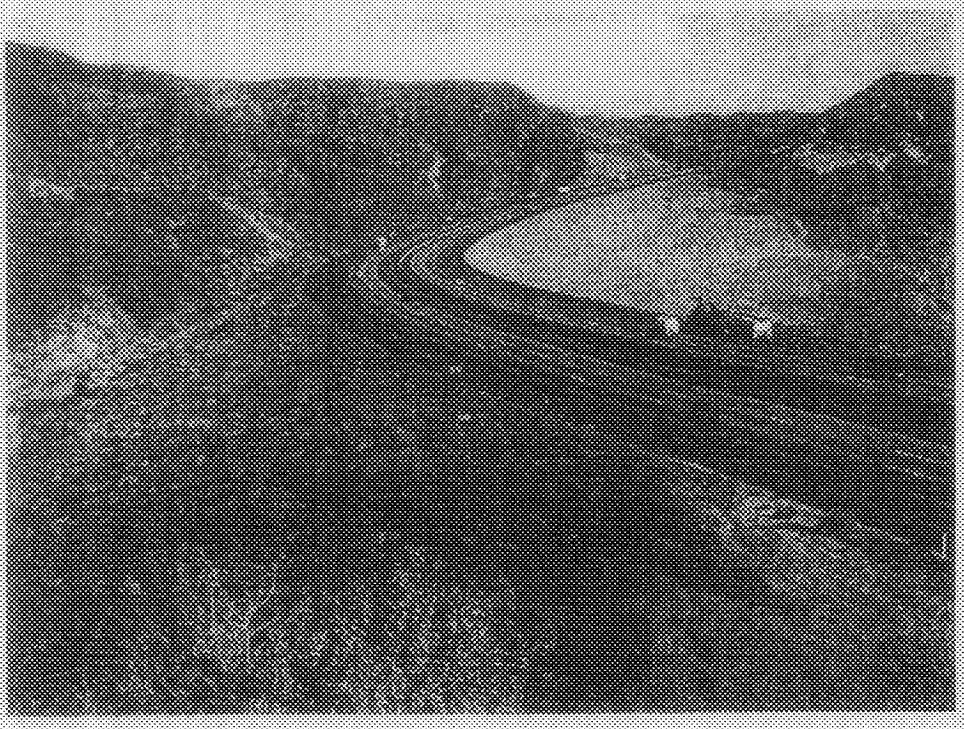


Figure 2. Cost-weighted distance map for puma between the Sierra Nevada core area (protected lands in purple) and Sierra Madre core area (protected lands in yellow), showing the 10% of cells with the lowest total cost in 1-percentile increments. Because our procedures will always produce a least cost corridor, even if the "best" corridor does not facilitate animal movement, species experts reviewed each map and recommended the smallest fraction of cells would create animal movement. In this case, the best 1% was considered a sufficient linkage for this species.

A



B

Figure 3. (A) At the bottom of the fill slope, 0.6-m diameter pipes (not visible) accommodate the flow of Cherry Canyon, the largest non-channeled drainage crossing Interstate 5 along the linkage between the eastern and western Sierra Madre. A bridge here would serve many focal species. (B) Several pumas have been killed in vehicle collisions on this portion of Interstate 15, where the freeway crosses the Santa Ana-Palomar linkage. Because the freeway is already cut into bedrock here, an underpass is not feasible, but a vegetated overpass would facilitate movement of most focal species.

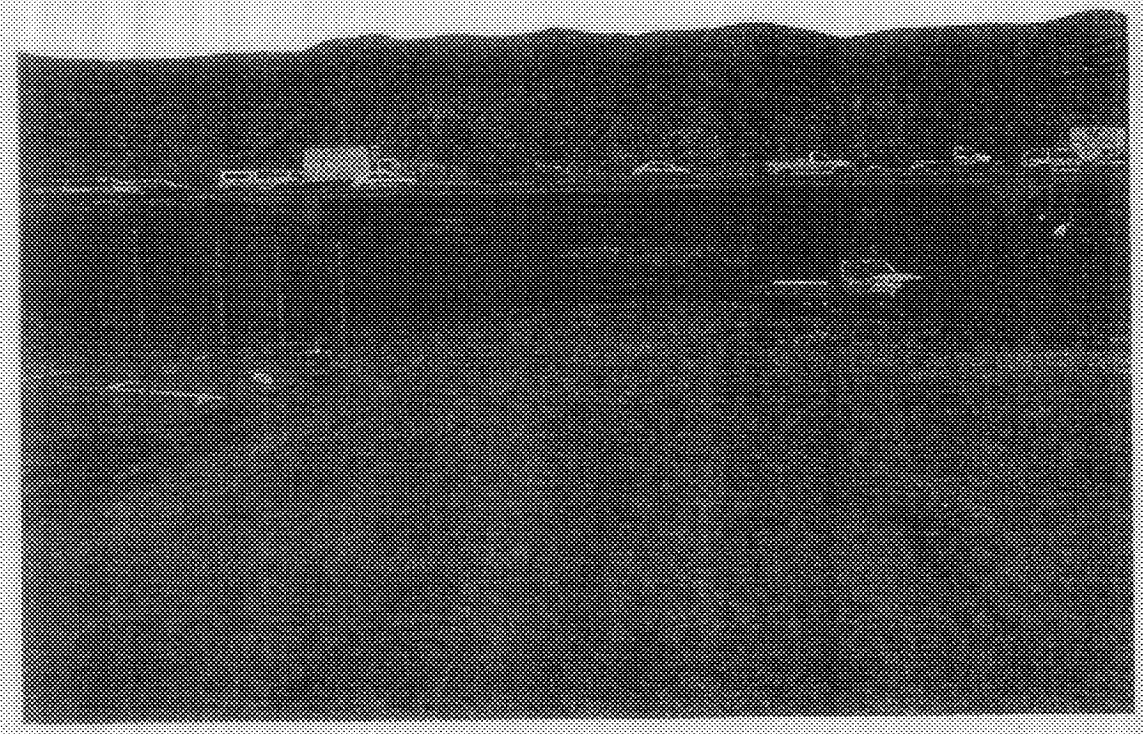


Figure 4. An interchange on the Riverside Freeway (SR 91) being converted into a wildlife crossing in February 2003, to facilitate movement along the linkage between the Santa Ana Mountains and the Chino Hills. Although this is not one of our 15 priority linkages, this illustrates the feasibility of the enhancements that we will recommend in some linkage areas. California State Parks is investing $1.5 million to restore natural vegetation and the Coal Canyon stream channel through the underpass.

Figure 5. The confluence of four highways, a railroad line, high-voltage power lines, and microwave communication towers, as seen from the edge of the California Aqueduct, which moves water 440 km from the Sacramento River delta into the Los Angeles Basin. Our project intends to add one more layer of infrastructure to this scene by protecting and restoring the ridge in the background, which provides the only wildland link between the Santa Susana Mountains (off left edge of the photo) and the San Gabriel Mountains (off right edge of photo).

WILDLIFE RESEARCH INSTITUTE

Dan Silver, Director
Endangered Habitat League
8424-A Santa Monica Blvd. PMB592
Los Angeles, CA 90069-4267

June 6,2001
Fax 323-654-1931

Dear Dan.

Regarding your inquiry about Golden Eagle activity in the area of Rancho Mission Viejo, Orange County, California.

The Wildlife Research Institute, Inc (WRI) has been monitoring the Golden Eagles of Southern California since 1987. This monitoring has built upon research and records collected by many others starting in 1895. Our most intense efforts have been in San Diego, Orange and Riverside Counties although we regularly monitor eagles in all of Southern California.

Specifically the Golden Eagles we refer to as the San Mateo pair utilize the area of the Rancho Mission Viejo. The Pair nest in San Mateo Canyon Wilderness of the Cleveland National Forest. The nest area is near the junction of San Diego, Orange and Riverside Counties. The Wilderness is remote and covered with Chaparral, a habitat type that is not suitable for Golden Eagle foraging. Golden Eagles need open grassland or scattered brush land to successfully hunt. This pair of Golden Eagles are seen flying from the protected nest and roost canyon cliffs to the open habitat of Talega, Gabino, La Paz, Blind and Cristianitos Canyons on a regular basis. We have observed them flying as far as Trampas Canyon with newly fledged young.

Although we have not tracked these eagles with transmitters to know exactly where in each canyon or hill they hunt we can say that 7 out of 10 foraging trips are west, in the direction of Rancho Mission Viejo. Our accumulated knowledge of studying over 200 pairs of Golden Eagles would indicate that this area is a significant and important foraging area for the San Mateo pair of Golden Eagles. The loss of this hunting area to the eagles would, in the opinion of our eagle research staff, affect their ability to successfully fledge young and will eventually lead to the loss of this Golden Eagle breeding pair altogether.

In our study area over 50% of the breeding Golden Eagles have been extirpated since the 1970's. The most significant contributing factor to these losses is destruction of habitat. Preservation of foraging habitat is as critical as protecting the nest sites of

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Golden Eagles. Without both nesting and foraging habitat Golden Eagles will continue to decline in Orange County and the rest of Southern California.

Our researchers and our 58 volunteers who help monitor all these eagles appreciate your efforts to help protect Golden Eagles. If we can be of further assistance please call me at (760) 765-1957.

Respectfully,

Dave Bittner
Executive Director

Bull. Southern California Acad. Sci.
93(1), 1994, pp. 1–12
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The Biology and Current Status of the Long-eared Owl in Coastal Southern California

Peter H. Bloom

Western Foundation of Vertebrate Zoology, Calle San Pablo, Camarillo, California 93010

Abstract.—The Long-eared Owl (*Asio otus*) is poorly known in southern California. This paper reviews its historic nesting distribution in Orange and western San Diego counties as determined from 79 egg set records from 5 museum collections, and contrasts this with the distribution of 50 nesting attempts as recorded in Orange and northern San Diego counties between 1968–1992. Comparisons reveal a substantial area of extirpation in the coastal region with a small, remnant population in interior areas. The number of historic breeding territories has decreased by at least 55%. Reproduction appears good with 85% of 40 nests fledging young. Diet was typical of other regions with small rodents (*Microtus californicus*, *Reithrodontomys megalotis*, and *Thomomys bottae*) comprising 90% of the prey by number.

Except for anecdotal accounts from early in this century, little is known about the biology of the Long-eared Owl (*Asio otus*) in coastal southern California (Dawson 1923; Willett 1933; Bent 1938). In this paper I present information obtained over a 24-year period (1968–1992) on nesting Long-eared Owls in coastal Orange and San Diego counties, California (Fig. 1) and contrast this with the historic (1889–1961) nesting distribution (Table 1). Also included are data on the breeding biology, nesting habitat, predators, diet, and the results of 1991 and 1992 surveys of historic and recent nest territories. These data were collected largely on an opportunistic basis while monitoring the breeding biology of the more common raptor species.

The impetus for this paper stems in part from reports of declines of Long-eared Owls in Pennsylvania, New Jersey, and California (Clark and Klem 1986; Bosakowski et al. 1989; Marti and Marks 1989), and recent distribution maps (Burton 1984; Johnsgard 1988; Marti and Marks 1989) which incorrectly indicate that the species does not breed in southwestern California. It also updates previous Long-eared Owl status reports provided in Garrett and Dunn (1981) and Unitt (1984).

Study Area

The historic breeding distribution of the Long-eared Owl included all of southern California (Grinnell and Miller 1944) with the likely exception of some interior eastern desert areas. For the purposes of this paper the historic study area included all of Orange County, the coastal slope of San Diego County west of Mount Palomar, and the Cuyamaca and Laguna mountains (Fig. 1). My study area included southern and western Orange County, and northern San Diego County,

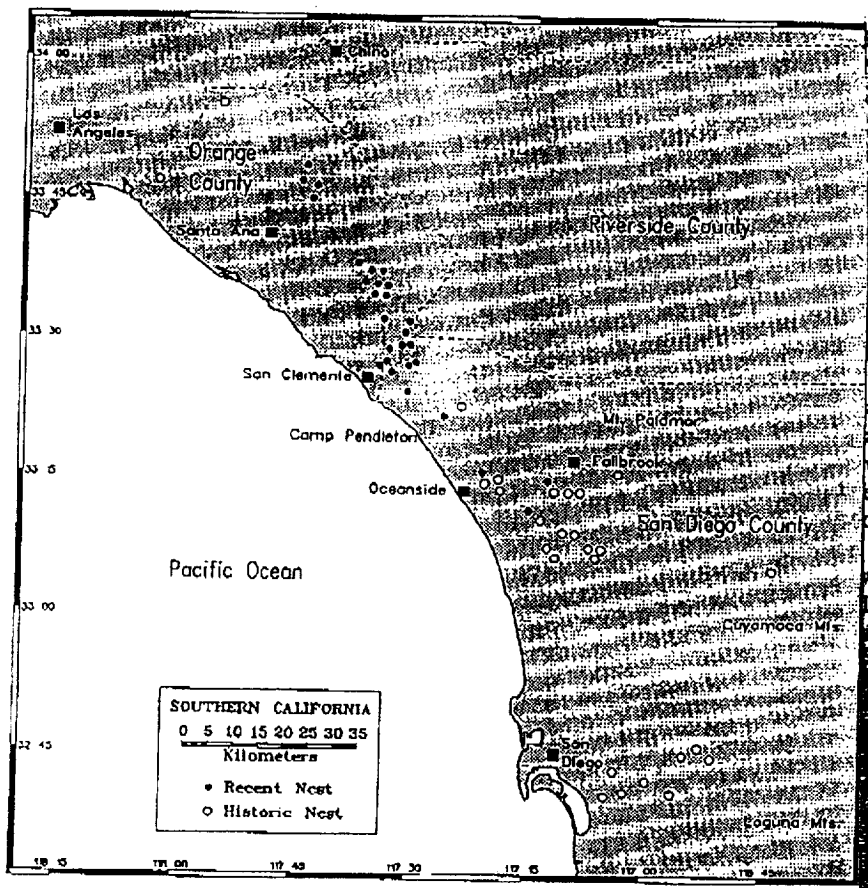

Fig. 1. Historic (1889–1961) and recent (1967–1992) locations of nesting Long-eared Owls in Orange and western San Diego counties.

California. Within Orange County, specific study sites included Rancho Mission Viejo, Irvine Ranch, Starr Ranch Audubon Sanctuary, Casper's Wilderness Park, Irvine Park, Wagon Wheel Park, Whiting Ranch Park, and Aliso-Wood Canyon Park. Within San Diego County, specific study sites were restricted to Camp Pendleton Marine Corps Base.

Oak woodland, riparian woodland, coastal sage scrub, native grassland, and non-native grassland are the predominant habitats in this region and elevation varies from sea level to 460 m. Precipitation averages 36 cm/yr and is seasonal, peaking in February (Bloom 1989).

Methods

All Orange and San Diego county egg set records were examined at the Western Foundation of Vertebrate Zoology (WFVZ), Museum of Vertebrate Zoology (MVZ),

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San Bernardino County Museum (SBCM), and the Santa Barbara Museum of Natural History (SBMNH) (Table 1). These collections contained the majority of Orange and San Diego county sets (L. Kiff pers. comm.). Owing to the vagueness of locality data on nesting records, no attempt was made to recheck exact nest locations. However, I examined street maps and conducted 15 aerial surveys, 1–2 hr in duration, to determine the extent of urbanization and the likelihood of a former territory being occupied. I have never found an active Long-eared Owl nest within 1 km of a residential area in California. Therefore, if a residential street now exists within 1 km of a historic Long-eared Owl nest site I considered it abandoned.

Many Long-eared Owl nesting territories were encountered while searching for nests of other raptorial species. Specific surveys for nesting Long-eared Owls in 1991 and 1992 lasting 0.5–4 hr in duration, were conducted between 15 January and 1 June each year, and consisted of examining known and potential nest groves and listening for calling adults or begging young. Bal-chatri traps and mist nets were also used to ascertain the presence or absence of Long-eared Owls (Smith et al. 1983; Bloom 1987). Additional recent nest records were provided by other observers (Table 2).

Calculations of habitat loss figures in Orange County between 1972 and 1990 were derived from reports detailing land use changes (County of Orange 1972, 1993). For the purposes of this paper I used only land-use classifications that might support breeding Long-eared Owls. These included only the designations "open space" and "vacant," which (in the 1974 edition) were defined as parks, cemeteries, beaches, and unused urban land. Unused urban land contained large ranches and the Trabuco District of the Cleveland National Forest. From the 1993 edition I used the designations that most closely approximated the 1974 edition, including "open space/recreation," "vacant <31% slope," and "vacant >30% slope." These include beaches, local and regional parks, national forests, golf courses, cemeteries, wildlife preserves, recreational marinas, and public and private campgrounds (County of Orange 1993). The latter 2 categories contain mostly ranchlands. While habitats such as cemeteries, beaches, golf courses, and marinas are not typically Long-eared Owl breeding habitat, excluding their acreages would make this part of my methodology difficult to repeat; therefore, my breeding habitat acreage estimates as they relate to changes between 1972–1990 for Orange County are undoubtably inflated and the actual acreage of suitable owl habitat is substantially less.

Foods habits were ascertained from pellets found in and directly below all active nests. Skulls and mandibles were used in the identification of rodents. A nest was considered successful if it fledged at least one young.

Results

Historic record.—Seventy-nine egg sets collected between March 1889 and March 1961 from Orange (2) and coastal San Diego counties (77), respectively, were found in museum collections. Mean clutch size for these sets was 5.1 (S.D. = 1.0; range 2–7). Nests were located throughout the coastal region in 10 species of trees and shrubs. Of 69 nest substrates recorded, 21 were oak (*Quercus* sp.), 18 each in willow (*Salix* sp.) and cottonwood (*Populus fremonti*), 4 in *Eucalyptus* sp., 3 in sycamore (*Platanus racemosa*), and 1 each in orange, alder (*Alnus rhombifolia*),

Table 1. Historic nesting records of Long-eared Owls in Orange and San Diego counties fr collections at the WFVZ, MVZ, SBCMNH, and SBMNH.

Museum no.	Date	Locality	No. eggs	Collector
		San Diego County		
WFVZ 4,463	7 Feb. 1931	9 mi. W of Pala	2	Harrison
WFVZ 48,109	25 Feb. 1926	McCoy Grove	4	Gallup
WFVZ 73,766	17 Mar. 1898	Lakeside	4	Ingersoll
WFVZ 52,699	14 Mar. 1920	San Diego River	4	Ingersoll
WFVZ 73,763	19 Mar. 1893	Lakeside	6	Ingersoll
WFVZ 46,973	11 Mar. 1923	Near San Marcos	5	Gallup
WFVZ 48,256	11 Mar. 1923	Near San Marcos	5	Gallup
WFVZ 73,759	14 Mar. 1925	Lakeside	5	Burnham
WFVZ 4,466	9 Mar. 1933	5 mi. E of Escondido	7	Roberts
WFVZ 96,063	10 Mar. 1901	Griejito	4	Dixon
WFVZ 73,784	10 Mar. 1907	Crescent Valley	6	Sharp
WFVZ 72,133	13 Mar. 1936	Sweetwater Lake	5	Harvey
WFVZ 4,468	14 Mar. 1936	Santa Margarita Ranch	6	Harrison
WFVZ 52,701	14 Mar. 1923	Lakeside	5	Burnham
WFVZ 73,782	11 Mar. 1923	San Marcos	5	Sharp
WFVZ 52,702	13 Mar. 1921	Sweetwater River	5	Burnham
WFVZ 73,772	10 Mar. 1921	Near Lakeside	5	Ingersoll
WFVZ 52,698	14 Mar. 1920	San Diego River	3	Ingersoll
WFVZ 9,986	15 Mar. 1916	Jamacha	5	Ingersoll
WFVZ 72,021	15 Mar. 1916	Near Lakeside	4	Huey
WFVZ 9,886	15 Mar. 1913	Near Lakeside	5	Huey
WFVZ 73,768	22 Mar. 1897	Near Lakeside	5	Ingersoll
WFVZ 73,769	22 Mar. 1897	Lakeside	7	Ingersoll
WFVZ 73,764	18 Mar. 1894	Lakeside	6	Ingersoll
WFVZ 4,467	20 Mar. 1934	¼ mi. N of Bonsall	5	Harrison
WFVZ 73,792	16 Mar. 1933	Flinn Springs	7	Potter
WFVZ 73,774	16 Mar. 1933	Dihissa	5	Ingersoll
WFVZ 4,470	26 Mar. 1940	10 mi. E of Encinitas	5	Harrison
WFVZ 4,469	26 Mar. 1940	10 mi. E of Encinitas	5	Harrison
WFVZ 32,412	28 Mar. 1949	Bonsall	5	Dixon
WFVZ 52,099	27 Mar. 1919	San Diego	7	Piltifield
WFVZ 73,785	30 Mar. 1919	Escondido	6	Sharp
WFVZ 73,700	27 Mar. 1920	Lakeside	5	Ingersoll
WFVZ 71,995	27 Mar. 1927	Dihissa	5	Huey
WFVZ 73,783	30 Mar. 1913	Crescent Valley	5	Sharp
WFVZ 89,900	25 Mar. 1895	Lakeside	3	Ingersoll
WFVZ 73,765	25 Mar. 1895	San Diego River	4	Ingersoll
WFVZ 73,761	30 Mar. 1889	Lakeside	6	Ingersoll
WFVZ 83,462	18 Mar. 1961	San Luis Rey Mission	4	Quigley
WFVZ 4,471	22 Mar. 1942	Rancho Santa Fe	7	Harrison
WFVZ 75,642	20 Mar. 1949	San Luis Rey River	5	Hall
WFVZ 73,762	21 Mar. 1892	Lakeside	5	Ingersoll
WFVZ139,573	17 Mar. 1923	Old Maids Canyon	6	Heaton
WFVZ 4,464	26 Feb. 1933	2 mi. E of Bonsall	6	Harrison
WFVZ 4,465	27 Feb. 1933	½ mi. E of Bonsall	6	Harrison
WFVZ147,086	12 Mar. 1949	San Luis Rey River	6	Hall
WFVZ161,078	5 Mar. 1919	Bandy Can., San Pasqual	6	Carpenter
WFVZ 48,108	21 Feb. 1926	Bandy Canyon	5	Gallup
WFVZ127,962	6 Apr. 1917	Bonsall	5	Carpenter
WFVZ 73,786	4 May 1919	Marikle Canyon	4	Sharp

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Table 1. Continued.

Museum no.	Date	Locality	No. eggs	Collector
WFVZ124,571	5 May 1903	San Pasqual	4	Wood
WFVZ 89,899	28 Mar. 1917	San Diego County	5	Potter
WFVZ 72,134	6 Apr. 1934	Sweetwater Lake	5	Harvey
WFVZ 73,781	13 Apr. 1902	San Pasqual	4	Sharp
WFVZ126,245	13 Apr. 1902	San Pasqual	7	Carpenter
WFVZ 55,120	7 Apr. 1901	San Pasqual	6	Carpenter
WFVZ 89,898	30 Apr. 1917	Lakeside	3	DeGroot
WFVZ 48,009	19 Apr. 1908	San Pasqual	5	Carpenter
WFVZ 73,760	8 Apr. 1923	Santa Isabel	5	Burnham
WFVZ 48,107	8 Apr. 1923	San Pasqual Valley	5	Gallup
WFVZ 4,476	3 Mar. 1920	Near Lakeview	7	Ingersoll
WFVZ 73,767	1 Mar. 1897	Lakeside	5	Ingersoll
WFVZ 52,700	6 Mar. 1920	San Diego River	4	Burnham
WFVZ 4,477	4 Mar. 1921	Fanita Ranch, Santee	5	Meanley
WFVZ107,394	15 Mar. 1903	San Pasqual	7	Dixon
WFVZ 52,703	6 Mar. 1921	Mission Valley	6	Burnham
WFVZ128,897	16 Mar. 1904	San Pasqual	5	Sharp
WFVZ 73,790	2 Mar. 1923	Fanita Ranch, Santee	5	Bancroft
WFVZ 73,771	10 Mar. 1901	Lakeside	7	Ingersoll
WFVZ 73,773	12 Mar. 1893	Escondido	3	Ingersoll
MVZ 13,305	29 Mar. 1925	Bonsall	3	Dixon
MVZ 5,973	17 Mar. 1896	Lakeside	5	Ingersoll
MVZ 5,974	25 Mar. 1900	Lakeside	5	Ingersoll
MVZ 5,972	27 Mar. 1920	Lakeside	5	Brown
SBCM 8,788	12 Mar. 1932	Bonsall	5	Hanna
SBCM 19,303	18 Feb. 1928	Lakeview	7	Sechrist
SBMNH 368-3*	20 Mar. 1897	Lakeside	6	Arnold
		Orange County		
WFVZ115,182	12 Apr. 1891	Alamitos	6	Shields
WFVZ147,087	12 Mar. 1939	Near La Habra	4	Hall

* County location not given on original data slip; I presumed it was San Diego County.

sumac (*Rhus* sp.), walnut (*Juglans regia*), and grape (*Vitis girdiana*). Of 47 nests for which the original nest builder was noted, 38.3% were American Crows (*Corvus brachyrhynchos*), 25.5% "rat" (*Neotoma* sp.), 12.8% Cooper's Hawks (*Accipiter cooperii*), 12.8% Red-shouldered Hawks (*Buteo lineatus*), 6.4% Swainson's Hawks (*B. swainsoni*), and 4.3% Red-tailed Hawks (*B. jamaicensis*).

Since egg collectors frequently returned to nesting territories each year, I determined that the minimum number of localities included in the 79 historic nest records represented at least 33 different localities. Eighteen (54.5%) of these 33 localities are now densely settled urban areas, or agricultural areas, and are no longer capable of supporting nesting Long-eared Owls. Nine localities given on data slips were too general to evaluate their current potential for nesting by Long-eared Owls or could not be found on maps. Only 6 (18%) (Jamacha, Sweetwater Lake, Bandy Canyon, San Pasqual Valley, Santa Ysabel, Santa Margarita Ranch) still showed any potential (>1 km from residential area) of being used by Long-eared Owls for nesting.

Recent studies.—Fifty observations of Long-eared Owl nesting attempts were

Table 2. Recent Long-eared Owl nest records in Orange and San Diego counties.

Date	Location/observation	
	Orange County	
April 1968	Weir Can., 3 km N of confluence with Santiago Can., Orange Co., CA. Five young, 2 fledged.	April
April 1973	Arroyo Trabuco, 0.5 km S of O'Neill Park, Orange Co., CA. Active nest (E. Lindquist pers. comm.).	15 April
1 April 1971	Weir Can., 4 km N of confluence with Santiago Can., Orange Co., CA. Five small young. 18 April 1971, 3 young.	1 May
April 1973	Fox Can., 0.5 km E of confluence with Bell Can., Starr Ranch Audubon Sanctuary, Orange Co., CA. Fledged young present.	21 April
8 April 1974	Weir Can., 4 km N of confluence with Santiago Can., Orange Co., CA. Five eggs. 10 May 1974, failed.	10 April
May 1982	0.5 km N of Blind Can., Orange Co., CA. One recently predated fledged young (J. Bryan pers. comm.).	6 May
22 May 1977	Bell Can., 0.75 km N of confluence with Crow Can., Starr Ranch Audubon Sanctuary, Orange Co., CA. Fledged young present (D. Bontrager pers. comm.).	1 April
28 April 1984	Bell Can., 0.75 km N of confluence with Crow Can., Starr Ranch Audubon Sanctuary, Orange Co., CA. Six eggs, 2 young, 4 weeks old.	Spring, 1 1989, 1
24 April 1984	Canada Gobernadora, Wagon Wheel Park, Orange Co., CA. One young (G. Chester pers. comm.).	Spring 197 1974, 197 1983, 198
11 May 1986	Gabino Can., 2.6 km N of confluence with La Paz Can., Orange Co., CA. Five young. 27 May 1986, 1 young predated.	22 April 198
22 May 1988	La Paz Can., 0.5 km N of confluence with Gabino Can., Orange Co., CA. Fledged young, 2 predated by Cooper's Hawk.	4 March 198
April 1988	Bell Can., 1 km S of Starr Ranch Audubon Sanctuary, Casper's Wilderness Park, Orange Co., CA. Fledged young present.	20 April 198
11 May 1988	Canada Gobernadora, Wagon Wheel Park, Orange Co., CA. Fledged young, 1 predated by Cooper's Hawk.	18 May 198
18 May 1989	La Paz Can., 0.5 km N of confluence with Gabino Can., Orange Co., CA. Three fledged young, 1 predated by Cooper's Hawk.	May 1989
19 April 1991	Canada Gobernadora, Wagon Wheel Park, Orange Co., CA. Three young.	May 1989
18 April 1991	Cristianitos Can., 0.1 km N of confluence with Talega Can., Orange Co., CA. Four young, one of which was predated by a Red-shouldered Hawk.	27 April 19
29 March 1992	Cristianitos Can., 0.1 km N of confluence with Talega Can., Orange Co., CA. Two young.	16 May 199
29 March 1992	Cristianitos Can., 0.1 km N of confluence with Talega Can., Orange Co., CA. Three young, one of which was predated by a Red-shouldered Hawk.	29 March 1
12 April 1992	Gabino Can., 2.3 km N of confluence with La Paz Can., Orange Co., CA. Five young.	
13 April 1992	Canada Gobernadora, Wagon Wheel Park, Orange Co., CA. Four young.	29 March 1
15 April 1992	Cristianitos Can., Talega Reserve, Orange Co., CA. Fledged young.	
15 May 1992	Gabino Can., 2.6 km N of confluence of La Paz Can., Orange Co., CA. Three fledged young.	
19 May 1992	Santiago Can., 0.25 km S of Irvine Lake, Orange Co., CA. Fledged young present.	
22 May 1992	Canada Gobernadora, 0.25 km S Wagon Wheel Park, Orange Co., CA. Fledged young present.	
25 May 1992	Bell Can., 0.1 km N of Fox Can., Starr Ranch Audubon Sanctuary, Orange Co., CA. Two fledged young.	

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Table 2. Continued.

Date	Location/observation
8 April 1992	La Paz Can., 0.5 km N of confluence with Gabino Can., Orange Co., CA. Two young.
15 April 1992	La Paz Can., 0.6 km N of confluence with Gabino Can., Orange Co., CA. Three fledged young.
1 May 1992	La Paz Can., 1.2 km N of confluence with Gabino Can., Orange Co., CA. Fledged young.
	San Diego County
21 April 1974	Horno Can., Camp Pendleton, San Diego Co., CA. Three fledged young.
10 April 1983	Lower San Onofre Can., Camp Pendleton, San Diego Co., CA. Five young. 16 April, failed due to mammal predation.
6 May 1983	Santa Margarita River, 8 km upstream from ocean, Camp Pendleton, San Diego Co., CA. Fledged 1 young.
1 April 1983	Talega Can., at confluence with Cristianitos Can., Camp Pendleton, San Diego Co., CA. One addled egg, failed.
Spring, 1988, 1989, 1990	South of Fallbrook, Hwy 76 and Gird St., San Diego Co., CA. Active nest (J. Oakley pers. comm.).
Spring 1973, 1974, 1975, 1983, 1988	Near Vista at Calveva Lake, San Diego Co., CA. Active nest (J. Oakley pers. comm.).
22 April 1983	Talega Can., 4.5 km N of confluence with Cristianitos Can., Camp Pendleton, San Diego Co., CA. Three fledged young.
4 March 1984	Talega Can., 4.5 km N of confluence with Cristianitos Can., Camp Pendleton, San Diego Co., CA. One addled egg, 4 young.
20 April 1984	Talega Can., 4.6 km N of confluence with Cristianitos Can., Camp Pendleton, San Diego Co., CA. Fledged young present.
18 May 1985	Talega Can., 4.5 km N of confluence with Cristianitos Can., Camp Pendleton, San Diego Co., CA. Failed with small young and eggs.
May 1989	Talega Can., Camp Pendleton, San Diego Co., CA. Failed with 3 small young (J. R. Bryan pers. comm.)
May 1989	Three km NE of Poway, San Diego Co., CA. Two fledged young (J. R. Bryan pers. comm.).
27 April 1991	Talega Can., 4.5 km N of confluence with Cristianitos Can., Camp Pendleton, San Diego Co., CA. Fledged young present.
16 May 1991	Talega Can., 2.6 km N of confluence with Cristianitos Can., Camp Pendleton, San Diego Co., CA. Three fledged young.
29 March 1992	Talega Can., 4.5 km N of confluence with Cristianitos Can., Camp Pendleton, San Diego Co., CA. Two Long-eared Owl eggs and 3 Cooper's Hawk eggs in the same nest being incubated by a Cooper's Hawk. Long-eared owl nesting attempt failed.
29 March 1992	Talega Can., 4.6 km N of confluence with Cristianitos Can., Camp Pendleton, San Diego Co., CA. Five young.

made in 30 different nesting territories in Orange and San Diego counties betwe 1968 and 1992 (Table 2). Specific surveys of known Long-eared Owl nest ter tories were conducted in 1991–1992. Of 20 nest territories surveyed in 1991, were active and 4 of these produced young. Fourteen territories were inactive. O 18 nest territories surveyed in 1992, 12 were active and 11 produced young. Si territories were inactive.

Of 29 nests where the identity of the original nest builders was known, 68.9 17.2, and 13.7 percent, respectively, were in abandoned nests of Cooper's Hawks American Crows, and Common Ravens (*Corvus corax*). Thirty nest trees wer coast live oaks (*Q. agrifolia*), and 1 was a willow. The most frequently used nestin habitat was closed canopy, young, coast live oak woodland where Cooper's Hawk and American Crows nested simultaneously, or, in alternating years, with th owls. In 4 instances in 1992, 2 pairs of Long-eared Owls nested within 25–100 m of each other.

Clutch sizes ranged from 2–8 eggs; mean clutch size was not determined. Thirty-four (85%) of 40 nests were successful. Nest failures from predation of individual Long-eared Owl chicks by Cooper's Hawks and Red-shouldered Hawks was frequent, especially if they nested in the same grove (Table 2). Competition for nests was occasionally intense. On 29 March 1992, I observed an old Cooper's Hawk nest with an adult Cooper's Hawk incubating 2 Long-eared Owl eggs and 3 of its own. The presence of an agitated adult Long-eared Owl in adjacent trees suggested that the Cooper's Hawk had recently usurped the Long-eared Owl nest and eggs. The nest fledged only Cooper's Hawks. Predation by Cooper's Hawks on Long-eared Owl chicks occurred during 3 nesting attempts at 2 territories, and in at least one instance all young were taken. D. R. Bontrager (pers. comm.) also observed an instance of attempted predation by an adult Red-shouldered Hawk on a Long-eared Owl fledgling in Orange County (Table 2). Red-shouldered Hawks preyed on at least 1 young from each of four nesting attempts and on one adult. One dead young Long-eared Owl was also found in the nest of a Red-tailed Hawk (*B. jamaicensis*). Elsewhere the Red-tailed Hawk has been recorded as a predator of adult Long-eared Owls (Collins 1960).

One hundred thirty-four pellets collected from 11 Long-eared Owl territories between 1985–1992 contained 102 vertebrates including California vole (*Microtus californicus*) (39), western harvest mouse (*Reithrodontomys megalotis*) (30), Botta pocket gopher (*Thomomys bottae*) (23), white-footed mouse (*Peromyscus*) sp. (4), pocket mouse (*Perognathus*) sp. (3), ornate shrew (*Sorex ornatus*) (1), and 2 unknown passerines.

Discussion

Long-eared Owls were formerly common in San Diego and Orange counties but are now becoming increasingly rare in southern California. New and early investigators (Cooper 1870; Sharp 1907; Dawson 1923; Willett 1933) all reported the species as common in oak woodland and willow thicket habitats of southwestern California. Sharp (1907) regarded it as a "common resident" and further stated that "Up to a few years ago almost every crow's, hawk's, or rat's nest along the river in San Pasqual had its pair of owls." Grinnell and Miller (1944) described the status of Long-eared Owls in California as "numbers are so large as to warrant term "common," even "abundant" locally. Reduction of late years

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is apparent, in the main probably mainly as result of clearing bottomlands for farming." Marti and Marks (1989) noted that the species is declining in California, and Garrett and Dunn (1981) stated that the Long-eared Owl has "virtually been eliminated there [in southern California] as a breeder." Unitt (1984) provided further documentation of the scarcity of recent San Diego County breeding records for this species and its substantial decline, stating that the species now nests only in the Anza Borrego Desert. He placed the last known coastal San Diego County breeding record at that time (1984) as 13 May 1973 near Oceanside.

The known present breeding population and historic distribution as determined from recent surveys and egg collections from two southern California counties suggest the Long-eared Owl has declined by at least 55% and possibly as much as 82%. Based upon recent habitat use trends in Orange County, the species will probably continue to decline. Of 112,195 ha (277,234 ac) of potential Long-eared Owl breeding habitat available under the categories of "open space" and "vacant" (County of Orange 1974) in 1972, only 94,982 ha (234,701 ac), representing a 15.3% decline, were still available in 1990 (County of Orange 1993). The reduction of active nesting territories is directly attributable to habitat change; however, a limited quantity of unsurveyed potential nesting habitat exists within the Cleveland National Forest which, when coupled with county, state park, National Audubon Society, and private conservancy acreages, may afford some continuing protection for owls within Orange and San Diego Counties. Presently, no Long-eared Owl breeding activity is known in any Orange County ranch or parklands west of the I-5 freeway. However, potential habitat remains there, and much of it may be designated as wilderness park additions. If so, these areas may yet be able to support a few breeding pairs of Long-eared Owls. The species was extirpated in most of western San Diego County west of I-15 with the exception of Camp Pendleton, and possibly portions of the San Luis Rey River, Santa Margarita River, and Fallbrook vicinity (Fig. 1). Most notable is the lack of any recent nesting records from the San Diego vicinity that was referred to by Grinnell and Miller (1944) as one of three "centers of abundance" in California and an area from which a minimum of 36 historic nesting records are known within 25 km of San Diego (Table 1, Fig. 1). The only hints of continued nesting activity in this area is from Cedar Canyon, east of San Diego, where a recently killed Long-eared Owl was found in summer, and 4 roosting owls were found in winter in the Proctor Valley, Otay Ranch area (Preston et al. 1992). Unitt (1984) also referred to records of roosting Long-eared Owls on the coastal slope with a maximum of 12 at Rancho Otay in 1979.

Based upon observations of 7 adults at different spring locations (1972–1992), I suspect that Camp Pendleton may still support several breeding pairs of Long-eared Owls along the Santa Margarita River between the coastal estuary and the confluence of De Luz Creek, and in the Santa Margarita Mountains near Case Springs. However, after 20 years of nesting raptor surveys which resulted in only 7 confirmed Long-eared Owl breeding territories I suspect the population is small (Table 2). One of the above territories has been inactive since 1974, and 2 have been inactive since 1983.

Long-eared Owls use a variety of vacant raptor and corvid nests and do not build their own. Hence, as numbers of other raptors decline so do opportunities for surplus nest structures that the owls depend upon. For example, 3 historic

nest sites in San Diego County were built by Swainson's Hawks, a species Shar (1902) called formerly "abundant" near Escondido. Swainson's Hawks are no completely extirpated from coastal southern California (Bloom 1980; Risebroug et al. 1990). As competition between raptors for increasingly smaller areas o nesting habitat and nest sites grows, so will the potential for predation on Long eared Owls, as exemplified by the observed interactions with adjacent nestin Cooper's Hawks and Red-shouldered Hawks.

Crow and raven breeding populations are large and probably increasing on th study area (pers. observ.). Although nest site availability may be proportionatel greater now than historically due to increased numbers of nesting ravens, th degree of predation exerted by ravens on breeding Long-eared Owls may be a additional important factor in the decline of the owl. It is interesting that non of 69 historic Long-eared Owl nests were built by ravens, yet 13.7% of 29 recen nests were built by this species.

Compared with nest success studies in Idaho (34–51%) (Marks 1986) and Oregon (70%) (Bull et al. 1989) the 85% nest success reported in this study is hig and may in part be attributable to the inclusion of nests discovered late in th season which could have inflated nesting success. It may also be due to nestin habitat quality. As suggested by Bull et al. (1989) on their coniferous Oregon study area, dense canopy cover probably reduces predation. The majority o territories in my study were composed of dense, closed canopy oak woodland which probably afforded greater protection from predation than shrubsteppe habitats in Idaho (Marks 1986). Higher quality foraging habitat would also be expected to increase nesting success.

The high proportion of small rodents found in Long-eared Owl diets in thi study was similar to that found elsewhere in the United States, with voles an gophers predominating (Marti 1976; Craig and Trost 1979; Marks and Yenser 1980; Bull et al. 1989). However, as would be expected due to different habitats they were distinct from Long-eared Owl diets in the Colorado Desert of Californi where pocket mice and kangaroo rats (*Dipodomys* sp.) were dominant (Barrow 1989).

Although I did not perform a rigorous analysis of Long-eared Owl nesting an foraging habitat, all territories contained substantial quantities of grasslands withi 1 km of oak woodland and riparian nesting habitat where voles and gophers coul be caught, suggesting that adjacent grasslands were important in the selection b Long-eared Owls of nest sites.

The destruction of grassland foraging habitat in spite of the preservation o small riparian and oak woodland nesting habitats has probably contributed to th Long-eared Owl's decline in southern California. Preservation of substantial ope space reserves that contain both nest groves and adequate foraging habitats ma yet prevent the local extirpation of this wide ranging owl species.

Acknowledgments

Rancho Mission Viejo, Western Foundation of Vertebrate Zoology, and th National Audubon Society provided funding for this study and are gratefull acknowledged. D. L. O'Neill and R. J. O'Neill are thanked for the numerous way they supported the research. The field assistance of R. Jackson, E. H. Henckel, J L. Henckel, R. J. Morales, and D. L. O'Neill was very helpful. Special thanks g

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to D. R. Bontrager, G. Chester, J. R. Bryan, J. A. Chubb, E. Lindquist, and J. Oakley for the use of unpublished observations. The assistance of L. Smith with records from Orange County is appreciated. Constructive comments were provided by C. T. Collins, J. S. Marks, C. D. Marti, M. L. Morrison, and L. F. Kiff. T. Danufsky (SBMNH), L. F. Kiff (WFVZ), G. Cardiff (SBCM), and N. K. Johnson (MVZ) are thanked for making museum records available.

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Accepted for publication 23 April 1993.

07/20/2004 11:37 FAX 5624394570 HAMILTON 013/013

Factors Influencing the Effectiveness of Wildlife Underpasses in Banff National Park, Alberta, Canada

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Abstract: *Wildlife crossing structures are intended to increase permeability and habitat connectivity across roads. Few studies, however, have assessed the effectiveness of these mitigation measures in a multispecies or community level context. We used a null model to test whether wildlife crossing structures serve large mammal species equally or whether such structures limit habitat connectivity across roads in species-specific ways. We also modeled species responses to 14 variables related to underpass structure, landscape features, and human activity. Species performance ratios (observed crossing frequency to expected crossing frequency) were evaluated for four large carnivore and three ungulate species in 11 underpass structures in Banff National Park, Alberta, Canada. Observed crossing frequencies were collected in 35 months of underpass monitoring. Expected frequencies were developed from three independent models: radio telemetry, pellet counts, and habitat-suitability indices. The null model showed that species responded to underpasses differently. In the presence of human activity carnivores were less likely to use underpasses than were ungulates. Apart from human activity, carnivore performance ratios were better correlated to landscape variables, and ungulate performance ratios were better correlated to structural variables. We suggest that future underpasses designed around topography, habitat quality, and location will be minimally successful if human activity is not managed.*

Factores que Influencian la Efectivadad de Pasadizos para vida Silvestre en el Parque Nacional Banff, Alberta, Canada

Resumen: *Las estructuras diseñadas para el cruce de vida silvestre tienen la intención de incrementar la permeabilidad y conectividad del hábitat a lo largo de las carreteras. Sin embargo, pocos estudios han evaluado la eficacia de estas medidas de mitigación en un contexto multi-especie o de comunidad. Utilizamos un modelo nulo para evaluar si las estructuras para el cruce de vida silvestre sirven de igual manera a las especies de mamíferos grandes, o si estas estructuras limitan la conectividad del hábitat a lo largo de carreteras de manera especie-específica. También modelamos las respuestas de las especies a 14 variables relacionadas con la estructura de los pasadizos, las características del paisaje y la actividad humana. Se evaluaron tasas de éxito por especie (frecuencia de cruces observados/frecuencia de cruces esperados) para cuatro carnívoros grandes y tres especies de ungulados en 11 estructuras de pasadizos en el parque nacional Banff, Alberta, Canada. Las observaciones de frecuencias de cruce esperadas se obtuvieron a partir de tres modelos independientes: radio telemetría, conteo de heces e índices de hábitat adeduado. El modelo nulo mostró que las especies responden de manera diferente a los pasadizos. En presencia de actividades humanas fue menos probable que los carnívoros utilizaran los pasadizos en comparación con los ungulados. Aparte de la actividad humana, las tasas de éxito para los carnívoros estuvieron mejor correlacionadas con variables estructurales. Sugerimos que los pasadizos diseñados en el futuro en base a la topografía, la calidad del hábitat y la ubicación, tendrán un mínimo éxito si la actividad humana no es manejada.*

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Paper submitted February 8, 1999, revised manuscript accepted July 10, 1999.

Introduction

The effect of heavily used roads on mammal populations has been the focus of many studies during recent years (Oxley et al. 1974; Mierau & Favara 1975; Mader 1984; Bennett 1991; Evink et al. 1996). These studies show that roads affect mammal populations in numerous ways, from habitat loss and habitat alienation (i.e., sensory disturbance) to physical barriers and road mortality (Adams & Geis 1983; Mansergh & Scotts 1989; Van der Zee et al. 1992; Brandenburg 1996). Among these effects, habitat fragmentation and physical barriers pose what many conservation ecologists consider the greatest obstruction to maintaining species diversity and ecological integrity (Wilcox & Murphy 1985; Saunders & Hobbs 1991; Dale et al. 1994; Forman & Alexander 1998).

Attempts to increase habitat connectivity and barrier permeability across road structures can be found in some road construction and upgrade projects. Wildlife overpasses and underpasses, for example, first constructed in the 1970s, are used as mitigation tools in many parts of the world today (Reed et al. 1975; Hunt et al. 1987; Romin & Bissonette 1996; Keller & Pfister 1997). Nonetheless, few studies have examined the efficacy of these mitigation structures (Romin & Bissonette 1996). Furthermore, the few that have been conducted are limited in their extent to single-species analyses (Reed et al. 1975; Ballon 1985; Schall et al. 1985; Singer & Doherty 1985; Woods 1990; Carsignol 1993; but see Foster & Humphrey 1995). No study has considered the usefulness of wildlife overpasses and underpasses at multispecies scales that encompass the large mammals.

Today, highway planners and land managers can ill afford the naïve luxury of single-species mitigation structures. Species do not function in isolation but are components of ecological systems that inherently fall into the category of organized complexity (Allen & Starr 1982; O'Neill et al. 1986). In an organized, complex system, species are dynamically linked to other species on multiple spatial and temporal scales (Kolasa & Pickett 1989; Pickett et al. 1989, 1997; Waltho & Kolasa 1996; Fiedler & Kareiva 1998). Therefore, any single-species mitigation structure is likely to have cascading effects, some positive and some negative, on nontarget species also. If a mitigation structure is to succeed, a multispecies approach is needed to evaluate the efficacy of such mitigation on nontarget species as well.

We evaluated whether underpass structures in Banff National Park, Alberta, Canada, serve all species (i.e., large mammals) equally, or whether such structures limit habitat connectivity across roads in species-specific ways. Furthermore, we aimed to determine which of 14 underpass variables species responded to most, with the anticipation that once these variables were identified the design of future mitigation measures could be improved.

Methods

We collected data along the Trans-Canada highway (TCH) in Banff National Park (BNP), Alberta, Canada (Fig. 1). The Trans-Canada highway in BNP runs along the floor of the Bow Valley (2–5 km wide), sharing the valley bottom with the Bow River, the township of Banff (population 9000), several high-volume two-lane highways, numerous secondary roads, and the Canadian Pacific Railway. The TCH is the major transportation corridor through the park (park length, 75 km), carrying an estimated 5 million visitors to the park per year, with an additional 5 million users en route between Calgary and Vancouver (Parks Canada Highway Services, unpublished data). The first 45 km of the TCH from the eastern park boundary (phase 1, 2, and 3A) is four lanes and bordered on both sides by a wildlife exclusion fence 2.4 m high (phase 1 completed in 1986, phase 2 in 1988, and phase 3A late 1997). The remaining 30 km to the western park boundary (Alberta–British Columbia border, phase 3B) is two lanes and unfenced. Plans exist to upgrade phase 3B to four lanes with fencing within the next 5–10 years.

The fenced portion constitutes an effective barrier to the movement of large mammals. To mitigate this barrier effect, highway engineers constructed 22 wildlife underpasses and two wildlife overpasses. The effectiveness of such structures to facilitate large mammal movements, however, is unknown. Because no two underpasses are similar in all structural and ecological aspects, we propose that species (i.e., large mammals) select underpasses that best correlate with their ecological needs and behavior. Attributes that best characterize high-use underpasses can then be integrated into new designs for an eventual phase 3B widening process. We tested this premise at three scales of ecological resolution: species, species groups, and large mammals. These scales were used because (1) we anticipate that the explanatory power of each attribute is dependent, at least in part, on the ecological resolution used (Rahel et al. 1984; Rahel 1990; Collins & Glenn 1991) and (2) the information needs of land managers and transportation planners with respect to mitigation structures can best be met by a variable scale approach. We chose only phase 1 and phase 2 underpasses for this study, however, because the recent completion of phase 3A mitigation structures does not permit sufficient time for wildlife habituation to occur at such landscape scales (A.P.C., unpublished data).

Wildlife Underpasses

We monitored 11 wildlife underpasses (Fig. 1): 9 cement open-span underpasses and 2 metal culverts. We characterized each underpass with 14 variables encompassing attributes of structural, landscape, and human activity

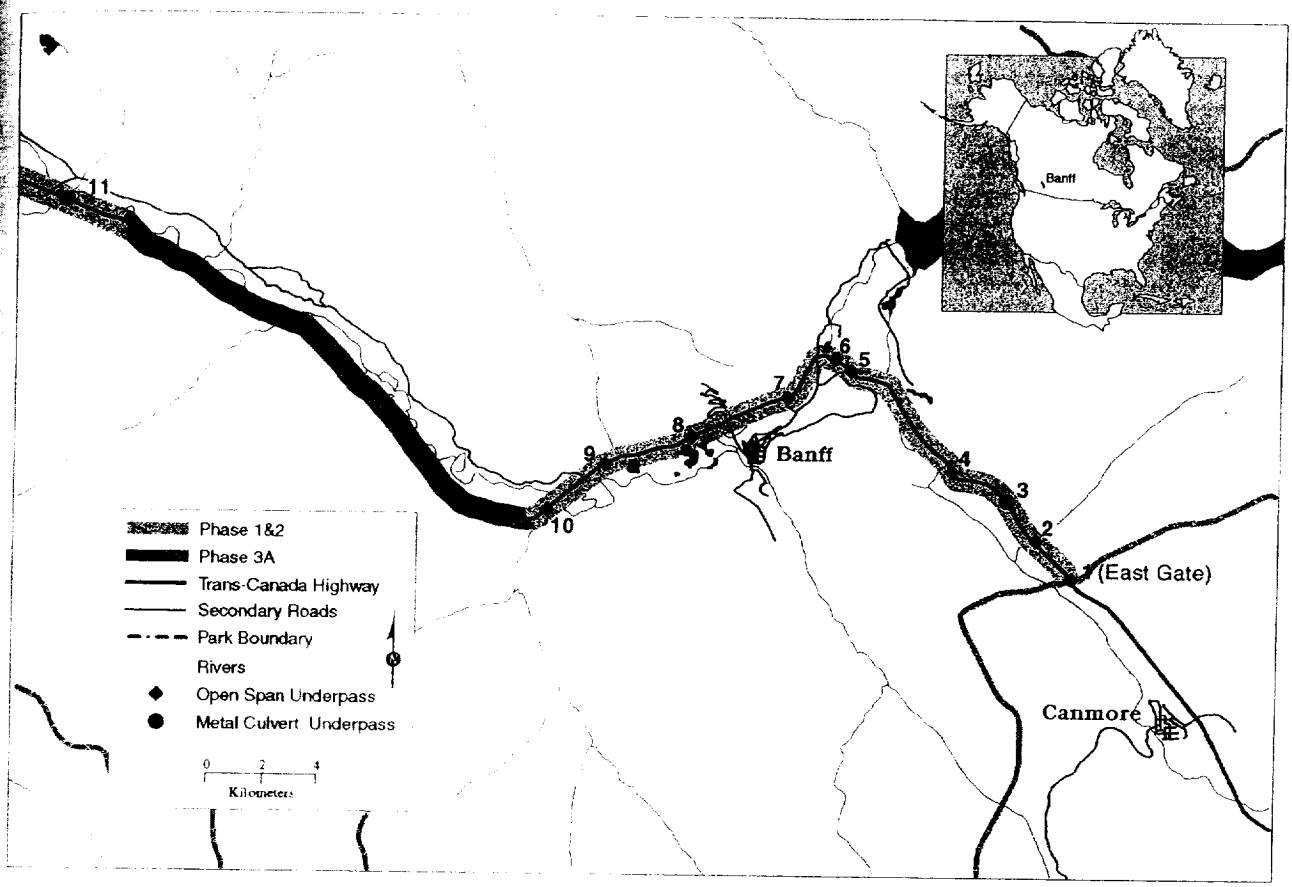

Figure 1. Location of study area and 11 wildlife underpasses along the Trans-Canada Highway (TCH) in Banff National Park, Alberta. Shaded sections of the TCH refer to phases: lightly shaded, phases 1 and 2; darkly shaded, phase 3A.

(Table 1). Structural variables included underpass width, height, length (including median), openness (width × height/length) (Reed & Ward 1985); and noise level (mean of *A*-weighted decibel readings taken at the center point within the underpass and 5 m from each end).

Landscape variables included distance to nearest forest cover, Canadian Pacific Railway, townsite, closest major drainage, and eastern-most park entrance (hereafter referred to as east gate). Human activity variables included types of human use in the underpasses characterized by counts of people on foot, bike, and horseback, and a human-use index calculated from the mean monthly counts of the three former variables combined.

Observed Crossing Frequencies

We measured wildlife use for the 11 underpasses using methods described by Bider (1968). Specifically, tracking sections (2 × 4 m) were set at both ends of each underpass to record evidence of underpass use. Tracking material consisted of a dry, loamy mix of sand, silt and clay 3–4 cm deep. At intervals of 3–4 days, we visited each underpass and classified the tracking medium as adequate or inadequate, depending on our ability to read tracks clearly. We recorded species presence (wolves [*Canis lupus*], cougars [*Puma concolor*], black bears [*Ursus americanus*], grizzly bears [*U. arctos*], deer [*Odocoileus* sp.], elk [*Cervus elaphus*], and moose [*Alces alces*]), species abundance, and human activity at each tracking section during each underpass visit. Through-passages were recorded for individuals if tracks in the same direction were present on both tracking sections. Tracking sections were then raked smooth in preparation for the next visit. Data were collected in this manner for two continuous monitoring periods: 1 January 1995–31 March 1996 (15 months) and 1 November 1996–30 June 1998 (20 months). Of 3311 underpass monitoring visits, 59 (1.8%) were classified as inadequate for data collection.

Expected Crossing Frequencies

If the 11 underpasses occur in a homogeneous-habitat landscape that includes random distribution of species

Table 1. Attributes of 11 wildlife underpasses used in analysis of factors influencing wildlife in Banff National Park, Alberta.

	Underpass										
Underpass attribute	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
Structural											
width (m)	9.8	13.4	4.2	9.8	9.5	14.9	10.0	9.8	10.3	9.0	7.0
height (m)	2.8	2.5	3.5	2.9	2.9	3.2	3.0	2.7	2.8	2.9	4.0
length (m)	63.0	83.2	96.1	40.0	39.7	38.0	27.1	27.2	25.6	40.1	56.0
openness	0.43	0.4	0.15	0.71	0.69	1.25	1.1	0.97	1.12	0.65	0.5
noise level[a]	68.1	70.5	64.1	66.8	66.0	63.8	64.3	67.4	67.4	67.1	64.1
Landscape (distance to)											
east gate (km)	0.0	2.1	3.5	5.8	10.5	11.5	12.0	14.4	17.0	18.8	38.8
forest cover (m)	22.3	63.3	11.9	15.2	47.3	16.1	35.9	23.3	27.5	23.9	35.4
nearest drainage (km)	1.0	0.0	0.1	0.4	0.6	0.0	0.6	1.2	0.4	0.2	0.3
Canadian Pacific Railway track (km)	0.5	0.75	0.8	0.02	0.02	0.02	0.25	1.2	0.4	0.75	0.75
nearest town (km)	1.6	3.5	5.5	6.0	1.5	0.5	0.2	1.7	5.2	7.2	0.8
Human activity											
human-use index[b]	0.4	1.9	1.8	0.6	5.3	5.3	15.2	3.2	11.4	0.6	0.5
bike	0	5	6	21	189	8	462	19	595	1	0
horseback	6	3	6	5	42	138	186	12	58	10	10
foot	7	45	14	20	34	77	129	80	241	10	29

[a] *Mean of A-weighted decibel readings taken at the center point within the underpass and 5 m from each end.*
[b] *Calculated from the mean monthly counts of people on foot, bike, and horseback.*

abundances, then the following assumptions may apply: (1) the 11 underpasses serve the same population of individuals and (2) each individual is aware of all 11 underpasses and can choose between underpasses based on underpass attributes alone. The Banff Bow Valley is a highly heterogeneous landscape, that is, lakes, mountain barriers, and narrow corridors (for example) restrict underpass accessibility on multiple spatiotemporal scales. If habitat fragmentation is perceived as extreme, then we may assume that each underpass serves its own unique subpopulation. If this were true, then differences in observed crossings frequencies between underpasses would reflect differences in subpopulation sizes alone and not attributes of the underpasses themselves. Although these two sets of assumptions represent endpoints along a continuum of possible interactions, the relative extent that species interact with the habitat landscape and distribution of underpasses is unknown. It is therefore necessary to examine observed crossing frequencies in the context of expected crossing frequencies (i.e., performance ratios).

Expected crossing frequencies were obtained from three independent data sets that included radiotelemetry location data, relative-abundance pellet transects, and habitat-suitability indices. Because it remains unclear what proportion of individuals from these data sets uses the underpasses directly, we defined our expected crossing frequencies as equal to the abundance data found at radii 1, 2, and 3 km from the center of each underpass. Specifically, we used (1) radiotelemetry location data for black bears (n = 255 locations), grizzly bears (n = 221 locations), wolves (n = 2314 locations), and elk (n = 1434 locations; Parks Canada, unpublished data); (2) relative-abundance pellet transects for deer (n = 1579 pellet sites), elk (n = 26,614 pellet sites), moose (n = 43 pellet sites), and wolves (n = 30 sites containing scat; Parks Canada, unpublished data); and (3) habitat suitability indices for black bears, cougars, wolves, deer, elk, and moose (Holroyd & Van Tighem 1983; Agriculture Canada 1989; Kansas & Raines 1990).

Analyses

We derived species-performance ratios for each of the three independent data sets by dividing observed crossing frequencies by expected crossing frequencies. Performance ratios were designed such that the higher the ratio, the more effectively the underpass appeared to facilitate species crossings.

We examined the premise that wildlife crossing structures serve species equally by testing the null hypothesis that performance ratios do not differ between species (paired t test with Bonferroni adjusted probability values; SYSTAT 1998). We tested the null hypothesis for each of the three performance models—radiotelemetry, habitat suitability indices, and log-transformed pellet counts—partly because no one model includes the complete species composition.

In the event that we rejected the null hypothesis, we proceeded with three steps to determine which of the 14 underpass attributes were most closely associated with species performance ratios. First, we standardized all performance ratios to a mean of zero and a standard deviation of one to remove absolute differences between the three models.

Second, we used a family of simple curvilinear and polynomial regression curves to optimize the fit between species-performance ratios and each underpass

attribute (Jandel Scientific 1994). We used the following criteria to choose the optimal equation for each regression analysis. (1) the regression model had to be statistically significant (at $p < 0.05$). (2) The beta coefficient for the highest ordered term had to be statistically significant. (3) Once an equation met the above criteria, we compared its F statistic with the F statistic for the next equation that also met these criteria but had one less ordered term. We chose the model with the higher F statistic and (4) iterated the above process for equations with consecutively fewer terms. (5) If no curvilinear or polynomial equation was accepted, we chose the simple linear regression model (equation 41; Appendix 1) to describe the relationship, assuming that it had not already been chosen through the iterative process. (6) If these criteria failed to produce a significant regression model for species per se and underpass attribute per se, we deleted the underpass attribute as being a significant factor influencing the species-performance ratio.

Third, for each species we ranked the regression models thus obtained according to the absolute value of each model's coefficient of determination. This three-step process allowed for the identification and ordering of underpass attributes (in order of importance) associated with each species performance ratio, but it failed to separate ecologically significant attributes from those that appeared significant but were statistical artifacts of the underpasses themselves.

The three-step process was repeated for each of the three scales of ecological resolution. For species groups, however, it was first necessary to identify group types according to similarities in species performance ratios as compared to some arbitrary definition. We used principal component analysis (PCA) to identify these species groups. Because none of the performance models contains a full species list, it was necessary to include all species performance ratios from each of the models into the single PCA.

Results

From 1 January 1995 to 30 June 1998 (excluding 1 April to 31 October 1996) 14,592 large-mammal underpass visits were recorded. Ungulates were 78% of this total, carnivores 5%, and human-related activities 17% (Table 2). Individual underpasses ranged from 373 visits to 2548 visits. Specific to wildlife, elk were the most frequently observed species (n = 8959, 74% of all wildlife), followed by deer (n = 2411, 20%), and then wolves (n = 311, 2.5%). The through-passage rate for wildlife species was high (mean 98%, SD = 1.9).

For each underpass, species-performance ratios significantly differed between species (paired t test with Bonferroni adjusted probability, $p < 0.001$). We therefore rejected the null hypothesis and focused instead on identifying the underpass attributes that most likely influenced a species's underpass use.

For individual species, the rank order of significant attributes was not significantly different between performance models (paired t test, all within-species comparisons not significant at $p < 0.05$). We therefore provide mean rank scores only (Table 3). The rank order of significant attributes, however, does differ between species (paired t test, Bonferroni adjusted probability values; $p < 0.05$). For example, we found that underpass distance from the east gate (positive correlation) was the most significant underpass attribute affecting black bear performance ratios, whereas underpass length (negative correlation) was the most significant attribute affecting elk performance ratios (Table 3).

At the second scale of ecological resolution, species groups, we used PCA to identify two group types (Factor 1, Fig. 2). The two groups were readily identifiable as large predators/omnivores (hereafter referred to as carnivores) and ungulates. For carnivores the most significant underpass attribute influencing the group's performance was distance to townsite (positively correlated), followed by human activities such as hiking (negatively correlated), human use index (negatively correlated), and horseback riding (negatively correlated). Landscape and structural variables were the least significant attributes influencing the group's performance ratio (i.e., distance to nearest drainage, negatively correlated; underpass openness, negatively correlated; Table 4).

In contrast, we found that the most significant underpass attributes influencing ungulates were structural and landscape factors. Specifically, the rank order was 1, underpass openness (negatively correlated); 2, noise level (positively correlated); 3, underpass width (negatively correlated), and 5, distance to nearest drainage. Human activity attributes, although significant, were ranked lower: 4, horseback riding (negatively correlated), and 6, hiking (negatively correlated; Table 4).

At the third scale of ecological resolution, large mammals (i.e., all species together), we found that the most significant underpass attribute influencing the community's performance ratio was structural openness (negatively correlated; Table 4). Distance to townsites was the second most significant attribute (positive correlation), followed by human activity (human-use index, horseback riding, hiking, and biking, all negatively correlated).

Discussion

There were no significant differences in the rank order of the 14 underpass attributes between the three performance ratio models (radiotelemetry, pellet count, and habitat suitability indices). This suggests that although the subpopulation that each underpass serves is unknown our confidence in using performance ratios as a means to standardize differ-

Table 2. Observed use of wildlife underpasses by carnivores and ungulates in Banff National Park, Alberta, 1995–1998.

	Underpasses										
Species	1	2	3	4	5	6	7	8	9	10	11
Black bear	10	20	43	37	13	8	0	4	8	34	16
Grizzly bear	0	0	0	2	0	0	0	0	0	5	0
Cougar	5	29	3	30	7	0	4	4	20	15	0
Wolf	1	7	3	28	3	5	1	5	77	146	35
Deer	554	42	294	253	215	21	61	338	288	291	54
Elk	825	201	331	1199	1062	467	1576	1522	821	683	272
Moose	1	0	1	0	0	0	0	0	0	0	0

ences in species abundance between underpasses is high. More importantly, however, these results permit us to test the null hypothesis independently of the actual grain in which species interact with the habitat template.

Our results suggest that underpass attributes differentially influence species performance ratios. Depending on the ecological resolution (i.e., species, species groups, large mammals), however, different underpass attributes were interpreted as dominant. One common thread at all resolutions was that human influence—whether it was distance to townsite or human activity within an underpass—consistently ranked high as a significant factor affecting species-performance ratios. At the species level, for example, results from six of the seven species ranked at least one human attribute as the first or second most important attribute influencing the species-performance ratio. At the group level, carnivores showed a positive correlation between underpass performance ratios and distance from town and a negative correlation to human activity. The inverse relation between the two human-related attributes occurred because the townsites served as sources of human populations from which human activity originates. The closer an underpass was to the town of Banff or Canmore, the greater the human use activity observed (Mattson et al. 1987; Kasworm & Manley 1990; McCutchen 1990; Jalkotzy & Ross 1993; Gibeau et al. 1996; Paquet et al. 1996; but see Rodriguez et al. 1997).

Ungulates, however, failed to respond to human activity in the same manner. Although significant negative correlations in performance ratios were observed, the relative importance of human activity ranked below that of structural attributes. Elk habituation to human presence close to town may, at least in part, have masked the performance ratios of unhabituated elk farther from town (Woods et al. 1996). At the community level, the most important attribute influencing species performance ratios was structural openness. The second most important attribute, however, was distance to the townsites (positive correlation).

These results lend support to the Banff National Park management plan, which emphasizes stricter limits on human development and more effective methods of managing and limiting human use within the park (Parks Canada 1997). The BNP management plan also recommends improving the effectiveness of phase 1 and 2 underpasses by "retrofitting." In this context we suggest that in such a multispecies system the most efficient

Table 3. Species level rank ordering of mean coefficient of determinations and their slope for models explaining underpass interactions in Banff National Park, Alberta.

Underpass attributes	Black bear	Grizzly bear	Cougar	Wolf	Deer	Elk	Moose
Width	8 −				4 −	3 −	5 −
Height			3 −	3 +		10 +	
Length	7 +					1 −	4 +
Openness	4 −				5 −	4 +	1 −
Noise level	12 +		1 +		3 +	8 +	
Distance to							
east gate	1 −			2 +			3 −
forest cover	11 −	3 −	4 +		6 −	11 −	6 −
nearest drainage	9 −			7 −	2 +	2 +	
Canadian Pacific Railway track		4 −		5 +	8 +		
nearest town	3 +	1 +	2 +	1 +		12 +	
human activity							
human-use index	6 −	2 −		6 −		5 −	8 −
bike	10 −			4 −		6 −	7 −
horseback	5 −				1 −	7 −	2 −
foot	2 −		5 −	8 −	7 −	9 −	9 −

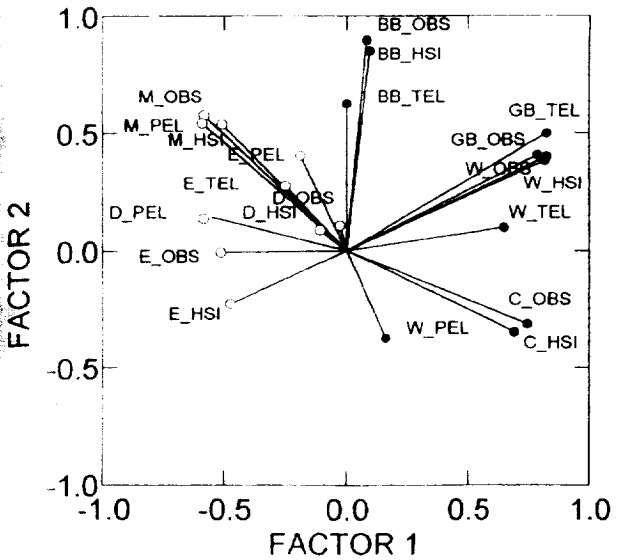

Figure 2. Principal component analysis of models of observed and expected underpass use for wildlife in Banff National Park, Alberta. Models were developed from observation data (OBS), radiotelemetry location data (TEL), relative-abundance pellet-transect data (PEL), and habitat suitability index data (HSI) for black bears (BB), grizzly bears (GB), cougars (C), wolves (W), deer (D), elk (E), and moose (M). Two discrete groups were identified along factor 1: large predators/omnivores (●) and herbivores (○).

(and probably economic) approach to retrofitting is to manage human activity near each underpass. Specifically, we recommend that foot trails be relocated and human use of underpasses be restricted. Continual monitoring of wildlife passage frequencies at these structures will permit Parks Canada to evaluate how this management strategy may translate into greater permeability of the Trans-Canada Highway and habitat connectivity for all wildlife populations in the Bow Valley.

Landscape variables other than distance to town may also be important attributes influencing species-performance ratios. Carnivores had a greater tendency to use underpasses close to drainages systems, for example, whereas ungulates tended to avoid them. Drainage systems are known travel routes for wildlife, particularly in narrow glacial valleys such as Banff's Bow Valley. The inverse relationship between carnivores and ungulates with respect to drainages may reflect processes such as predator-prey interactions rather than any direct effect of landscape attributes on underpass use. Recent studies have shown that predators can have important effects on the community structure of prey species (Lima & Dill 1990; Dickman 1992; Jedrzejewski et al. 1993). For example, deer are known to keep to the periphery of wolf territories (Hoskinson & Mech 1976; Mech 1977) and reduce their feeding effort when exposed to odors of wolves and other predator species (Muller-Schwarze 1972; Sullivan et al. 1985). Furthermore, there is some evidence that the presence of badgers (*Meles meles*) can disrupt their prey species (hedgehogs [*Erinacceus europaeus*]) use of tunnels under roads in England (C. Doncaster, unpublished data).

Table 4. Rank ordering of mean coefficients of determination and their slope for models explaining underpass interactions at the level of species groups and large mammals in Banff National Park, Alberta.

Underpass attributes	*Carnivores*	*Ungulates*	*Large mammals*
Width		3 −	6 −
Height			10 −
Length		8 +	11 +
Openness	5−	1 −	1 −
Noise level	7+	2 +	8 +
Distance to			
east gate		10 −	13 +
forest cover		7 −	12 −
nearest drainage	6 −	5 +	
Canadian Pacific			
Railway track		12 +	9 +
nearest town	1+	13 +	2 +
Human activity			
human-use index	3 −	9 −	3 −
bike	8 −	11 −	7 −
horseback	4 −	4 −	4 −
foot	2 −	6 −	5−

The results from our analyses also suggest that structural attributes were significant in species-performance ratios, especially for ungulates. Ungulates preferred underpass structures with a low openness ratio, narrow width, and long tunnel dimensions. We doubt, however, that such species prefer constricted underpasses over larger and more open underpasses. Previous studies have shown that ungulates were reluctant to use underpasses <7 m wide or <2.4 m high (Reed et al. 1975; Yanes et al. 1995; Rosell et al. 1997). Therefore, in a series of post-hoc regression analyses, we found that openness was significantly correlated to length, noise, and distance to town (linear regression, $p < 0.05$). These post-hoc tests suggested that the importance of these structural attributes may be statistical artifacts.

Although there is limited information on the suitability of underpass design for large carnivores (but see Rodriguez et al. 1997), it is understood underpasses that are long and low in clearance inhibit use by carnivores (Hunt et al. 1987; Beier & Loe 1992; Foster & Humphrey 1995). Results from our analyses agree in part with this expectation because wolf performance ratios were positively correlated with underpass height; for other carnivore species, however, attributes of underpass structure contributed little.

It is possible that the overall weakness of structural attributes in explaining species performance ratios may be

due to each species's individual familiarization with the 12-year-old underpasses. Individuals require time to adapt to underpass structures (Reed et al. 1975; Waters 1988; Bunyan 1990; Land & Lotz 1996; A.P.C., unpublished data); once adaptation has occurred, the dynamics of human activity and attributes of landscape heterogeneity may play a larger role in determining species-performance ratios than the structural attributes themselves (Gibeau & Herrero 1998).

The underpass attributes varied in importance between both species and ecological resolutions. The multiscale approach we used demonstrates that the informational needs of a state transportation planner responsible for site-specific mitigation for deer (Reed et al. 1975; Romin & Bissonette 1996) will likely be different from those of a land manager in BNP mandated to maintain ecosystem integrity of a 650,000-ha national park. Independent of the ecological resolution used, however, species-performance ratios were consistently negatively correlated with some measure of human activity. Therefore, the best designed and landscaped underpasses may be ineffective if human activity is not controlled.

Acknowledgments

J. Mamalis, B. Bertch, A. Whitehead, Z. Callaway, K. Wells, P. Smillie, C. St-Pierre, and M. Brumfit assisted in the data collection. We thank Parks Canada Highway Services Centre (PCHSC) and Banff National Park, World Wildlife Fund-Canada, and the Agricultural Research Foundation at Oregon State University for providing funding for the research. T. McGuire (PCHSC) was instrumental in providing necessary funds for the project. T. Hurd and C. White (Banff National Park) helped secure administrative and logistical support. D. Zell provided support for the geographic information system. The following researchers generously allowed us to use their data for this analysis: M. Hebblewhite, C. Callaghan, P. Paquet, M. Gibeau, S. Herrero, and T. Hurd. We thank M. Hourdequin, E. Main, G. Meffe, and two anonymous reviewers for critically reading earlier versions of this manuscript.

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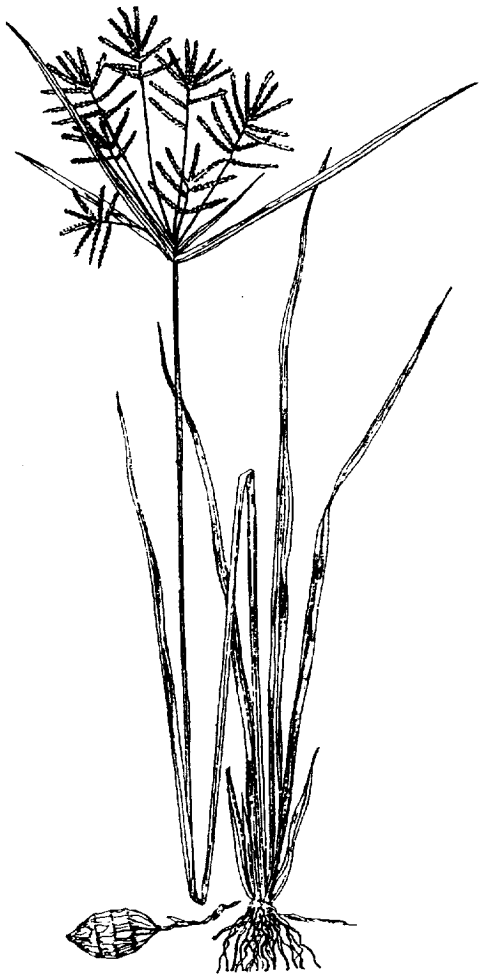
Appendix 1

Curvilinear regression equations used to optimize the fit between species-performance ratios and each underpass attribute.

Number	*Equation*
1	$\ln y = a + bx + cx^2 + dx^3$
2	$y^2 = a + bx + cx^2 + dx^3$
3	$y^{0.5} = a + bx + cx^2 + dx^3$
4	$y^{-1} = a + bx + cx^2 + dx^3$
5	$y = a + b(\ln x)^{-1} + c(\ln x)^{-2} + d(\ln x)^{-3}$
6	$y = a + b(x)^{-1} + c(x)^{-2} + d(x)^{-3}$
7	$y = a + b\ln x + c(\ln x)^2 + d(\ln x)^3$
8	$y = a + b(\ln x)^2 + c\ln x + d(\ln x)^{-1}$
9	$y = a + bx + cx^2 + d(x)^{-1}$
10	$y = a + bx + cx^2 + dx^3$
11	$\ln y = a + bx + cx^2$
12	$y^2 = a + bx + cx^2$
13	$y^{0.5} = a + bx - cx^2$
14	$y = a + b(\ln x)^{-1} + c(\ln x)^{-2}$
15	$y = a + b(x)^{-1} + c(x)^{-2}$
16	$y = a + b\ln x + c(\ln x)^{-1}$
17	$y = a + b(\ln x)^2 + c\ln x$
18	$y = a + bx + c(x)^{-1}$
19	$y = a + bx + cx^2$
20	$\ln y = a + bx$
21	$y = a + be^{-x}$
22	$y = a + b(x)^{-2}$
23	$y = a + b\ln x(x)^{-2}$
24	$y = a + b(x)^{-1.5}$
25	$y = a + b(x)^{-1}$
26	$y = a + b\ln x(x)^{-1}$
27	$y = a + b(x)^{-0.5}$
28	$y = a + b(\ln x)^{-1}$
29	$y = a + b\ln x$
30	$y = a + bx^{0.5}$
31	$y = a + bx(\ln x)^{-1}$
32	$y = a + b(\ln x)^2$
33	$y = a + bx^{0.5}\ln x$
34	$y = a + be^x$
35	$y = a + bx^3$
36	$y = a + bx^{2.5}$
37	$y = a + bx^2\ln x$
38	$y = a + bx^2$
39	$y = a + bx^{1.5}$
40	$y = a + bx\ln x$
41	$y = a + bx$



Journal of Applied Ecology 2001
38, 1340–1349

Drainage culverts as habitat linkages and factors affecting passage by mammals

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Summary

1. Drainage culverts are ubiquitous features in road corridors, yet little is known about the efficacy of culverts for increasing road permeability and habitat connectivity for terrestrial wildlife. Culvert use by small- and medium-sized mammals was investigated along roads in Banff National Park, Alberta, Canada. An array of culvert types was sampled varying in dimensions, habitat and road features during the winters of 1999 and 2000. Expected passage frequencies were obtained by sampling relative species abundance along transects at the ends of each culvert.

2. Weasels *Mustela erminea* and *M. frenata* and deer mice *Peromyscus maniculatus* used the culverts for passage most frequently, whereas red squirrels *Tamiasciurus hudsonicus* and snowshoe hares *Lepus americanus* were the most common small mammals in the study area according to transects sampled near each culvert.

3. Species' performance indices (observed crossing vs. expected crossing) were calculated for five species by comparing their tracks inside and adjacent to 36 culverts. Culvert performance indices were significantly different between the five species: culvert attributes influenced species' use but different attributes appeared to affect use by different species.

4. At all scales of resolution (species, species group and community level), traffic volume, noise levels and road width ranked high as significant factors affecting species' use of the culverts. Passage by American martens *Martes americana*, snowshoe hares and red squirrels all increased with traffic volume, the most important variable. Coyote *Canis latrans* use of culverts was negatively correlated with traffic volume. Increasing noise and road width appeared to be negative influences on culvert passage by coyotes, snowshoe hares and red squirrels.

5. Structural variables partially explained passage by weasels and martens. Weasel passage was positively correlated with culvert height but negatively correlated with culvert openness. Martens preferred culverts with low clearance and high openness ratios. High through-culvert visibility was important for snowshoe hares but not for weasels. The passage by weasels and snowshoe hares was positively correlated with the amount of vegetative cover adjacent to culverts.

6. For many small- and medium-sized mammals drainage culverts can mitigate the potentially harmful effects of busy transport corridors by providing a vital habitat linkage. To maximize connectivity across roads for mammals, future road construction schemes should include frequently spaced culverts of mixed size classes and should have abundant vegetative cover present near culvert entrances. Further work is required to assess the effects of culverts on population demography and gene flow adjacent to large roads.

Key-words: Banff National Park, barrier effect, connectivity, habitat fragmentation, mitigation measures, passage efficacy, road ecology.

Journal of Applied Ecology (2001) **38**, 1340–1349

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Introduction

Ecological theory about road corridors highlights their functional role as conduits, barriers (or filters), habitats, sources and sinks (Bennett 1991; Forman 1995). These effects can be of major ecological significance (Forman & Alexander 1998; Spellerberg & Morrison 1998). Many roads are barriers or filters to horizontal processes such as animal movement. Further, as roads are upgraded to accommodate greater traffic densities the rate of successful wildlife crossings might decrease significantly (Barnett, How & Humphreys 1978; Lovallo & Anderson 1996; Philcox, Grogan & Macdonald 1999), becoming in some cases the leading cause of animal mortality (Maehr, Land & Roelke 1991; Van der Zee *et al.* 1992; Clarke, White & Harris 1998) and effectively fragmenting otherwise connected habitats (Trombulak & Frissell 2000).

A recent review of the ecological effect of roads reported that barrier effects might emerge as the greatest ecological impact of roads with vehicles (Forman & Alexander 1998). In an increasing number of landscapes, the regular movements of animals involve road crossings. Efforts to increase road permeability and mitigate potential barrier effects might offset the risk of isolating or reducing populations (Opdam *et al.* 1993; Canters 1997). Specifically, wildlife underpasses and overpasses have been designed to facilitate the movements of wildlife (Bekker, Hengel & van der Sluijs 1995). Although not designed for animal passage, drainage culverts are ubiquitous features in road and rail corridors. However, practically nothing is known about their effectiveness for increasing road permeability and habitat connectivity for smaller mammals. Proximity to cover and culvert dimensions has been reported as important factors affecting use by small- and medium-sized terrestrial vertebrates (Hunt, Dickens & Whelan 1987; Yanes, Velasco & Suárez 1995; Rodriguez, Crema & Delibes 1996).

The Trans-Canada highway (TCH) is a major transportation corridor through Banff National Park (BNP), Alberta, Canada. The highway and other roads bisect critical montane and subalpine habitats in Banff's Bow River Valley on which many mammals depend. Over 70% of montane habitat in BNP is within the transportation corridor. At present, the TCH consists of 47 km of four-lane highway; however, there are plans to upgrade the remaining 30 km to four lanes within the next 5–10 years (Clevenger & Waltho 2000). This doubling in width and associated increases in traffic volumes present greater difficulties for animal crossings. Culverts along the TCH may allow safe crossings and thus increase permeability of this busy road corridor.

We investigated the use of drainage culverts by small- and medium-sized mammals along roads in BNP. Although the TCH was of primary concern, we sampled an array of culvert types along roads varying in width, traffic volume and landscape. Our specific objectives were to: (i) determine what species used drainage culverts to cross roads; (i) evaluate whether culverts served all species equally or whether some culverts limited habitat connectivity across roads in species-specific ways; (iii) model species' responses to structural, landscape and road-related attributes and identify which were most important in explaining animal passage and culvert effectiveness; and (iv) provide recommendations for incorporating small- and medium-size mammal requirements into drainage culvert design and transportation corridor planning.

Study area

The work was carried out in the Bow River Valley along the Trans-Canada transportation corridor in BNP (51°15′ N, 115°30′ W). Situated approximately 120 km west of Calgary, Banff is the most heavily visited national park in Canada with over 5 million visitors per year. Most of these visitors arrive by private vehicle or motor coach along the TCH. The highway is also a major commercial motorway between Calgary and Vancouver. On average, daily traffic volume at the park east entrance is more than 14 000 vehicles per day, year-round, peaking at more than 35 000 vehicles per day during summer. Use is currently increasing at a rate of 3% per year (Parks Canada Highway Service Centre, Calgary, Alberta).

The transportation corridor also contains the Canadian Pacific Railway mainline, access roads to Banff town site and several important two-lane roads, highways 93, 40 and 1A. The study was carried out along the TCH (two-lane and four-lane sections with and without central reservations) and highway 1A (two-lane with no central reservations).

The Bow River Valley is situated within the front and main ranges of the Canadian Rocky Mountains. Topography is regarded as mountainous, with elevations from 1300 m to over 3400 m, and valley floor width from 2 to 5 km. The climate is continental and characterized by relatively long winters and short summers (Holland & Coen 1983). Mean annual snowfall at the town of Banff is 249 cm. The transportation corridor traverses the montane ecoregion. Vegetation in the park encompasses montane, subalpine and alpine ecoregions. Montane habitats are found in low elevation valley bottoms and characterized by Douglas fir *Pseudotsuga menziesii* (Mirbel) Franco, white spruce *Picea glauca* (Moench) Voss, lodgepole pine *Pinus contorta* Dougl. ex Loud., aspen *Populus tremuloides* Michx. and natural grasslands. Subalpine and alpine ecoregions primarily consist of Engelmann spruce *Picea engelmanii* Parry ex. Engelm. and subalpine fir *Abies lasiocarpa* (Hook.) Nutt. forests interspersed with riparian shrub communities, subalpine grasslands and avalanche terrain, giving way to open shrub–forb meadows in the alpine ecoregion (Achuff & Corns 1983).

Table 1. Names and definitions of 19 variables used in a multivariate analysis of factors influencing mammal passage at 36 drainage culverts in Banff National Park, Alberta, Canada (1999–2000)

Attribute group Attribute	Code	Definition
STRUCTURAL		
Width*	W	Culvert width (m)
Height	HT	Culvert height (m)
Length*	L	Culvert length (m)
Openness	OP	Culvert openness (= width × length/height)†
Aperture	AP	Mean percentage through-culvert visibility taken from each opening and measured in 25% increments between 0% and 100%
Road-culvert angle	R_ANG	= (X_{dist} × angle created by X_{dist} and Y_{dist}), where X_{dist} = horizontal distance from road edge to culvert opening; Y_{dist} = vertical distance below road grade level to culvert opening.
LANDSCAPE		
Habitat type	HAB	1 = forest-open mix, 2 = closed forest
Percentage forest cover	FOR	Measured as percentage forest cover along two 100-m transects‡
Percentage shrub cover	SHRUB	Percentage shrub cover measured along two 100-m transects‡
Percentage open*	OPEN	Percentage open habitat measured along two 100-m transects‡
Distance to cover	D_COV	Distance to cover in metres (trees or shrubs > 1·5 m high)
Distance to nearest passage structure	D_STR	Distance to nearest mitigation passage in metres (wildlife crossing structure or full-length culvert)
Elevation	ELEV	Elevation (m)
Topography	TOPO	1 = flat uniform, 2 = uneven terrain
ROAD-RELATED		
Road width	RD_W	Width between outer edges of road pavement (m)
Verge width*	VER_W	Width from pavement edge to ecotone created by road (m)
Road clearance*	RD_CL	Distance of road width + verge width (m)
Noise level	NOISE	Mean of 16 A-weighted decibel (dbl) readings taken 5 m from culvert opening at 15-s intervals during 4 min. Readings were taken on a single day between 10:00 h and 14:00 h
Traffic volume	T_VOL	Mean annual average daily traffic volume

*Removed from multivariate analysis due to multicollinearity.
†Reed & Ward (1985).
‡Transect 1 on the culvert axis extended 100-m from the opening. Transect 2 in front of the opening and 50-m out on both sides.

Methods

DRAINAGE CULVERTS

We quantified small- and medium-sized mammal use of 36 drainage culverts along the TCH (distance = 55 km) and highway 1A (distance = 24 km). Drainage culvert selection was stratified by habitat type and culvert size. Only full-length culverts were sampled, i.e. those fully spanning the road width without openings in the central reservation. We characterized each culvert with continuous (n = 17) and categorical (n = 2) variables encompassing structural, landscape and road-related attributes (Table 1).

OBSERVED PASSAGE FREQUENCIES

We monitored the passage of animals at each culvert using sooted track-plates (75 × 30 cm; Zielinski & Kucera 1995). Multiple plates were used to cover the bottom of the culvert. No baits were used. We checked track-plates weekly and recorded each species' presence, estimated the number of species crossings and the direction of travel. We noted the presence of species' tracks in the snow within a 20-m radius of culvert openings. If tracks indicated the culvert was used but there was no recording on the track-plate(s) we counted this as passage. Mammal species for which tracks were recorded in this study included coyote *Canis latrans* Say, American marten *Martes americana* Turton, weasels *Mustela erminea* L. and *M. frenata* Lichtenstein, snowshoe hare *Lepus americanus* Erxleben, red squirrel *Tamiasciurus hudsonicus* Erxleben, bushy-tailed wood rat *Neotoma cinerea* Ord, deer mice *Peromyscus maniculatus* Wagner, voles (Arvicolinae) and shrews *Sorex* sp.

ANALYSES

If the 36 drainage culverts occurred in a homogeneous habitat landscape that included random distribution of species, then the following assumptions may apply: (i) the 36 drainage culverts served the same population of individuals and (ii) each individual was aware of all 36 culverts and could choose between culverts based on culvert attributes alone. These assumptions, however, were unrealistic as individual ranges within species such as red squirrel and deer mice were at least an order or two of magnitude less than the spatial scale of the 36 culverts. It was most likely that drainage culverts instead served their own unique subpopulations. It

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was therefore necessary to examine observed crossing frequencies for each drainage culvert in the context of local culvert-specific expected crossing frequencies (i.e. performance indices).

Expected passage frequencies were obtained from measures of relative abundance of each species in the vicinity of each culvert. At the ends of each culvert a 500-m transect perpendicular to the road was established. Each transect was divided into 10 50-m segments. Transects were surveyed for tracks of small- and medium-sized mammals between 24 and 48 h after snowfall. On each segment we tallied the number of animal tracks crossing it. To reduce any potential biases incurred from non-randomly distributed tracks, we registered only the presence (> 1 track) or absence of tracks in each 50-m segment of any given transect. Relative abundance for each species was quantified on the number of transect segments that were consistent with the range of their movements near the culverts. For small mammals (shrews, voles and deer mice) we counted detections on the first three segments (1–3) closest to the culverts, for medium-size mammals (snowshoe hares, red squirrels and wood rats) on segments 1–6, and for larger mammals (weasels, martens and coyotes) on segments 1–10. We then derived species' performance indices using the following formula:

$$PR_i = Log\left(\left(\left(\left(\frac{Obs_i + 0{\cdot}5}{Exp_i + 0{\cdot}5}\right)^2 + \left(\frac{Obs_i - 0{\cdot}5}{Exp_i - 0{\cdot}5}\right)^2 \times \left(\left|\frac{Exp_i + 0{\cdot}5}{Obs_i - 0{\cdot}5}\right|\right) \times 10^{(Obs_i - Exp_i)}\right)\right)^{0{\cdot}5}\right)$$

where Pr_i is the species' performance index for species i, Obs_i is the observed crossing frequencies for species i, and Exp_i is the expected crossing frequencies for species i. Performance indices were designed such that the higher the performance index the more effectively the culvert appeared to facilitate species' crossings. Specifically, the performance index gave a higher value to species' crossings where (i) the absolute difference between observed and expected crossing frequencies was greater but their relative difference was the same, and (ii) the absolute difference between observed and expected crossing frequencies was the same but the total number of observed crossings was greater.

We examined the premise that drainage culverts served species equally by testing the null hypothesis that performance indices did not differ between species. In the event that we rejected the null hypotheses, we proceeded with two steps to determine which of the culvert attributes were most closely associated with species' performance indices.

Prior to carrying out a multivariate analysis, we screened variable data for normality, linearity, multicollinearity and outliers using bivariate scatterplots, correlation matrices and residual analysis plots (Neter, Wasserman & Kutner 1985; Tabachnick & Fidell 1996). To reduce the effects of multicollinearity we selectively removed one independent variable from any pair of independent variables having a correlation coefficient higher than 0·75 (Morrison, Marcot & Mannan 1992). Outliers were removed from an analysis if standard residuals fell outside two standard deviations from the mean.

We performed forward stepwise multiple regressions on the performance indices of the culverts for small- and medium-sized mammals (Tabachnick & Fidell 1996). For each species we ranked the regression models thus obtained according to the absolute value of each model's coefficient of determination. This process allowed for the identification and ordering of culvert attributes (in order of importance) associated with each species' performance index; however, it failed to separate ecologically significant attributes from those that appeared significant but were statistical artefacts of the culvert themselves. Principal components analysis (PCA) was used to examine which sets of species formed coherent subsets that were relatively independent of one another (Ramsey & Schafer 1997). We then used principal components regression to evaluate the importance of the independent variables in facilitating passage by each species group at the culverts. For the two categorical variables (7, 14), performance indices were compared using the Mann–Whitney *U*-test (Zar 1999). We used the Statisica kernel release 5·5 statistical package for all analyses (StatSoft 2000).

Results

Data on small- and medium-sized mammal movement at 36 culverts were collected during winter (January–April) 1999 and 2000. During this period we checked each culvert at least 12 times. A total of 618 crossings by a minimum of nine species was recorded. Weasels and deer mice used the culverts most (28% and 29% of all detections, respectively), followed by bushy-tailed wood rats and American martens (Fig. 1). Shrews were detected at 22 of the culverts (61%), weasels at 21 culverts (58%), and martens and deer mice at 18 (50%). Coyotes, bushy-tailed wood rats and voles used the fewest number of culverts ($n = 2$ culverts). Species' use of individual culverts ranged from 0 to 6. The average number of species detected at the culverts was 2·8 (SD = 1·6).

Relative abundance transects were sampled six times. Tracks of eight of the nine species were recorded a total of 6990 times along 228 km of permanent transects. This included tracks for all species crossing transects including more than one track per segment. For calculating relative abundance we noted species presence (> 1 track) in the 50-m segments a total of 3155 times. Red squirrels and snowshoe hares together accounted for more than 50% of all species detections, whereas martens and weasels combined made up 39% (Fig. 1). The small mammal community (wood rats, deer mice, voles and shrews) accounted for only 1·6% of

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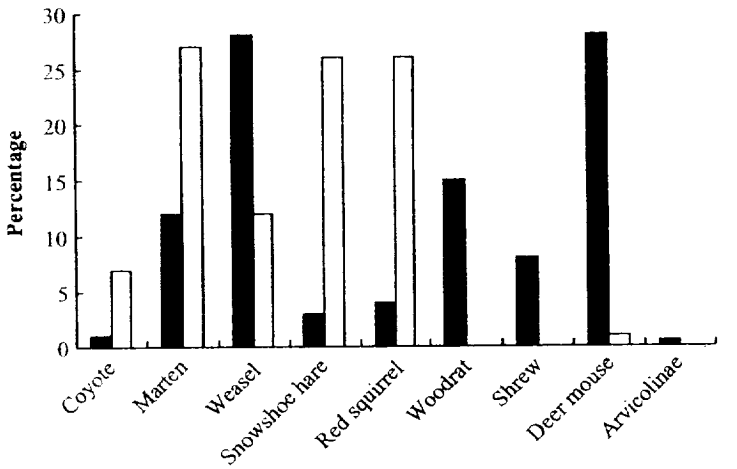

Fig. 1. Percentage occurrence of nine mammal species using drainage culverts (solid bars; $n = 618$ crossings) and found on adjacent snow transects (white bars; $n = 3155$ detections) in Banff National Park, Alberta, Canada (1999–2000). Expected detections were based on snow transect sampling (see the Methods).

crossings on transects. Because of the inability to detect small mammals on transects, we excluded these four species from the subsequent multivariate analysis. The following analyses focused on five medium-sized mammal species (coyote, marten, weasel, snowshoe hare and red squirrel).

The results showed that culvert performance indices were significantly different between the five species [Kruskal–Wallis ANOVA, $H(4, 140) = 60{\cdot}4$, $P < 0{\cdot}001$]. Therefore, we rejected the null hypothesis that species' use of culverts was uniform and focused on determining which attribute of culverts was most likely to influence use by individual species, species groups and the mammal community.

Of the 17 continuous variables, five were excluded from the multiple regression analysis due to multicollinearity: road clearance, verge width, culvert length, amount of open habitat and culvert width (Table 1). In the stepwise regression analysis five models were developed for species' responses to the culvert attributes. For all five species the multiple regression models described a significant proportion of the variation in performance ratios ($P < 0{\cdot}003$). Coefficients of determination (R^2) for the models ranged from 0·47 in red squirrels to 0·81 in snowshoe hares. Of the five models, 25 of 95 (= 5 × 19 variables) variables were statistically significant. Ten (40%) of the 25 variables pertained to road-related features, nine (36%) landscape features and six (24%) structural attributes (Table 2). However, significant culvert attributes and their rank order in the models differed between species. For example, noise level (negative correlation) was the most significant culvert attribute for snowshoe hares, whereas traffic volume (negative correlation) was the most important attribute affecting coyote performance indices. Similarly, culvert height was the most significant attribute for weasels, but was of little importance for the other species except martens.

Traffic volume was a significant predictor of performance index for four of the five species and ranked as the most important of all attributes in determining passage for three of the taxa (Table 2). It was the most important attribute for coyotes, martens and red squirrels, and ranked fourth for snowshoe hares. For all species except coyotes, the relationship was positive: the higher the traffic volume, the greater the use of culverts by martens, snowshoe hares and red squirrels. Noise was a significant factor explaining culvert use by four of five taxa. It had high explanatory power for snowshoe hare and red squirrel passage at culverts; however, it ranked low for carnivores (weasels 6, martens 5). The relationship between noise levels and passage in all models was negative. For two taxa, road width was found to be a significant factor (coyotes 2, red squirrels 4) influencing culvert use. The correlation between culvert use and road width was negative for both species. Coyotes and red squirrels had a tendency not to use culverts on wide roads.

Structural attributes such as culvert height and openness were significant attributes influencing performance indices for two of five taxa. Weasel passage was positively correlated with culvert height but negatively correlated with culvert openness. Conversely, martens preferred culverts with low clearance and high openness ratios. The amount of culvert aperture significantly influenced passage for the two species. Weasels had a tendency to use culverts with low aperture, whereas high through-culvert visibility was important for snowshoe hares. Landscape attributes had low explanatory value in determining the effectiveness of culverts. However, the distance to the nearest passage structure was an important variable for martens. The greater the distance between passages the higher the likelihood of martens using a culvert for cross-highway travel.

Habitat type did not influence passage for any of the five species except coyotes ($U = 404{\cdot}5$, d.f. = 1, $P = 0{\cdot}003$), which had a tendency to use culverts located in

Table 2. Results of multivariate linear regressions on the performance indices of 36 drainage culverts for five mammal species in Banff National Park, Alberta, Canada. Significant coefficient of determinations and their slope are rank-ordered to show their relative importance in explaining factors facilitating passage. For attribute definitions see Table 1

Attribute	Beta	SE	*P*-value	Rank
Coyote				
T_VOL	-0·53	0·15	0·001	1
RD_W	-0·43	0·13	0·004	2
SHRUB	0·22	0·1	0·038	3
Marten				
T_VOL	0·78	0·18	0·001	1
OP	0·58	0·21	0·01	2
HT	-0·51	0·23	0·038	3
NOISE	-0·50	0·15	0·003	4
D_STR	0·42	0·11	0·001	5
Weasel				
HT	0·88	0·30	0·007	1
AP	-0·64	0·24	0·015	2
OP	0·61	0·28	0·037	3
D_COV	0·57	0·19	0·006	4
FOR	-0·36	0·15	0·022	5
NOISE	-0·34	0·15	0·035	6
Snowshoe hare				
NOISE	-0·69	0·12	0·001	1
ELEV	0·43	0·1	0·001	2
FOR	0·41	0·12	0·002	3
T_VOL	0·36	0·16	0·037	4
AP	0·31	0·11	0·011	5
SHRUB	0·21	0·1	0·049	6
Red squirrel				
T_VOL	0·67	0·24	0·011	1
NOISE	-0·62	0·19	0·002	2
RD_W	0·61	0·18	0·002	3

areas of closed forest. Similarly, topography only affected snowshoe hare passage; culverts in uneven terrain were used more than culverts located in level terrain (U = 422, d.f. = 1, P = 0·001).

We identified two distinct groups of species based on performance indices using PCA (Fig. 2). Two factors were extracted: factor 1 had high loadings (> 0·70) for martens, snowshoe hares and red squirrels; factor 2 had high loadings (> 0·70) for coyotes and weasels. We performed multiple regression analysis on the two species groups using two methods. First, we ran the multiple regression analysis using factor scores from the PCA (Table 3). The analysis produced a significant model for both species groups (P < 0·002). Coefficients of determination (R^2) were 0·56 for factor 1 and 0·55 for factor 2. Road width had the highest explanatory power (negatively correlated) for species grouped in factor 1, followed by noise levels (negatively correlated) and culvert distance to cover (positively correlated). For species grouped in factor 2, we found road width (negatively correlated) was the only factor that influenced species' passage at the culverts.

Secondly, we ran the multiple regression analysis using combined performance indices calculated for the species in each group (Table 3). The analysis produced a significant model for both species groups (P < 0·001). Coefficients of determination (R^2) were 0·56 for species group 1 (martens, snowshoe hares and red squirrels) and 0·58 for species group 2 (coyotes and weasels). Species group 1 responded to four culvert attributes. Traffic volume was the most important variable (positively correlated), followed by road width, noise levels and elevation (all negatively correlated). Five variables affected passage of species from group 2. Distance to cover, traffic volume and the amount of forest cover were negatively correlated with passage, whereas road-culvert angle was positively correlated. The amount of shrub cover (negatively correlated) partially explained passage of species.

Finally, we performed multiple regression analysis on performance indices for all five species together (Table 4). The analysis produced a significant model

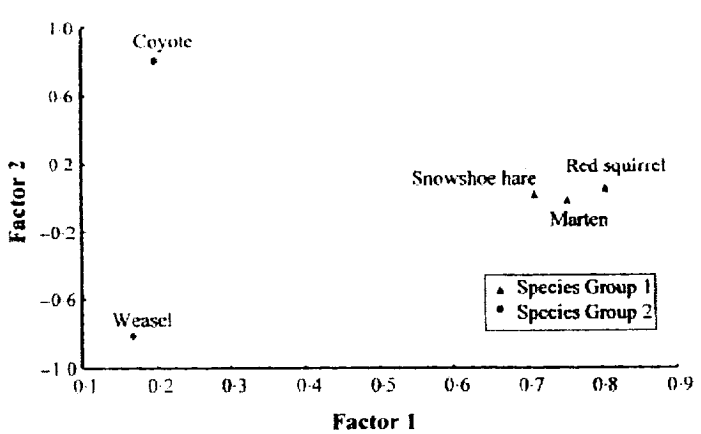

Fig. 2. Factor loadings for five mammal species from principal components analysis (Varimax normalized rotation of axes) of performance indices of 36 drainage culverts in Banff National Park, Alberta, Canada. Two distinct groups were identified for use in multiple linear regression: group 1, marten, red squirrel and snowshoe hare (black triangles); group 2, coyote and weasel (black dots). Road width, noise levels and distance to cover were significant correlates associated with factor 1. Road width was the only significant correlate for factor 2.

Table 3. Results from principal components analysis (PCA) to identify species groups based on their interactions with 36 culverts in Banff National Park, Alberta, Canada. Both species groups had significant regression models that explained culvert use ($P < 0.002$). Coefficients of determination (R^2) were 0.56 for factor 1 and 0.55 for factor 2. Significant coefficient of determinations are rank-ordered from principal components regression using factor scores from PCA and regression analysis performed on combined performance index data for the species in each of the two groups

Attribute	Beta	SE	*P*-value	Rank
Factor 1* (marten, snowshoe hare, red squirrel)				
RD_W	−0.72	0.24	0.007	1
NOISE	−0.68	0.19	0.002	2
D_COV	0.37	0.17	0.039	3
Factor 2* (coyote, weasel)				
RD_W	−0.83	0.14	0.001	1
Group 1† (marten, snowshoe hare, red squirrel)				
T_VOL	0.75	0.21	0.001	1
RD_W	0.66	0.17	0.001	2
NOISE	−0.66	0.16	0.001	3
ELEV	−0.37	0.16	0.025	4
Group 2† (coyote, weasel)				
D_COV	−0.79	0.14	0.001	1
T_VOL	−0.62	0.15	0.001	2
FOR	0.54	0.15	0.002	3
R_ANG	0.48	0.15	0.004	4
SHRUB	−0.37	0.13	0.01	5

*Multiple regression analysis using factor scores from PCA.
†Multiple regression analysis performed on combined performance index data for the species in each of the two groups.

Table 4. Results of multivariate linear regressions on the combined performance indices of 36 drainage culverts for five mammal species as a group in Banff National Park, Alberta, Canada. Significant coefficient of determinations and their slope are rank-ordered to show their relative importance in explaining factors facilitating passage at the community level. For attribute definitions see Table 1

Attribute	Beta	SE	*P*-value	Rank
T_VOL	0.72	0.2	0.001	1
NOISE	0.71	0.16	0.001	2
RD_W	0.61	0.17	0.001	3
ELEV	0.36	0.15	0.026	4

($P < 0.001$). The coefficient of determination (R^2) was 0.58. We found the most significant culvert attribute influencing the mammal community's performance index was traffic volume (positive correlation). Noise levels, road width and elevation were all negatively correlated.

Discussion

Our results suggested that culvert attributes influence species' use but different attributes appeared to affect use by different species. One common theme at all scales of resolution – individual species, species group and community level – was that traffic volume, and to a lesser degree noise levels and road width, ranked high as a significant factor affecting species' use of the culverts.

One would expect that as road width increased medium-sized forest mammals would be increasingly vulnerable. The risk of predation while attempting to cross exposed road corridors may be greater as well (Korpimaki & Norrdahl 1989; Rodríguez, Crema & Delibes 1996). Coyotes, being the largest of the mammal species studied, tended to use culverts less in high traffic density situations, whereas three of the four smaller mammals (martens, snowshoe hares and red squirrels), and not surprisingly the three-species group, showed greater use of the passages. Forest-associated mammal species generally avoid open areas without overstorey or shrub cover (Buskirk & Powell 1994; Ruggiero *et al.* 1994) and we would expect the same response to an open road corridor (Oxley, Fenton & Carmody 1974; Mader 1984; Swihart & Slade 1984). Culvert use by these species might be a response to this fragmented and unsafe habitat and a result of learned behaviour passed on by surviving individuals selecting culverts for cross-highway travel.

Noise consistently ranked highly as a negative factor influencing culvert passage at all resolutions, ranking second most important at the community level. Marten, weasel, snowshoe hare and red squirrel passage at the culverts was negatively correlated with noise levels, suggesting that traffic-related disturbances may cause some species to reduce their activity near the highway, or avoid the area altogether. Research near busy highways in Massachusetts, USA, and the Netherlands has focused on areas of reduced bird abundance, which were believed to be a consequence of traffic noise (Reijnen *et al.* 1995; Reijnen, Foppen & Meeuwsen 1996; Forman & Deblinger 2000). Studies of terrestrial wildlife also concur that buffer areas around roads are generally avoided, the size of the buffer depending on traffic volume (McLellan & Shackleton 1988; Thurber *et al.* 1994; Mace *et al.* 1996; Gibeau 2000).

The dimension of the tunnels is considered to be one of the most important variables in the design of passageways for vertebrates (Reed, Woodward & Pojar 1975; Ballon 1985; Hunt, Dickens & Whelan 1987). Martens, weasels and, to a lesser extent, snowshoe hares responded most to the structural attributes of culverts. Martens had a tendency to use culverts with low clearance and high openness ratios, whereas weasels used culverts with high clearance, low openness ratios and low through-culvert visibility. These results may largely be explained by habitat preferences of the two mustelids. Martens prefer areas with dense canopy cover and complex understoreys (Buskirk & Powell 1994; Ruggiero *et al.* 1994), whereas weasels rely entirely on a hunting strategy that requires travelling through burrows and runway systems of rodents and through all kinds of cover into which these prey could escape (King 1989). High through-culvert visibility would be of little importance for weasels because a large part of the time they hunt underground. Conversely, low through-culvert visibility is believed to

inhibit passage use by lagomorphs and carnivores (Beier & Loe 1992; Rodríguez, Crema & Delibes 1996; Rosell *et al.* 1997). In our study culvert passage by snowshoe hares was partially explained by aperture and those with high through-culvert visibility.

Landscape variables may also be important attributes influencing the use of culverts. The presence or amount of vegetative cover at passage entrances has been considered an essential component for designing effective tunnels (Hunt, Dickens & Whelan 1987; Rodríguez, Crema & Delibes 1996). It is believed that increased cover provides greater protection and security for animals approaching the passages. Our results indicated that distance to cover and the amount of it within the vicinity of culverts was a significant factor determining passage for weasels and snowshoe hares, and to a lesser extent coyotes. Elevation and topography adjacent to the culvert were significant attributes influencing the performance index of snowshoe hares. The importance of these attributes may be more an artefact of local habitat conditions than of direct significance on species' passage.

The predominance of weasels and martens at the culverts contrasted sharply with the scarcity of hare and red squirrels, despite the latter being some of the most prevalent species detected on the transects (Fig. 1). The inverse relationship between predator and prey species with respect to culvert use is noteworthy. There is some evidence from England that the presence of badgers *Meles meles* L. can disrupt the use of tunnels under roads by hedgehogs *Erinaceus europaeus* L. (Doncaster 1999). Whether this may be occurring in our study area remains to be investigated. Scent-marking (faeces) by martens and weasels was commonly observed at culvert entrances throughout the sampling period and may be the behavioural mechanism whereby prey species could detect and avoid the predator (Gorman 1984; Curio 1993; Jedrzejewski, Rychlik & Jedrzejewska 1993; Kats & Dill 1998).

From this study we found that road-related factors had the greatest influence on mammal passage at culverts. Structural and landscape attributes of culverts were lesser predictors of culvert use. These results concur with those of Yanes, Velasco & Suárez (1995) and Rodríguez, Crema & Delibes (1996), who found that factors related to the road and the landscape best explained animal use, whereas culvert design and dimensions had little effect. Of the five species only weasels appeared to be unaffected by road-related attributes of culverts. Weasels, and to a lesser extent martens, appeared to be affected by the structural attributes of culverts. When considering the relative density of species in our study area, mammalian carnivores accounted for the greatest amount of passage use. Others have found, to the contrary, that small mammals constituted the majority of crossings (Yanes, Velasco & Suárez 1995; Rodríguez, Crema & Delibes 1996).

Our results suggest that for many small- and medium-sized mammals drainage culverts can mitigate the potentially harmful effects of busy transportation corridors. For forest-associated wildlife, like most of the species we studied, culverts appear to provide a means of crossing open habitat created by road corridors (in some places up to 100 m wide), providing a vital habitat linkage. Open roadside habitat has been shown to be important for the movement and dispersal of small mammals (Huey 1941; Getz, Cole & Gates 1978; Underhill & Angold 2000). For weasels and their prey the open roadside verges, which cut up and fragment the heavily forested Bow Valley, may also be important habitat. Our findings suggest that, for mammalian carnivores, the culverts appear to be critical in linking habitats and maintaining habitat connectivity. During this work we were unable to determine whether the low use of culverts by prey species was because crossings were not attempted or because they preferred crossing above the road. Further work is required to assess the effects of culverts on population demography and gene flow adjacent to roads with high traffic volumes.

In our study area the mean distance between all mitigation passages (large wildlife crossing structure or full-length culvert) in the two road corridors we sampled was 465 m (SD = 411 m, range = 1·2 – 2658 m, $n = 275$). To ensure cross-highway connectivity and gene flow it will be important to have at least one culvert or passage within an individual's home range (Gerlach & Musolf 2000). Given the average home range size of the species in our study (Chapman & Feldhamer 1982) and the existing distribution of culverts along roads, this condition can be met for only the two largest mammal species (coyote and marten). Drainage culvert costs to highway infrastructure projects are trivial. To improve the permeability of roads for small- and medium-sized mammals we recommend that, first, culverts be placed at more frequent intervals (150–300 m) to provide sufficient opportunities for animals of all body sizes to avoid crossing busy roads. Secondly, if a road does not have large wildlife crossing structures in place, we recommend a mixed size class of culverts to accommodate the greatest variety of species possible. The size of the culverts will depend on the size of the fauna most likely to be interacting with the road. Large culverts (1·0–1·5 m diameter) will facilitate passage for medium-sized mammals (e.g. coyote), while small culverts (0·5–1·0 m diameter) will best serve small mammals (marten and smaller). Lastly, we advise that vegetative cover be present near culvert entrances to enhance passage by carnivores and small mammals.

Acknowledgements

Support for this research came from Parks Canada and Public Works and Government Services Canada (contract C8160-8-0010). Mike Brumfit, Miguel Rico, Brian Johnstone, Mark Edwards and Lori Homstol assisted in collecting field data. Darrel Zell provided valuable GIS support, Nigel Waltho lendt statistical advice and critical input, and Cathy Hourigan helped locate

bibliographic materials. We thank Terry McGuire for securing funds for our research and Dave Dalman, Tom Hurd and Cliff White for their administrative and logistical support. Stephen Trombulak, Steve Ormerod and an anonymous referee improved the manuscript with their thoughtful comments.

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Received 7 March 2001; revision received 16 August 2001

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The Ecological Road-Effect Zone of a Massachusetts (U.S.A.) Suburban Highway

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Abstract: *Ecological flows and biological diversity trace broad patterns across the landscape, whereas transportation planning for human mobility traditionally focuses on a narrow strip close to a road or highway. To help close this gap we examined the "road-effect zone" over which significant ecological effects extend outward from a road. Nine ecological factors—involving wetlands, streams, road salt, exotic plants, moose, deer, amphibians, forest birds, and grassland birds—were measured or estimated near 25 km of a busy four-lane highway west of Boston, Massachusetts. The effects of all factors extended >100 m from the road, and moose corridors, road avoidance by grassland birds, and perhaps road salt in a shallow reservoir extended outwards >1 km. Most factors had effects at 2–5 specific locations, whereas traffic noise apparently exerted effects along most of the road length. Creating a map of these effects indicates that the road-effect zone averages approximately 600 m in width and is asymmetric, with convoluted boundaries and a few long fingers. We conclude that busy roads and nature reserves should be well separated, and that future transportation systems across landscapes can provide for ecological flows and biological diversity in addition to safe and efficient human mobility.*

Zona Ecológica de Efecto Carretero en una Autopista Suburbana de Massachusetts (U.S.A.)

Resumen: *Los flujos ecológicos y la diversidad biológica trazan patrones amplios a lo largo del paisaje, mientras que la planeación del transporte para mobilidad humana se enfoca tradicionalmente en una franja angosta cercana a las carreteras o autopistas. Para ayudar a cerrar esta brecha examinamos la "zona de efecto carretero" sobre la cual se extienden efectos ecológicos significativos que parten de una carretera. Nueve factores ecológicos (involucrando humedales, arroyos, sal de la carretera, plantas exóticas, alces, venados, anfibios, aves de bosque y aves de pastizal) fueron medidos o estimado cerca de 25 km de una autopista muy utilizada de cuatro carriles ubicada al Oeste de Boston, Massachusetts. Los efectos en todos estos factores se extendiéron >100 m de la autopista, los efectos en corredores de alces, de evasión de la carretera por aves de pastizales y la sal proveniente de la carretera en un reservorio somero se extendiéron >1 km. La mayoría de los factores tuvieron efectos en 2-5 localidades específicas, mientras que el ruido del tráfico tuvo efectos a lo largo de casi la totalidad de la extensión de la autopista. La creación de un mapa de estos efectos indica que la zona de efecto carretero promedia 600 m en amplitud y es asimétrica con límites intrincados y algunos relieves geográficos intrincados y largos. Concluímos que las carreteras muy transitadas y las reservas de la naturaleza deben estar muy bien separadas, y que los futuros sistemas de transportación pueden proveer flujos ecológicos y diversidad biológica a lo largo del paisaje, además de una mobilidad humana segura y eficiente.*

Introduction

The 9.4 million km^2 of the United States resemble a brightly colored mosaic or mural, with a fine-scale pattern of water superimposed on patches of different vegetation and land use, which in turn differentiate into large, distinctive physiographic zones. Over the last four centuries a 6.2 million-km network of public roads, now used by 200 million vehicles, has been superimposed on this land to provide safe and efficient human mobility (National Research Council 1997). The effect of

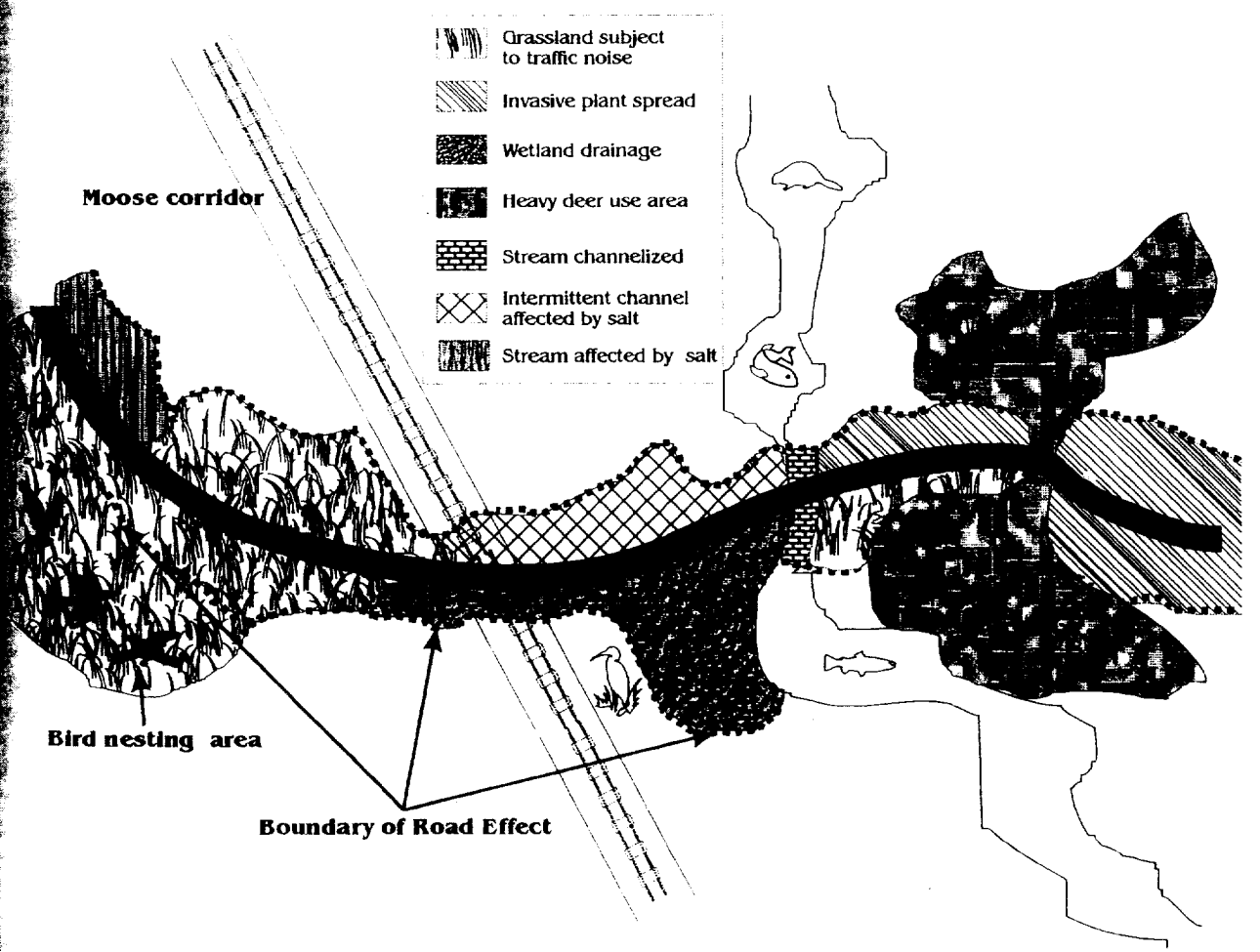
Paper submitted February 8, 1999; revised manuscript accepted July 16, 1999.

his engineering marvel on the foundation of the United tates—the ecological infrastructure—must be considerble. Recent evaluations indicate that one-fifth of the nited States land area, and nearly the same proportion f The Netherlands, is directly affected ecologically by e road system (M. Reijnen et al. 1995; R. Reijnen et al. 995, 1996; Forman & Deblinger 1998; Forman 1999).

Determining the ecological "road-effect zone" for roads a central part of such evaluations (Forman et al. 1997; orman & Alexander 1998; Forman & Deblinger 1998; orman 1999). This zone is the area over which significnt ecological effects extend outward from a road. It is any times wider than the road surface plus roadsides, r verges (Bennett 1991; Reck & Kaule 1993; Reijnen 995; Forman 1995). The road-effect zone is highly ymmetric, due to nature's directional flows and the atial patterns on opposite sides of a road, and has conoluted boundaries (Fig. 1).

We used transportation planning as the context for presenting and illustrating the road-effect zone. Whereas ecological flows and biological diversity manifest broad patterns across the landscape (Turner 1989; Forman 1995; Harris et al. 1996) and road networks affect the fragmentation and human use of entire landscapes (Dale et al. 1994; Reed et al. 1996), transportation planning has traditionally focused meticulously on the narrow area of the road bed and its immediate surrounding strip (Stoeckeler 1965; Directorate-General for Public Works and Water Management 1995; National Research Council 1997). It is time to close the gap between nature's broad landscape processes and the detailed focus of road construction and upgrading projects.

A landscape ecology approach is promising for setting mitigation priorities for the ecological effects of the existing road network, which was built largely before the recent, rapid growth in ecological knowledge. Success-



igure 1. Hypothetical diagram illustrating curvilinear nature of road effects for various ecological features such s high-density deer areas (road mortality), grassland bird nesting areas (noise disturbance), moose corridors road mortality), and various wetland and waterway alterations including exotic plant invasion, salt intrusion, nd channelization.

ful mitigation and compensation projects scattered across the United States, such as salamander tunnels in Massachusetts and underpasses for ground water and wildlife in Florida, serve as useful pilot projects (Evink et al. 1996; Jackson 1996; Forman et al. 1997). Several European nations and Australia have begun to implement widespread environmental mitigation for roads (Langton 1989; Saunders & Hobbs 1991; Pfister & Keller 1995; Canters 1997). The Netherlands, where transportation policy explicitly meshes human mobility and natural processes in the landscape, has completed an array of mitigation and compensation projects, both in new road construction and for existing roads (Directorate-General for Public Works and Water Management 1995; Road and Hydraulic Engineering Division 1995; Forman & Hersperger 1996; Canters 1997; Friedman 1997*a*, 1997*b*; Forman & Alexander 1998).

In the context of protecting species, habitats, and natural processes, our broad objective was to examine the road-effect zone concept based on a particular example. Our specific goals were (1) to compare the distances and spatial patterns of ecological factors that extend outward considerable distances from a highway and (2) to combine these results to map the shape of the road-effect zone for a highway.

Highway, Landscape, and Ecological Factors

In 1997 we selected and studied an area in the middle suburbs (Lincoln, Concord, Acton) and outer suburbs (Boxborough, Littleton) west of Boston, Massachusetts (U.S.A.). Route 2 was chosen as a reasonably typical case of a major four-lane artery radiating outward from a U.S. city through an area experiencing rapid growth in houses and vehicular traffic. This 24.5-km stretch of highway begins 10 km west of the urban area (Cambridge city limit) and follows a relatively straight west-northwest direction. It connects two major "ring roads" of the urban region, the inner-loop Interstate highway 95 (I-95, also Route 128) and the outer-loop Interstate 495 (I-495). This portion of Route 2 was constructed in 1935, and much of the length was upgraded between 1987 and 1993. Interstate highway 95 (Route 128) was completed about 1950 and I-495 about 1970.

The section of highway we studied had four traffic lanes with a central divider. Fifty percent of the highway section was divided by a steel fence barrier on posts (guardrail), 25% was divided by continuous concrete barriers, 5% was divided by a median strip of mowed grass, and 20% of the highway section had no divider. Grassy roadsides along most of the highway generally extended a few meters beyond the paved road surface, and 40% of the section length had a steel fence barrier along the roadside. Thirty-three roads connected with Route 2 over its 24.5-km length. Overall, the eastern portion (kilometers 0–6) and central portion (kilometers 6–18) had small road connections, the central area had crossroads with stoplights, and the western portion (kilometers 18–25) was a controlled-access highway with only entrance-and-exit interchanges.

Traffic volume for the eastern 17 km of Route 2 was approximately 50,000 vehicles per day (Monday through Friday; March data from kilometer 12.5; Concord Town Records). Traffic volume was 34,000 at kilometer 18 (Acton Town Records) and 42,000 at kilometer 24 (Littleton Town Records). The traffic speed limit was generally 45 mph (73 km/hour) in the eastern and central portions and 55 mph (89 km/hour) in the western portion. The inner-loop highway, I-95, had >150,000 vehicles/day; the outer loop, I-495, had >50,000 vehicles/day.

The surrounding land was covered with glacial deposits and mainly sandy soils (Schofield & Baron 1993). Swamps, ponds, and streams were abundant, and Route 2 crossed a reservoir and two rivers. Deciduous forest with evergreens (predominately *Acer, Quercus, Betula, Fraxinus, Pinus*) generally appeared as the background matrix, some of which was wetland. Along 15% of the roadside the highway crossed or was adjacent to seven open-field areas ranging in size from 10–40 ha. Residential neighborhoods covered about one-third of this suburban landscape.

Two river crossings and three railroad crossings had underpasses through which wildlife moved to cross Route 2. The Sudbury River, with its elongated National Wildlife Refuge, flows northward as a major vegetation corridor crossing Route 2 at kilometer 10. The road crossed over 13 streams (first- to third-order). One medium-sized airport, Hanscom Air Force Base 3 km north of Route 2 at kilometer 4.5, contained a large open area partially managed for grassland birds. New Hampshire, 50 km to the north, was the source of moose (*Alces alces*) that periodically dispersed to the Route 2 area.

Road (or highway) refers to the area of paved road surface plus any median area, maintained roadsides, and adjacent up- or downslope roadbanks. In effect, the road is the area extending outward that receives road maintenance, or the area where the adjoining topographic contour is altered by the existence of the road, whichever is further. Additional information on Route 2, the surroundings, and mapping are presented by Forman and Deblinger (1998).

More than 20 ecological effects of roads have been described (Walker & Walker 1991; Reck & Kaule 1993; Forman 1995; Forman et al. 1997; National Research Council 1997). These extend outward for widely varying distances. The road-effect zone, however, is determined only by those factors that extend outward the farthest distances. Therefore factors such as the effects of dust or road salt on vegetation, the presence of heavy metals, microclimatic changes, and small mammal crossings, whose effects in most areas extend outward only tens of meters, were omitted from the list of key factors. We

also eliminated road access for long-distance hunting and other human activities or disturbances (Dale et al. 1994, Forman 1995) because numerous smaller connecting roads permit such access to nearby forested land. Short-term ecological effects of the road construction process (Ashley & Robinson 1996) were also omitted.

The following therefore remained as potential key factors that may extend outward from the highway >100 m (in some cases perhaps for kilometers). Water- and plant-related factors included (1) altered streams and wetland drainage, (2) road salt reaching surface-water bodies, and (3) habitat invasion by exotic species planted on roadsides. Key animal habitat and movement patterns affected by roads included (1) large mammals such as moose and deer (*Odocoileus virginianus*), (2) forest and grassland birds, and (3) amphibians.

We measured some factors directly, whereas others were estimated based on evidence in other studies. Data sets ranged from reasonably thorough to embryonic, so some details should be interpreted with caution. We included best estimates of all factors that could be estimated because for the road-effect zone it is important to see the entire picture.

Road Effects on Water and Plants

Altered Streams and Wetland Drainage

To determine the number, location, and distance from the highway of all channelized or rerouted streams and wetlands at least partially drained due to the construction of Route 2, we examined all streams crossing under the road and recorded the length of any channelization (straightening of the natural stream curviness) upslope and downslope. Almost all streams flowed through wetlands, and stream curviness was easy to observe in November 1997 with a light snow cover on the ground. Intermittent channels were measured in addition to year-round streams.

Thirteen streams and three intermittent channels crossed under the road, which is generally routed across higher terrain. Ten of the streams were first-order, two second-order, and one third-order (based on U.S. Geological Survey 7.5′ topographic quadrangle map). One stream and one intermittent channel showed evidence of alteration predating the 1935 construction of Route 2 and were excluded from our analysis.

Almost all streams and intermittent channels crossing the road were channelized for some distance either upslope, downslope, or both. Two-thirds of the streams were channelized upslope and one-third downslope. Both intermittent channels upslope and no channels downslope were straightened. The length of channelized streams varied from 30 m to 400 m upslope and from 30 m to 500 m downslope of the road. Only two streams were channelized 100 m or more away from the road (Fig. 2). Apparently no stream was rerouted >30 m for construction of the road.

Almost all wetlands adjacent to the road were swamps dominated mainly by red maple (*Acer rubrum*). A few were marshes with cattail (*Typha latifolia*) and purple loosestrife (*Lythrum salicaria*). The presence of a channelized stream either upslope or downslope was used as an indicator of at least partial wetland drainage (Stoeckeler 1965).

Nine wetlands were crossed by or adjacent to the 25 km of Route 2. All of these showed evidence of wetland drainage, indicating that the wetlands are smaller now than before road construction. Wetland drainage effects extended outward from the road for distances varying from 50 m to 500 m. Five wetlands were affected ≥100 m from the road (Fig. 2).

Thus, two streams were channelized and five wetlands partially drained to a distance of >100 m from Route 2. These measures of stream and intermittent channel straightening, plus wetland drainage, are conservative estimates of road effects on the aquatic and wetland ecosystems. Measuring attributes such as change in sediment load, fish populations, and streamflow regime would likely show road effects extending considerably farther than those we recorded. Similarly, water table and wetland soil measurements would probably show wetland effects extending farther from the road.

Road Salt and Surface-Water Bodies

To estimate where salt spread on the highway in winter may affect natural ecosystems, especially the many surface-water bodies near Route 2, we consulted local natural-resource specialists and searched for evidence from the literature. Visible damage to natural woody vegetation by salt appeared to be localized within 10 m or so of the road, even on downslope sides and in open areas. Road salt is also known to move in groundwater and pollute wells in the sandy, gravelly glacial till of Massachusetts and elsewhere in New England (National Research Council 1991), but local natural-resource people knew of no reports or evidence of this effect along the Route 2 study segment. Thus, the primary potential widely spreading ecological effects of road salt are believed to be on shallow ponds, lakes, and reservoirs, streams parallel and adjacent to the road, and vernal pools near the road (National Research Council 1991).

The only evidence we found of road salt pollution along Route 2 was from the Cambridge Reservoir at kilometer 0.5 (Fig. 2). Within approximately 1 km of Route 2 the reservoir was only about 1.0–1.5 m deep. Elevated salt levels in this supply of city drinking water have been reported for many years. The primary source is considered to be I-95 along its eastern border and the secondary source Route 2, where "Low Road Salt" signs are often displayed in winter.

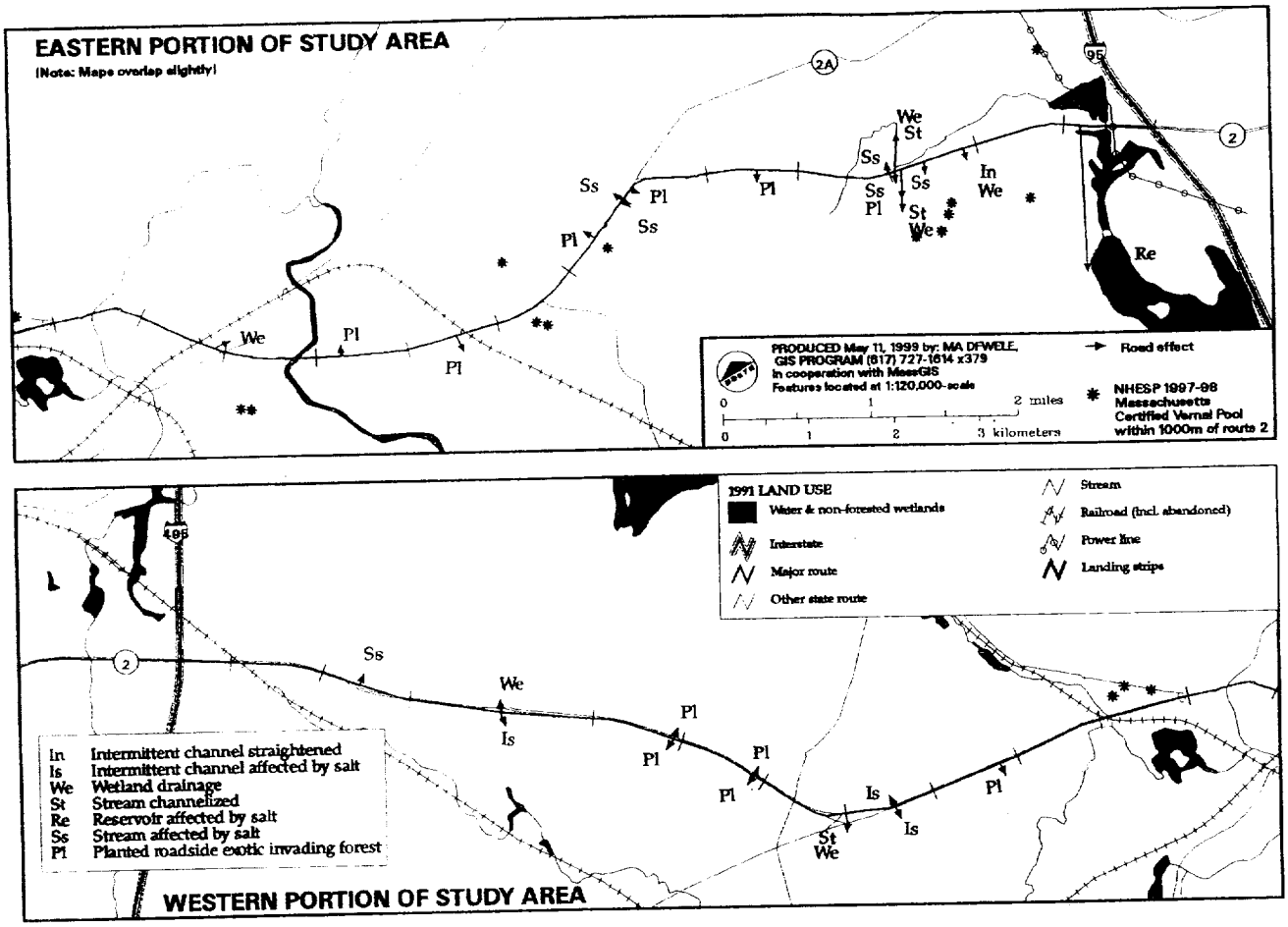


Figure 2. Locations of major water- and plant-related effects of divided highway Route 2 in suburbs west of Boston, Massachusetts. Top map is eastern half and bottom map is western half of study area. Wetland drainage and stream and intermittent-channel straightening that extend at least 100 m from the highway are marked. Streams and channels estimated to be affected by road salt run parallel and adjacent to the road for at least 100 m. All locations of woody non-native species apparently invading from roadsides into natural woods are marked. Adapted from Forman and Deblinger (1998).

Four first-order streams flowed parallel and adjacent to the road (within 30 m) for a distance of at least 100 m (distances arbitrary but consistent with the terrain; stream directions not realigned by road construction). Three such intermittent channels were also present. Road salt can be expected to reach these parallel streams and channels in quantities sufficient to affect downstream aquatic ecosystems (Isabelle et al. 1987; Fennessey 1989; National Research Council 1991). In addition to the four first-order streams, we included two stream segments that were close to a salt storage area at kilometer 6 (Fig. 2). A parallel adjacent fourth-order stream and the three intermittent channels were not mapped because it was less clear what significant ecological effects would be expected.

Three vernal pools with official state certification were located within 200 m of Route 2, and 15 such pools occurred within 1 km of the highway (Fig. 2). Salt, which moves in groundwater through porous glacial till and reaches a shallow pool or pond, can be expected to cause elevated pool salinity and affect sensitive species, especially in spring. At least two of the vernal pools are downslope of Route 2 and are most likely to suffer salt effects.

Thus, one reservoir is known to have widely extending road salt effects, and we can hypothesize ecological effects on at least four streams and two vernal pools. The distance that effects from Route 2 extend is unknown, but they may be in the range of 200–1500 m.

Habitat Invasion by Planted Roadside Exotics

To determine where and how far non-native (exotic) species planted along the roadside spread into the adjoining natural forest (Saunders & Hobbs 1991; Tyser &

Worley 1992), we drove slowly along the entire route and recorded locations of all exotic woody plantings visible in the roadbed (planted by highway personnel, community groups, or adjacent landowners). Based mainly on location within a roadside, we excluded plants that apparently colonized naturally. For each roadside planting encountered we recorded the adjoining land use: natural woods, open, or built. Of the approximately 100 roadside locations with planted exotics, we examined on foot >50 of the most likely spots for species invasions. The remaining locations were surrounded by built area and thus were excluded. Wherever natural woods (upland or wetland) were next to a planted woody exotic (22 locations), we examined the nearest 1 ha of woods on foot to determine the presence or absence and the distance of seedlings or saplings apparently originating from the planted exotic. Each woods survey lasted 15–20 minutes during 1–12 October 1997, when peak autumn colors facilitated plant identifications.

Forty-four woody exotic species were planted at the approximately 100 locations along the 25-km suburban highway (Forman & Deblinger 1998). Exotics included a few species native to the United States but not growing naturally near Route 2. The most frequently planted species were yew (*Taxus* sp.), Norway spruce (*Picea abies*), blue spruce (*Picea pungens*), and arbor vitae (*Thuja occidentalis*).

Both the average and variance in number of planted roadside species decreased with distance from city boundary (Forman & Deblinger 1998), but both increased with local building density near the highway (within 200 m of the road surface in a 1-km road segment, measured from aerial photographs). Few exotic species were planted in roadsides where nearby building density was <60 buildings/km^2. No correlation was found between the species richness of roadside plantings and local road density (also measured within 200 m) near the highway.

Evidence of invasion into natural ecosystems by these planted roadside exotics was present in 11 woods (Fig. 2). This represented 50% of the cases in which woods adjoined a planted woody exotic. Six invading species were recorded: Norway maple (*Acer platanoides*), littleleaf linden (*Tilia cordata*), red pine (*Pinus resinosa*), red spruce (*Picea rubens*), euonymous (*Euonymous alata*), and privet (*Ligustrum vulgare*). The percent of woods invaded did not correlate with distance from urban center (measured from Cambridge boundary). Also there was no correlation with nearby building density or nearby road density. The distance a species invaded into woods from the border of the road surface ranged from 10 m to 120 m, although more intensive sampling might have detected invasions to greater distances.

Thus, 11 woods are apparently being invaded from roadside plantings of non-native woody species along the 25 km of suburban Route 2. The distance presently affected is up to about 120 m from the highway.

Road Effects on Wildlife and Species Pattern

The overall effects of a road on animal populations appear to be (1) a barrier effect that blocks movement routes and subdivides species into smaller subpopulations, (2) animal avoidance of nearby habitat due to traffic noise, and (3) roadkills (Forman & Alexander 1998). For Route 2 we provide estimates for the location, distance, and importance of (1) the blocking of wildlife corridor routes of moose and salamander, (2) roadkills of deer, and (3) avoidance of nearby habitat by forest and grassland birds.

Species such as white-tailed deer may adapt behaviorally to roads by avoiding nearby habitats where traffic noise inhibits predator detection and by selecting particularly advantageous routes and times to cross roads. On the other hand, some species, such as the spotted salamander (*Ambystoma maculatum*) are genetically and physiologically "programmed" to migrate at a certain time from uplands to wet areas for breeding; en route they head directly across a road (Langton 1989; Fahrig et al. 1995). Therefore, transportation planning should provide for both species with considerable ability and those with little ability to avoid roads.

Distant areas, including large patches of natural vegetation commonly containing large populations, are often key sources of and targets for animals approaching or crossing highways (e.g., deer and fisher [*Martes pennanti*]; Harris et al. 1996; Findlay & Houlahan 1997). Distinct, major wildlife routes (e.g., of moose and salamander) may cross highways (Bennett 1991; Harris et al. 1996), and habitat near roads sometimes contains concentrated resident populations (e.g., of deer).

Large Mammals

Moose populations in northern New England have increased exponentially in the past 15 years. Although a small resident population is beginning to emerge in central and western Massachusetts, moose in eastern Massachusetts are usually young males dispersing southward from New Hampshire in search of females during the breeding season in September–October or young females dispersing to new home ranges in May–June (Vecellio et al. 1993). Perhaps due to their large size and relatively low metabolic rate, moose may move through the landscape with little regard to human activity.

Fourteen individual moose have been sighted in our study area since 1992 (Forman & Deblinger 1998). They all crossed major highways, including I-495, and apparently tended to cross in railroad and river underpasses

(Fig. 3). These records illustrate that important moose routes in a suburban landscape with fragmented habitat are railroad, river, and powerline corridors (Fig. 3). Adjacent wetlands and lakes probably enhance the corridor quality. The easternmost moose sighted at kilometer 1 was a yearling female that traveled along a powerline right-of-way and railroad tracks into downtown Boston.

White-tailed deer density is generally highest in the few remaining large tracts of protected forest, a pattern partly associated with recently reduced hunting in this suburban landscape (Deblinger et al. 1993). Two such areas of deer concentration exist next to Route 2, where relatively natural forest land is also adjacent to rivers and wetlands (Fig. 3). Both forest areas are bisected by railroad beds that deer use to cross Route 2 as they move into suburban development areas. Locations of deer hit by vehicles along Route 2 tend to be concentrated near these adjacent protected areas of high deer density (1995–1996 records of Concord Police Department).

Forest and Grassland Birds

Forest-interior birds such as Ovenbirds (*Seiurus aurocapillus*), cuckoos (*Coccyzus* spp.), and Pileated Woodpeckers (*Dryocopus pileatus*) have specific habitat requirements that may be affected by highway noise. Detailed forest-bird data near Route 2 have not been compiled. Therefore, to estimate the effect of this highway on forest birds we extrapolated from the most complete data set available from another temperate area.

Dutch studies have determined road "effect-distances"—(distance from a road for which a significant change, such as reduction in bird density, is recorded)—next to main roads with the same traffic volume as that of Route 2

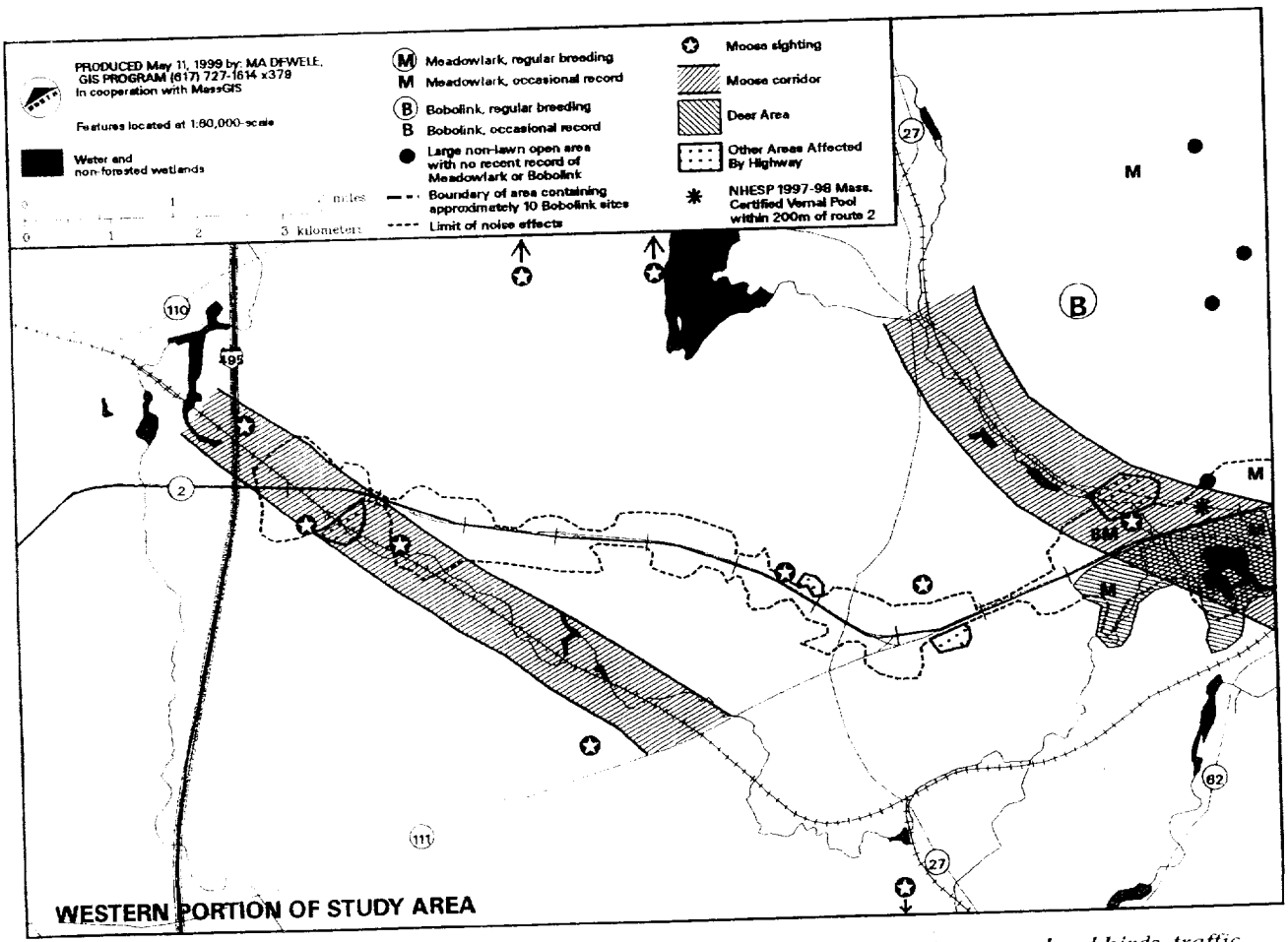


Figure 3. The road-effect zone of Route 2, plus locations of moose, deer concentrations, grassland birds, traffic noise effects, and other highway effects in the surrounding landscape. The road-effect zone is indicated by short dashes plus dotted areas. Dotted areas are major wildlife corridors and locations of widely extending water and plant effects (Fig. 2). No bird data are available for the Western and peripheral portions of the map. Adapted from Forman and Deblinger (1998).

(Foppen & Reijnen 1994; Reijnen 1995; M. Reijnen et al. 1995; R. Reijnen et al. 1995). Evidence indicates that traffic noise rather than visual disturbance, air pollutants, or predators along roads is the primary cause for avian community changes. A major effect of traffic noise is hypothesized to be its interference with bird communication during incubation and fledgling phases of reproduction.

For forest birds as a whole and for the most sensitive species, effect-distances in woodland extend hundreds of meters from a busy road (Fig. 4). The population density of the most sensitive forest-interior species is reduced in woods to approximately 650 m from a main road. In this zone the population is one-third lower than that at greater distances. We used this 650 m for the most sensitive species, rather than the distance for all species combined, in estimating the road-effect zone for Route 2. The most sensitive species tend to be of primary conservation interest.

Grassland birds are those species found only or predominantly in large open areas such as meadow, hayfield, cultivation (tillage), pasture, or some combination thereof. Three of the five key grassland species in the Route 2 area are state-listed threatened species: Upland Sandpiper (*Bartramia longicauda*), Grasshopper Sparrow (*Ammodramus savannarum*), and Henslow's Sparrow (*A. henslowii*). The other two species, Meadowlark (*Sternella magna*) and Bobolink (*Dolichonyx oryzivorus*), are often found in somewhat smaller open areas than those of the preceding species. Hanscom Air Force Base (2–3 km north of Route 2 in Lincoln, Concord, and Bedford), a medium-sized airport with approximately 146 ha of grassland, serves as the major local area for grassland bird populations. The Upland Sandpiper is reported only from Hanscom and one site (Lincoln) 3 km south of Route 2, the Grasshopper Sparrow from Hanscom and one location (Concord) 1.5 km south of Route 2; and Henslow's sparrow from one site (Lincoln) 2 km north and one site (Lincoln) 3 km south of Route 2.

Grassland birds are intensively observed in the area of kilometers 0–15 (Lincoln, Concord, eastern Acton). Breeding-season (15 May to 1 August) records of several experienced ornithologists, naturalists, and officials for approximately 1993–1998 were accumulated and mapped for Meadowlarks and Bobolinks. Open areas observed

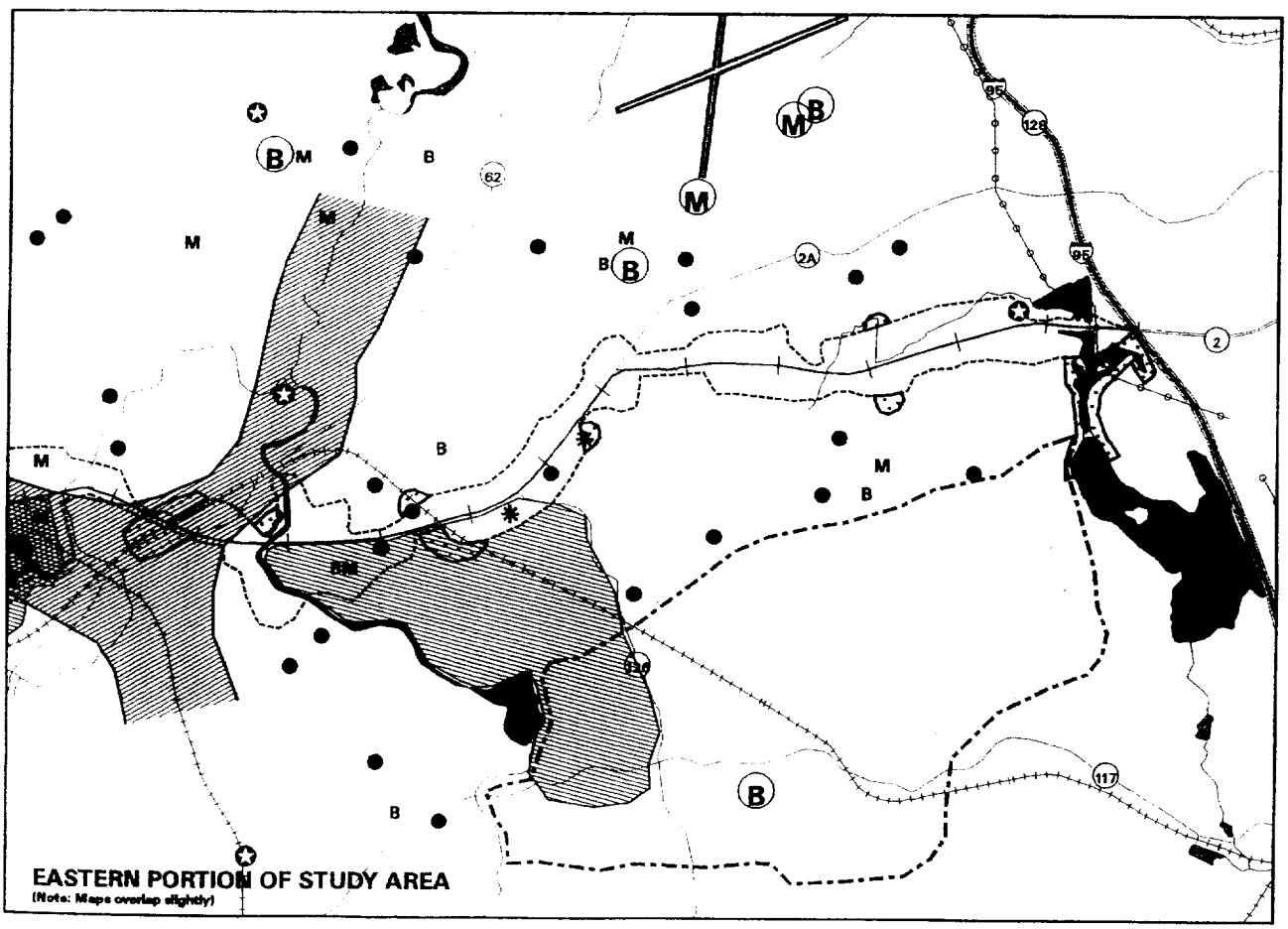


Figure 3 (continued)

were grouped into three categories: regular breeding (evidence of breeding in 3 or more years), occasional sighting (present in 1 or 2 years), and no sighting. Size of open area does not correlate with distance from Route 2 (two of the largest open areas are adjacent to the highway).

Within 1 km of Route 2, Meadowlarks and Bobolinks are only occasionally sighted and apparently do not or only rarely breed (Fig. 3). No open area within this 1-km distance is a regular breeding site for either species. In contrast, regular breeding occurs at two sites in the 1–3 km zone and at four sites in the 3–5 km zone. Caution in interpreting this grassland bird pattern is warranted due to the scattered bird records, the scarcity of open areas by the highway, and the diverse management regimes of open areas. Nevertheless, the data are consistent with the hypothesis that grassland birds are reduced in density and species number for hundreds of meters (or perhaps 1-2 km) from Route 2.

We turn again to the more complete European data set, which shows a decrease in density (Fig. 4) and diversity of grassland birds by main roads (Van der Zande et al. 1980; R. Reijnen 1995; M. Reijnen et al. 1995; R. Reijnen et al. 1996). The most sensitive grassland species is reduced in density to a distance of 930 m from a main road, a figure we used to calculate the road-effect zone.

Amphibians

Salamanders migrate to and breed synchronously in temporary ponds in early spring. Such mass migrations between home range and breeding location, when bisected by roadways, can result in significant mortality (Fahrig et al. 1995; Ashley & Robinson 1996). In Amherst, Massachusetts (110 km to the west), for example, road closure during the migratory period reduced mortality, and after two amphibian tunnels with associated drift fences were placed under the road, mortality decreased further (Langton 1989; Jackson 1996).

Three state-certified vernal pools are within 200 m of Route 2 (Fig. 3). Although amphibian movement has not been studied here, the highway is considered a likely barrier to movement in the vicinity of these locations.

Road-Effect Zone

The preceding results for nine diverse ecological variables are synthesized to delineate the road-effect zone for Route 2.

Some factors, such as invading roadside plants, produced effects at several distinct locations, but apparently for Route 2 the effects extended outward only about 100 m. Salamander migration routes may be blocked by a highway one hundred to a few hundred meters from a vernal pool. Road salt effects on aquatic systems may extend outward some 200–1500 m, also at distinct locations. In contrast, traffic noise apparently affected bird communities in forest and open areas for hundreds of meters on both sides and along a large proportion of the highway. For mammals such as deer, fisher, and black bear (*Ursus americanus*) the highway eliminated suitable habitat and interrupted major travel corridors between large core patches of suitable vegetated habitat. These core-habitat areas were located up to several kilometers from the highway (for instance, the only recent bear record in the vicinity of kilometers 0–18 along Route 2 was in a 400-ha forest centered 5 km north of kilometer 9).

The road-effect zone for Route 2 (Fig. 3; Forman & Deblinger 1998; Forman 1999) had highly convoluted boundaries as a result of the sequence of affected ecological factors along the road and their differing effect-distances (Forman et al. 1997; Forman & Alexander 1998). The road-effect zone at most points was asymmetric partially because of directional water and wind flows across the zone. Topographic patterns and cut roadbanks also caused asymmetry in ecological effect distances. Nevertheless, the different arrangement of suitable habitats and land uses generally present on opposite sides of the highway, especially of major natural-vegetation patches and corridors, was a major cause of the asymmetric patterns of ecological effects.

The maximum distance that direct ecological effects extended outward from Route 2 (edge of road surface) averaged just over 300 m (Fig. 3). Therefore the average width of the road-effect zone for this suburban highway exceeded 600 m, with the area affected being approximately 0.6 km^2 per kilometer of road length. Of course, variability from side to side and from location to location along the route was high and of considerable ecological interest. Variability appeared higher in the middle suburbs (kilometers 0–18) than in the outer suburbs. We hypothesized that this was the result mainly of more land-use heterogeneity (i.e., a more even mix of woods, built areas, and open areas) in the middle suburbs, compared with more extensive forest cover in the outer suburbs.

Two important ecological factors could not be estimated for this study, but in time they should be added. First, highways that eliminate suitable habitat and interrupt major travel corridors between large patches of suitable vegetated habitat for large mammals may produce effects extending for kilometers from the highway (Dale et al. 1994; Forman 1995; Harris et al. 1996; Findlay & Houlahan 1997). The effects of interrupted wildlife corridors would typically appear as "fingers" extending outward from the road-effect zone boundary (similar to fingers representing the effect of road sediments on downstream fish). Second, the road subdivides previously large connected populations into smaller subpopulations (Langton 1989; Reed et al. 1996; Forman & Alexander 1998) that tend to be isolated on habitat patches

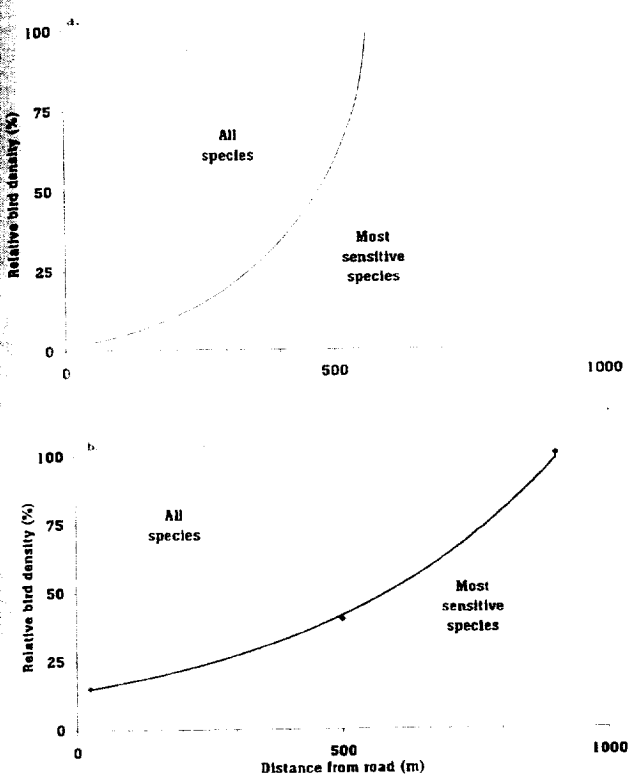


Figure 4. Birds in (a) forest and (b) pasture relative to distance from main roads with traffic noise. In forest the pattern for all species combined is compared with that for the sensitive Cuckoo; all species in grassland are compared with the sensitive Black-tailed Godwit. Based on songbird studies at 69 locations (54 in woodland, 15 in open grassland) by highways with 50,000–60,000 vehicles/day in The Netherlands (M. Reijnen et al. 1995; R. Reijnen 1995; R. Reijnen et al. 1995, 1996). Adapted from M. Reijnen et al. 1995 (Forman & Deblinger 1998).

and that may be distant from the road. The subpopulations are considered less stable and more vulnerable to local disappearance or extinction (Wiens 1996).

Conclusion

We envision a future transportation system that provides effectively for both (1) natural processes and biodiversity and (2) safe and efficient human mobility. Transportation planning should take a broad perspective on the spatial patterns and ecological flows extending horizontally across the landscape. The road-effect zone we describe is the minimum distance from a road or proposed road appropriate in planning.

Busy roads should be kept well away from nature reserves and similar protected areas. Natural areas near such roads may be impoverished in species sensitive to road and traffic disturbance. Road ecology is one of the great frontiers awaiting science and society. A range of solutions to the problem of roads exists, and research should develop others to effectively address the most extensive ecological factors underlying the road-effect zone. Research, pilot projects, monitoring, and public education are needed to attain this vision of a future transportation system.

Acknowledgments

We are deeply grateful to J. W. Brain, S. F. Ells, C. F. Gibson, A. L. Jones, E. Mallett, D. H. Monahan, T. Tidman, and R. K. Walton for grassland bird data; to P. J. Barosh for information on geology and hydrology; to T. Hayes, G. McGeon, D. H. Monahan, and T. Tidman for moose data; to R. Reijnen for highlighting the importance of traffic noise on avian populations; to T. Early for preparing the figure; and to K. Bramley, D. Graaskamp, and S. McRae for preparing maps.

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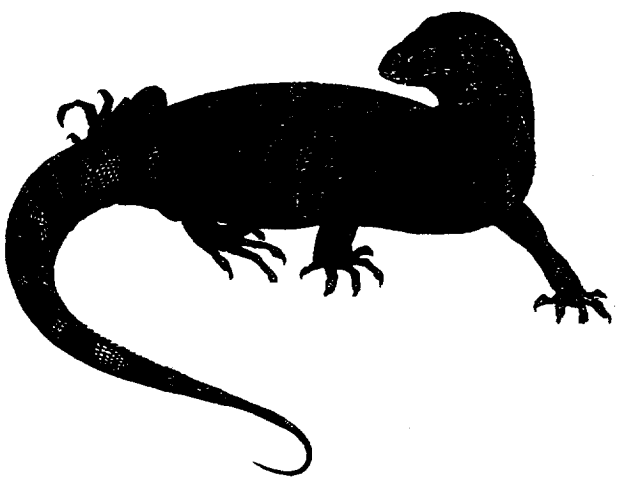

Interface Between Ecology and Land Development in California
Edited by J.E. Keeley. 1993. Southern California Academy of Sciences, Los Angeles

A Regional Landscape Approach to Maintaining Biodiversity: Protected Areas in Orange County and Environs

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Abstract. We analyzed 34 existing parks and reserves in Orange County and adjacent portions of Riverside, San Bernardino, and San Diego counties for their adequacy of protecting the natural biodiversity in the region. Most of these parks and reserves are linear or nearly so in shape, isolated from one another, and can be classified as providing only partial protection for native biotic elements. Based on gap analysis using a geographic information system, we found that widely varying proportions of the ranges of seven diminished vegetational communities (e.g., coastal sage scrub) and four rare species (e.g., California gnatcatcher) occur within existing protected areas. Although the 23 new parks and reserves proposed for the region would add little to the proportion of element ranges under protection, they would be important for expanding and linking together some of the existing parks and reserves. The transportation corridors (tollroads) proposed within Orange County appear to be incompatible with maintaining biodiversity in southern California because they would disrupt, reduce, and isolate the populations of many biotic elements. Creating a regional landscape to maintain natural diversity and intact ecosystems in the county and environs will require the expanding and joining of protected areas in several key localities.

Keywords. Biodiversity; biotic elements; gap analysis; geographic information system; habitat corridors; intact ecosystems; landscape linkages; Orange County; parks and reserves; protected areas; regional landscape; southern California; tollroads; transportation corridors.

Introduction and Objectives

Loss and fragmentation of habitat are major causes of the extirpation of native species and the disruption of intact communities (Wilcox and Murphy 1985; Wilcove et al. 1986; Saunders et al. 1991). In southern California, for example, fragmentation of chaparral habitat has led to reduced bird diversity in this vegetation type (Soulé et al. 1988; Bolger et al. 1991; Langen et al. 1991). These impacts are intensified where rapid development confronts remaining wildlife and natural areas. Given the rapid population growth and habitat alteration that has occurred in southern California in the last few decades, Orange County and adjacent areas represent a microcosm of the conflicts between conservation and development observed throughout the state. Despite the rapid changes in this region, a sizable portion of it is under some type of protection, especially in the southern and southeastern sectors of the county and adjoining lands. Thus, the possibility still exists to create a landscape-scale network of parks and reserves that would help protect the remaining species and ecosystems in the region as a whole.

We had three objectives in carrying out this study: (1) to describe the level of protection, shape, and degree of connection to one another of 34 protected areas in Orange County and environs; (2) to analyze these areas in terms of their protection of 11 sensitive vegetational communities and individual species in the region; (3) to offer recommendations for sustaining biodiversity in the region based on the distributions of these biotic elements, on the conservation effectiveness of the existing and proposed protected areas, and on the anticipated future developments in the region, especially the transportation corridors (tollroads) planned for Orange County.

Materials and Methods

Definitions

Three terms are important to define as used in our analysis:

> *Protected area*: Any designated area dominated by natural habitat (e.g., park, reserve, open space) in the region studied, regardless of its main management goals.

Biotic element: A rare animal species or diminished vegetational community considered at the outset of the study to be representative of declining biodiversity in the region.

Regional landscape: An interconnected set of habitat areas large enough to allow natural movements of species, to maintain viable populations and intact communities, and to be able to absorb and recover from natural disturbances such as fire. This definition is generally consistent with the bioreserve concept of Jenkins (1991) and the regional-scale perspective of Noss (1991).

Region studied

The region studied includes all of Orange County as well as the portion of Chino Hills State Park that lies in San Bernardino County, the portion of Cleveland National Forest that extends into Riverside and San Diego counties, the Santa Rosa Plateau Preserve in Riverside County, and Camp Pendleton, immediately to the south in San Diego County (Fig. 1), which includes the Santa Margarita River, an important riparian system in southern California.

Protected areas

We analyzed 34 protected areas assigned to 12 categories based on the private or public agency that owns or manages them (Table 1). We classified these areas as fully protected if they are managed primarily for biodiversity and wilderness values and as partially protected if managed for multiple uses, including biodiversity and wilderness values. Shapes of the protected areas were assigned qualitatively by visual inspection of maps. The degree of connection of each protected area was determined by calculating the proportion of the perimeter of the protected area contiguous with another protected area. We used the ARC/INFO geographic information system (GIS) software.

Biotic elements

The 11 biotic elements we chose for distributional analysis include greatly reduced vegetational communities and rare or officially listed endangered species in the region (Table 2). Each element is briefly described as follows:

1. *Coastal marsh:* In our analysis, this community comprises coastal salt marsh and coastal brackish marsh as described by Holland (1986). An estimated 75-90% of coastal salt marsh in southern California has been destroyed, and the remaining associated estuarine habitats have also been severely degraded (Ferren 1990).

2. *Belding's savannah sparrow:* This subspecies requires coastal salt marsh habitat (Massey 1979) and has been listed as endangered by the state of California since 1974. It is a disturbance-sensitive species whose populations decline as marsh habitat is destroyed but increase when the habitat is restored (Zembal et al. 1988).

3. *Riparian woodland:* In our analysis, this community comprises southern coast live oak riparian forest, southern sycamore alder riparian woodland, southern cottonwood willow riparian forest, and southern willow scrub as described by Holland (1986). Mature riparian habitats are often characterized as having the greatest biological diversity and highest productivity among natural habitats in California (Sorenson,1989). Estimates of riparian habitat loss in southern California floodplain areas run as high as 95-97% (Faber et al. 1989).

4. *Least Bell's vireo:* This subspecies requires riparian habitat for nesting and also uses adjacent upland habitats, particularly chaparral and coastal sage scrub, for foraging (Gray and Greaves 1984; Kus and Miner 1989). It is a neotropical migrant and is listed as endangered by both the federal government and the state of California.

5. *Coastal sage scrub:* This community consists of several subassociations in southern California (DeSimone and Burk 1992) and has been reduced by as much as 85% in this part of the state (Westman 1981, as cited in O'Leary 1990). It supports a suite of declining animal species, including the orange-throated whiptail, San Diego horned lizard, coastal cactus wren and California gnatcatcher (O'Leary 1990).

6. *California gnatcatcher:* This species requires coastal sage scrub habitat (Atwood 1991) and is a candidate for listing as endangered by the federal government. This sedentary, specialized species is especially vulnerable to local extinction in the region studied because it occurs as small, isolated populations in shrinking islands of its required habitat (Atwood 1990).

Table 1. Characteristics of 34 protected areas in 12 categories of ownership and management in Orange County and environs. Numbers for protected areas and letters for separate segments correspond to those in Figure 1.

Category/Protected area	Area (ha)	Level of protection	Shape	Degree of connection (% contiguous perimeter)
I. Federal marsh restoration				
1. Corps of Engineers	44	Full	More linear than round	0
II. Federal military reserve				
2. Camp Pendleton	53,047	Partial	Round	11
III. National forest				
3. Cleveland	61,484	Partial	More round than linear	16
IV. National wildlife refuge				
4. Seal Beach	377	Partial	Round	0
V. State ecological reserve				
5. Bolsa Chica	102	Full	Linear	0
6. Upper Newport Bay	235	Full	Linear	31
VI. State park				
7. Chino Hills	4,577	Partial	More linear than round	4
8. Crystal Cove	1,043	Partial	More round than linear	0
VII. State wildlife commission reserve				
9. Tecate Cypress	388	Full	Round	0
VIII. University of California natural reserve				
10. San Joaquin Marsh	220	Full	More linear than round	0
IX. County regional park				
11. Aliso-Wood Canyons	A: 1,811	Partial	More round than linear	9
	B: 170	Partial	Linear	0
12. Carbon Canyon	78	Partial	More linear than round	21
13. Fairview	34	Partial	Linear	14
14. Featherly	190	Partial	Linear	0
15. Irvine	149	Partial	More round than linear	0
16. Laguna Niguel	71	Partial	Linear	0
17. Mason	153	Partial	Linear	0
18. Modjeska Canyon Nature Reserve	30	Partial	More linear than round	100
19. O'Neill	730	Partial	Linear	0
20. Salt Creek	129	Partial	Linear	0
21. Santiago Oaks	A: 303	Partial	Linear	0
	B: 57	Partial	Linear	0
22. Talbert	64	Partial	Linear	8
23. Upper Newport Bay	A: 53	Partial	Linear	28
	B: 10	Partial	Linear	46
24. Yorba	45	Partial	Linear	0
X. County wilderness park				
25. Caspers	3,106	Full	Round	47
26. Wagon Wheel Canyon	226	Full	More linear than round	0
27. Whiting Ranch	A: 435	Full	Round	0
	B: 172	Full	Linear	0
XI. Open space within cities				
28. Big Bend Greenbelt	95	Partial	Round	28
29. Brush Canyon	126	Partial	More linear than round	0
30. Sycamore Hills Park	126	Partial	More round than linear	0
XII. Private reserves				
31. Audubon Starr Ranch Sanctuary	1,411	Full	More round than linear	39
32. Huntington Beach Wetlands Conservancy				
	A: 16	Full	Linear	0
	B: 48	Full	Linear	0
33. Santa Rosa Plateau Preserve	3,220	Full	More round than linear	0
34. Talega Valley Reserve	497	Full	Round	0

7. *Engelmann oak woodland:* This community occurs in small, scattered stands, and the named species has the smallest distribution of any oak in California (Scott 1991). The last naturally reproducing stands in the region studied occur in the Santa Rosa Plateau Preserve (Dangermond & Associates, Inc. 1991).

8. *Valley needlegrass grassland:* This community is characterized by the presence of the perennial, tussock-forming purple needlegrass *Stipa pulchra* (Holland 1986). Only an estimated 0.1% of the perennial grasslands that once covered almost one-fifth of the state of California remain today (Barry 1972, as cited in Keeley 1990).

9. *Tecate cypress forest:* This rare community exists in several locations in Baja California and in only four stands in southern California; three in San Diego County and one in Orange County (Dunn 1985). The latter, the only one in the region studied, contains both the oldest and probably the largest Tecate cypress trees in the world (Spenger 1985).

Table 2. Conservation status of the 11 biotic elements whose distributions in the region studied were analyzed

	Element	Status
1.	Coastal marsh	Greatly reduced
2.	Belding's savannah sparrow	State endangered
3.	Riparian woodland	Greatly reduced
4.	Least Bell's vireo	State and federal endangered
5.	Coastal sage scrub	Greatly reduced
6.	California gnatcatcher	Candidate for listing
7.	Engelmann oak woodland	Last viable stands
8.	Valley needlegrass grassland	Greatly reduced
9.	Tecate cypress forest	Vulnerable relict
10.	Vernal pools	Rare, unique habitats
11.	Mountain lion	State protected

10. *Vernal pools:* In our analysis, these unique, seasonal bodies of standing water are included as communities and comprise southern interior basalt flow vernal pools at the Santa Rosa Plateau Preserve and San Diego mesa hardpan vernal pools at Camp Pendleton as described by Holland (1986). Vernal pools support a diverse and highly specialized biota (Jones & Stokes Associates 1987). However, only a few vernal pools remain in southern California; for example, perhaps less than 7% of all vernal pools that ever occurred in San Diego County now remain (Bauder 1986, as cited in Jones & Stokes Associates 1987).

11. *Mountain lion:* This species is the top predator in non-desert southern California ecosystems and is a protected mammal in the state. The population in the region studied consists of 20-25 adult females and three males in the Santa Ana Mountains and 1 or 2 females in the Chino Hills (Paul Beier personal communication 1990).

Information sources and GIS analysis

Locations of existing and proposed protected areas and proposed transportation corridors for Orange County were obtained from the Regional Recreation and Open Space Lands map prepared by the Environmental Management Agency of Orange County. Locations of protected areas in Riverside, San Bernardino, and San Diego counties were obtained from road maps and Bureau of Land Management maps of the Santa Ana and Oceanside quadrangles.

We obtained most of the information on the distributions of the biotic elements from the Natural Diversity Data Base (NDDB), a computerized inventory of the locations of populations of rare and threatened plants, animals, and natural communities in California, using software called Rarefind. The NDDB is administered by the California Department of Fish and Game with support from The Nature Conservancy. Information on certain elements was acquired from other sources as follows:

1. *Coastal sage scrub:* from a distribution map of this vegetation type for Orange County prepared by Fred Roberts and a report on the Santa Rosa Plateau by Dangermond & Associates, Inc. (1991). Distributional information on coastal sage scrub on Camp Pendleton and the Cleveland National Forest was not obtained.

2. *California gnatcatcher:* from the latest (1992) edition of the NDDB and a report on the gnatcatcher in Orange County parks by Almanza and Associates (1991).

3. *Engelmann oak woodland:* from the report by Dangermond & Associates, Inc. (1991).

4. *Valley needlegrass grassland:* from the latest (1992) edition of the NDDB and a review of California valley grasslands by Keeley (1990).

5. *Tecate cypress forest:* from a lands acquisition proposal for the Tecate cypress in Orange County prepared by Spenger (1990).

6. *Mountain lion:* from Paul Beier (personal communication 1990), project leader for the Orange County cooperative mountain lion study.

We used ARC/INFO and Atlas GIS software to store, as layers, maps of the existing and proposed protected areas, of the distributions of the biotic elements, and of the existing major freeways and proposed transportation corridors in the region. We then overlaid the different map layers for visual inspection and performed a gap analysis (see Scott et al. 1991) to determine quantitatively the proportion of the ranges of 10 of the biotic elements located inside of existing and proposed protected areas. The mountain lion was not included in this analysis because of its wide-ranging movements.

Results and Discussion

Size, shape, level of protection, and degree of connection of protected areas

The protected areas in the region studied vary greatly in their size, shape, and degree of connection (Table 1,

Fig. 1). Three orders of magnitude in size distinguish the several parks and reserves, all smaller than 100 ha, from Camp Pendleton and Cleveland National Forest, each containing more than 50,000 ha. About 77% (30 of 39 segments) of these protected areas are less than 500 ha in size. Almost two-thirds (64%) of these parks and reserves are linear (n = 18) or more linear than round (n = 7) in shape, and the same proportion of them is not contiguous with any other protected area. Slightly more than one-third (n = 14) are fully protected, and these comprise 7.5% of the total area under protection.

The protected areas in the region are potentially subject to the effects of fragmentation. Despite the existence of a few large protected areas, most are relatively small, linear or nearly so, and isolated from other such areas, and offer only partial protection for natural biodiversity. Fragmentation can be expected to result in smaller local populations of a given species, which are at increased risk of extirpation, genetic drift, and inbreeding, dysfunctional age and sex ratios (see Simberloff 1988). An increasing number of species will predictably fall below their minimum viable population sizes.

Fragmentation also means that protected areas are surrounded by a matrix of agricultural, industrial or other types of developed land. Thus, the main physical characteristics (e.g., wind, moisture, nutrient and pollutant levels) of the habitat fragments may be largely determined by conditions arising in the surrounding landscape (Saunders et al. 1991). Importantly, the amount of edge habitat increases as protected areas become smaller and narrower (Kelly and Rotenberry 1993). These conditions increase the likelihood that native animals will wander into alien habitats and exotic species will invade protected areas. Intuitively, fragmentation can be expected to reduce the probability that intact ecosystems will persist.

Occurrence of biotic elements inside and outside of protected areas

Our gap analysis shows that the biotic elements studied occur to varying degrees within existing protected areas (Table 3, Figs. 2 and 3). All identified vernal pools and viable stands of Engelmann oak in the region are located within existing protected areas. In contrast, only one-fourth of the coastal sage scrub vegetation is under current protection.

We emphasize that the distributions of all the biotic elements represent only fractions of their former ranges (and abundance) in the region (see Table 2). For example, most of the major vegetation types have largely been lost. Therefore, any additional protection is arguably important for their continued existence in southern California. For this reason, we calculated the proportions of the element distributions that would be included within the 23 additional protected areas proposed for the region (Table 3) and these proposed protected areas are listed in Table 4. Even though the proposed protected areas would add substantially to the protection of marsh and coastal sage scrub, taken together the existing and proposed parks and reserves would include more than 80% of the remaining distributions of five of the 10 biotic elements (Fig. 3).

Table 3. Proportions of 10 biotic element distributions within existing and proposed protected areas in the region studied. These values represent protected portions of already rare or greatly reduced biotic elements (see Table 2).

Element	Percent within protected area		
	Existing	Proposed	Total
1. Coastal marsh	59	25	84
2. Belding's savannah sparrow	89	0	89
3. Riparian woodland	64	5	69
4. Least Bell's vireo	71	0	71
5. Coastal sage scrub	25	16	41
6. California gnatcatcher	36	7	43
7. Engelmann oak woodland	100	0	100
8. Valley needlegrass grassland	81	0	81
9. Tecate cypress forest	60	0	60
10. Vernal pools	100	0	100

Conservation value of proposed protected areas

The 23 parks and reserves proposed for the region studied would increase the total area under some type of protection by about 8%. Of this added amount, 31% would be fully protected; 77% of the 26 individual segments would be linear or nearly linear in shape and 27% of them completely isolated from other protected areas (Table 4, Fig. 4). These characteristics, coupled with those described in the previous section on the proportion of element ranges that would be contained within the new protected areas, indicate that these new parks and reserves would be of limited value to conservation of biodiversity in the region.

Despite these features of seemingly low conservation value, the proposed parks and reserves would enhance the maintenance of biodiversity by providing either full or partial protection to habitats and communities in some previously unprotected locations, and connecting with and thereby enlarging, several existing protected areas. The creation of new, fully protected areas such as the Bolsa Chica Wetlands Restoration Area (#1, Table 4, Fig. 4), Irvine Coast Wilderness Park (#20 A, B, C), Weir Canyon Wilderness Park (#22), and the Whiting Ranch Wilderness Park Addition (#23)

Table 4. Characteristics of 23 proposed protected areas in three categories of ownership and management in the region studied. Numbers for proposed protected areas and letters for separate segments correspond to those in Figure 4.

Category/Protected area	Area (ha)	Level of protection	Shape	Degree of connection (% contiguous perimeter)
I. State restoration area				
1. Bolsa Chica Wetlands	505	Full	More linear than round	33
II. County regional park				
2. Aliso-Wood Canyons additions				
	A: 124	Partial	More linear than round	57
	B: 203	Partial	More round than linear	50
3. Black Star Canyon	711	Partial	More linear than round	100
4. Bolsa Chica Linear	91	Partial	Linear	64
5. El Toro MCAS	162	Partial	More round than linear	0
6. Laguna/Laurel	735	Partial	More linear than round	21
7. Limestone Canyon	2,239	Partial	Round	19
8. Los Alamitos Naval Air Station	592	Partial	More linear than round	0
9. Marine Corps LTAS	174	Partial	Round	0
10. Olinda	232	Partial	More linear than round	29
11. O'Neill addition	184	Partial	Linear	32
12. Peters Canyon	169	Partial	Linear	0
13. Potrero Los Pinos	342	Partial	More linear than round	100
14. Prima Deshecha	520	Partial	More linear than round	0
15. Sand Canyon Reservoir	211	Partial	More linear than round	23
16. San Juan Canyon	207	Partial	Linear	100
17. Seal Beach Naval Weapons Station	250	Partial	Round	36
18. Villa Park Basin	132	Partial	More linear than round	44
III. County wilderness park				
19. Hot Springs Canyon	120	Full	Linear	100
20. Irvine Coast	A: 156	Full	More linear than round	0
	B: 265	Full	More linear than round	0
	C: 868	Full	More round than linear	63
21. Upper Trabuco Canyon	481	Full	Linear	100
22. Weir Canyon	674	Full	More linear than round	36
23. Whiting Ranch addition	161	Full	Linear	29

appears to be particularly important in terms of added protection for habitats and communities. Also, most (73%) of the proposed parks and reserves are contiguous to some degree with another protected area (see Table 4). Moreover, they increase the degree of connection for several existing protected areas (Table 5). For these reasons, the proposed protected areas would aid in the maintenance of biodiversity, and thus it is vital they be established.

Predicted impacts of proposed transportation corridors

The tollroads proposed for Orange County will have negative effects on the maintenance of biodiversity in the region. Roads have been shown to isolate protected areas, disrupt ecosystems, fragment populations and communities, and create barriers to movement of individual animals (e.g., Harris and Atkins 1991; Pace 1991). All of these impacts can be expected to occur if major new roads are built in the region studied.

The existing major freeways (shown in Fig. 4) pass through the sections of greatest urbanization in the region, whereas the proposed transportation corridors would pass through either sections of the least disturbed natural areas or sections where development has only recently penetrated. The tollroads would bisect the largest remaining natural landscape in the region studied outside of Camp Pendleton and Cleveland National Forest. Figure 4 shows that the tollroads would cut through O'Neill Regional Park, one segment of Whiting Ranch Wilderness Park, one segment of Aliso-Wood Canyons Regional Park and the proposed Laguna/Laurel Regional Park.

These transportation corridors would help to complete the already partial isolation of entire protected areas or groups of protected areas, in effect, cutting them off from any of the larger parks and reserves. Examples are Irvine Regional Park, Santiago Oaks Regional Park, San Joaquin Marsh Natural Reserve, and Talega Valley Reserve. Proposed protected areas similarly affected would be Weir Canyon Wilderness Park, Peters Canyon Regional Park, Sand Canyon Reservoir Regional Park, and Prima Deshecha Regional Park.

The proposed transportation corridors would cut through many remaining stands of vegetation, resulting in further negative impacts. The GIS overlay in Figure 5 illustrates the marked extent to which paths of the planned tollroads coincide with biotic element distributions, especially coastal sage scrub and, to a considerable extent, that of the California gnatcatcher. Building these transportation corridors will cause major habitat fragmentation, disruption of natural communities, isolation of species populations from one another, and out-

Table 5. Increases in degree of connection of existing protected areas if all additional protected areas proposed for the region studied were to be established. Numbers for existing protected areas and letters for separate segments correspond to those in Table 1.[1]

	Existing protected area	Increase in degree of connection (% contiguous perimeter)
5	Bolsa Chica State Ecological Reserve	0 to 48
7	Chino Hills State Park	4 to 6
8	Crystal Cove State Park	0 to 42
11	Aliso-Wood Canyons Regional Park (segment A)	9 to 25
15	Irvine Regional Park	0 to 24
17	Mason Regional Park	0 to 15
21	Santiago Oaks Regional Park (segment A)	0 to 20
27	Whiting Ranch Wilderness Park (segment A)	0 to 15
30	Sycamore Hills Park	0 to 6

[1] The protected areas not listed would remain unchanged.

right population reductions and local extirpations.

Because of these inevitable negative effects, we consider the transportation corridors proposed for Orange County as incompatible with any biologically driven plan to preserve maximal biodiversity in the region studied. We offer general recommendations for such a plan below.

Recommended expansions and linkages of protected areas

Camp Pendleton and Cleveland National Forest are by far the largest protected areas in the region studied, and they provide the backbone for any landscape-scale plan to sustain maximal biodiversity in the region. However, these large, multiple-use areas are isolated to varying degrees from most of the other, smaller parks and reserves under consideration. Habitat fragmentation with its recognized negative impacts on biodiversity continues apace as development penetrates the last remaining natural areas. Protected areas therefore need to be upgraded and interconnected as Pryde (1988) has recommended in a somewhat similar analysis of parks and reserves in San Diego County.

Two approaches for reducing the effects of habitat fragmentation are to increase the size of neighboring protected areas until they conjoin, and to preserve or restore habitat corridors between the areas (Harris and Atkins 1991). The proposed parks and reserves, if established, would contribute to the first approach (see Table 4, Fig. 4) as would further land acquisitions. However, the second approach is probably the more likely alternative in highly developed areas.

Habitat corridors are increasingly recognized as part of the solution to landscape fragmentation (e.g., Mackintosh 1989; Hudson 1991; Saunders and Hobbs 1991). These natural or restored linear landscape features are used to connect two or more larger tracts of essentially similar habitat; they serve as movement routes for animals and avenues for genetic transfer or other natural ecological processes across the landscape (Harris and Atkins 1991). Ideally, these corridors collectively encompass the full range of native habitats and link nature reserves into regional networks (Noss 1991). Even though corridors may allow the spread of disease or exotic species (Simberloff and Cox 1987), the advantage of offsetting negative impacts of habitat fragmentation appears to outweigh by far their disadvantages. Moreover, habitat corridors can serve an important connective function even in relatively urbanized settings. Greenways, which might be thought of as recreational and wildlife corridors within city limits, have already been shown to provide passageways for a variety of free-ranging vertebrates in cities such as Anchorage, Alaska, Portland, Oregon, and Tucson, Arizona (Hay 1991).

In the context of the above discussion, we recommend a regional landscape approach to maintain the biodiversity of Orange County and environs. We identify nine "linkage zones" (Fig. 6) where emphasis should be placed on expanding protected areas and establishing habitat corridors so as to form a network of protected areas in the region as a whole. Although the details of the strategies to be undertaken in each zone are beyond the scope of this paper, we offer below some specific comments to support our recommendations.

Linkage zones 1 and 2 emphasize the need to enlarge the few remaining coastal marsh habitats in the region and to allow natural predators such as the coyote to have access to these systems. These predators maintain a balance in the ecosystem by controlling the numbers of smaller, often exotic predators. For example, where coyotes have access to coastal marshes they limit the numbers of non-native red fox, which otherwise can have a severe impact on the reproductive success of marsh-nesting birds, such as the endangered light-footed clapper rail (Zembal 1993).

Linkage zone 3 represents the need to increase the connections between protected areas in the southwestern sector of the region studied. The proposed, three-segment Irvine Coast Wilderness Park (Fig. 4) seems particularly important to establish in this regard. As shown in Figure 5, this sector contains relatively dense concentrations of coastal sage scrub and California gnatcatcher.

Linkage zone 4 stresses the need to provide an adequate corridor between Chino Hills State Park and Cleveland National Forest so that the subpopulation of

mountain lions in the Chino Hills will not be isolated from the larger lion population in the Santa Ana Mountains. Creation of an effective corridor in this case requires not only the maintenance of existing freeway underpasses but access to these passageways through protection of the nearby canyon lands used for travel by mountain lions.

Linkage zones 5 and 6 express the need to interconnect the smaller, relatively isolated parks and reserves in these foothill localities and to link them with Cleveland National Forest. As shown in Figure 5, these localities contain some of the best unprotected riparian forest and coastal sage scrub habitats in Orange County. Linkage zone 7 focuses attention on the need to establish connections between the protected areas in the southwestern sector of the region studied with Camp Pendleton to the south and with Caspers Wilderness Park and Cleveland National Forest to the southeast. This zone also contains important concentrations of still unprotected riparian woodland, coastal sage scrub and associated species (Fig. 5).

Linkage zones 8 and 9 direct attention to the importance of expanding the Santa Rosa Plateau Preserve and connecting it with Cleveland National Forest and with Camp Pendleton and the Santa Margarita River. As shown in Figure 5, the Santa Rosa Plateau Preserve harbors a diverse mosaic of many rare biotic elements and serves as an important habitat corridor for mountain lions. It is surrounded by high quality natural habitat that is rapidly being lost and degraded.

If the transportation corridors proposed for Orange County are built, it is vital that underpasses be part of the design so as to allow safe crossing by free-ranging animals. These underpasses, however, will not prevent the further habitat destruction and fragmentation, disruption of vegetational communities, and isolation of the more sedentary animal species that will result from construction of these tollroads. Even mobile animals will be subject to a funneling and thereby an isolating effect as they are forced to traverse narrow passageways beneath the tollroads.

In conclusion, we reiterate Soule's (1991) admonition that establishing corridors before fragmentation is complete is much less expensive than retrofitting the landscape with corridors after degradation has eliminated the natural habitat between remnants and reserves.

Acknowledgments. We thank Robin Cox who helped us initiate and encouraged us to complete this project. Georgette Bitrich, Keri Snailum, Dan Villareal, and especially Debbie Guy helped compile information in the early stages. Tom Lupo provided map overlays of element distributions from the Natural Diversity Data Base (NDDB) and Joel Weintraub showed us how to use the NDDB software. Bill Lloyd provided instruction on the use of GIS software. Paul Beier was generous with his data on mountain lions, and Fred Roberts provided vegetational information. Pete and Sandy DeSimone were important sources of information and encouragement and critically read the manuscript. Financial assistance was received from the Saturn Corporation through a student innovation award and from the School of Natural Science and Mathematics at California State University, Fullerton.

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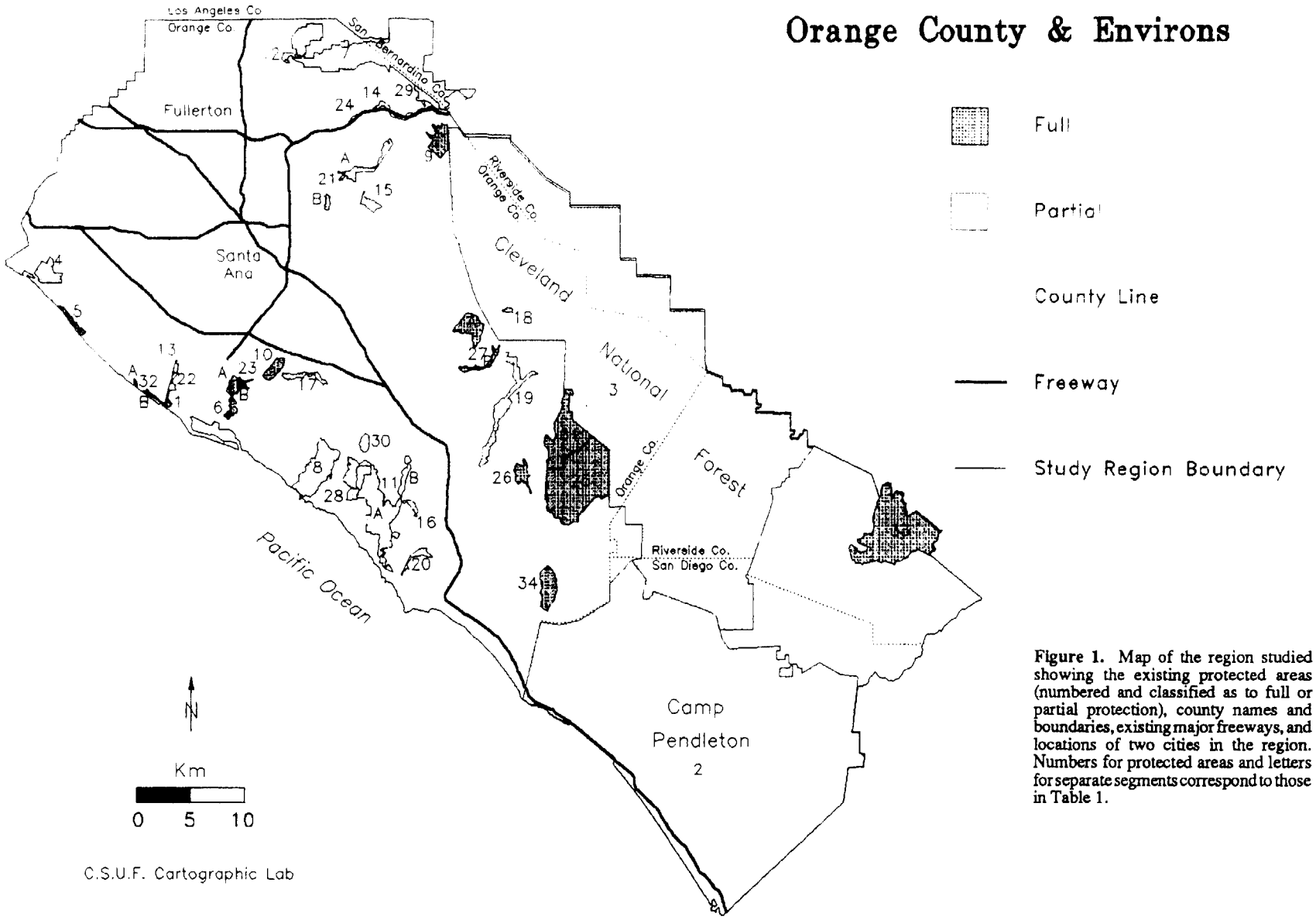

Figure 1. Map of the region studied showing the existing protected areas (numbered and classified as to full or partial protection), county names and boundaries, existing major freeways, and locations of two cities in the region. Numbers for protected areas and letters for separate segments correspond to those in Table 1.

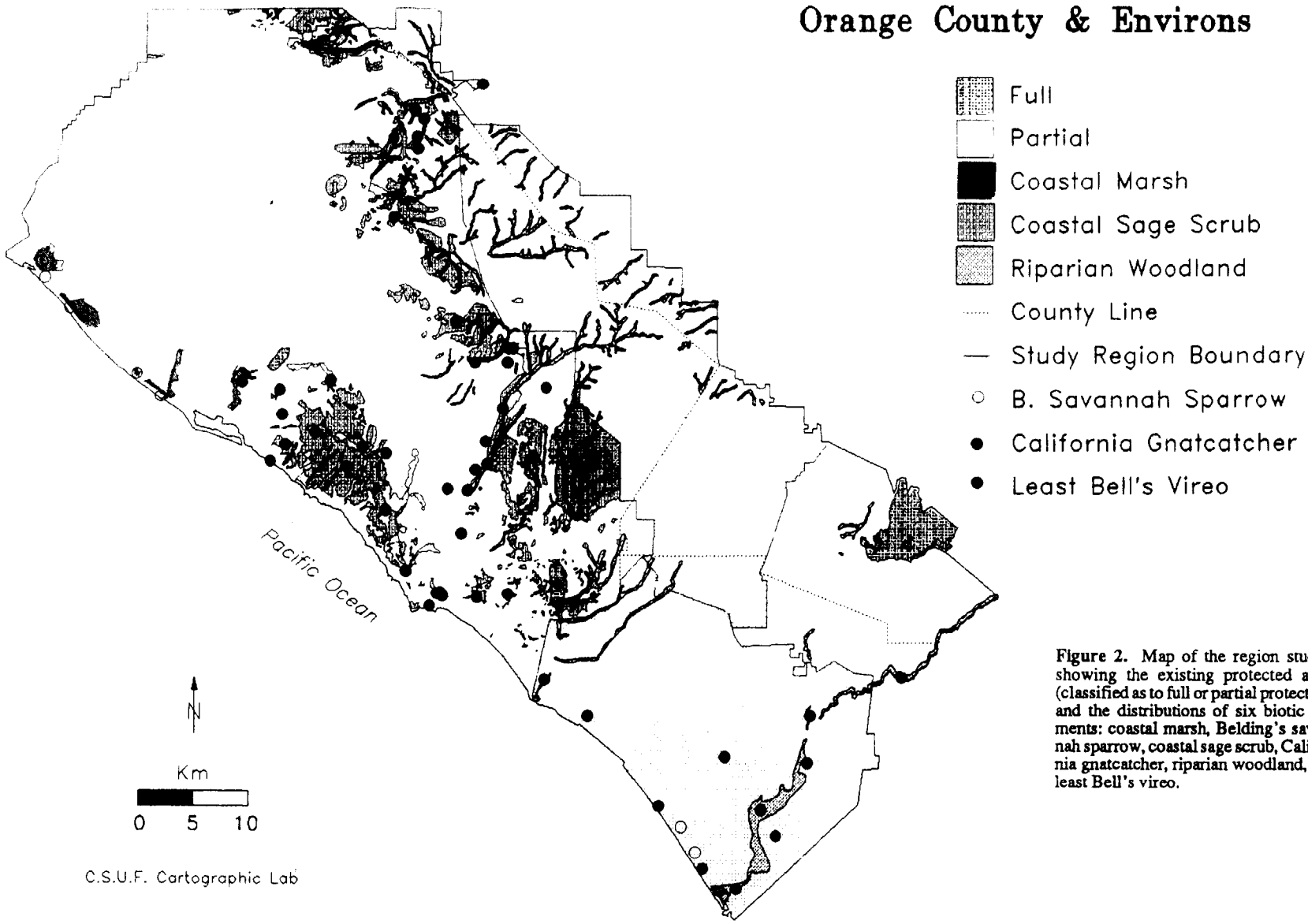

Figure 2. Map of the region studied showing the existing protected areas (classified as to full or partial protection) and the distributions of six biotic elements: coastal marsh, Belding's savannah sparrow, coastal sage scrub, California gnatcatcher, riparian woodland, and least Bell's vireo.

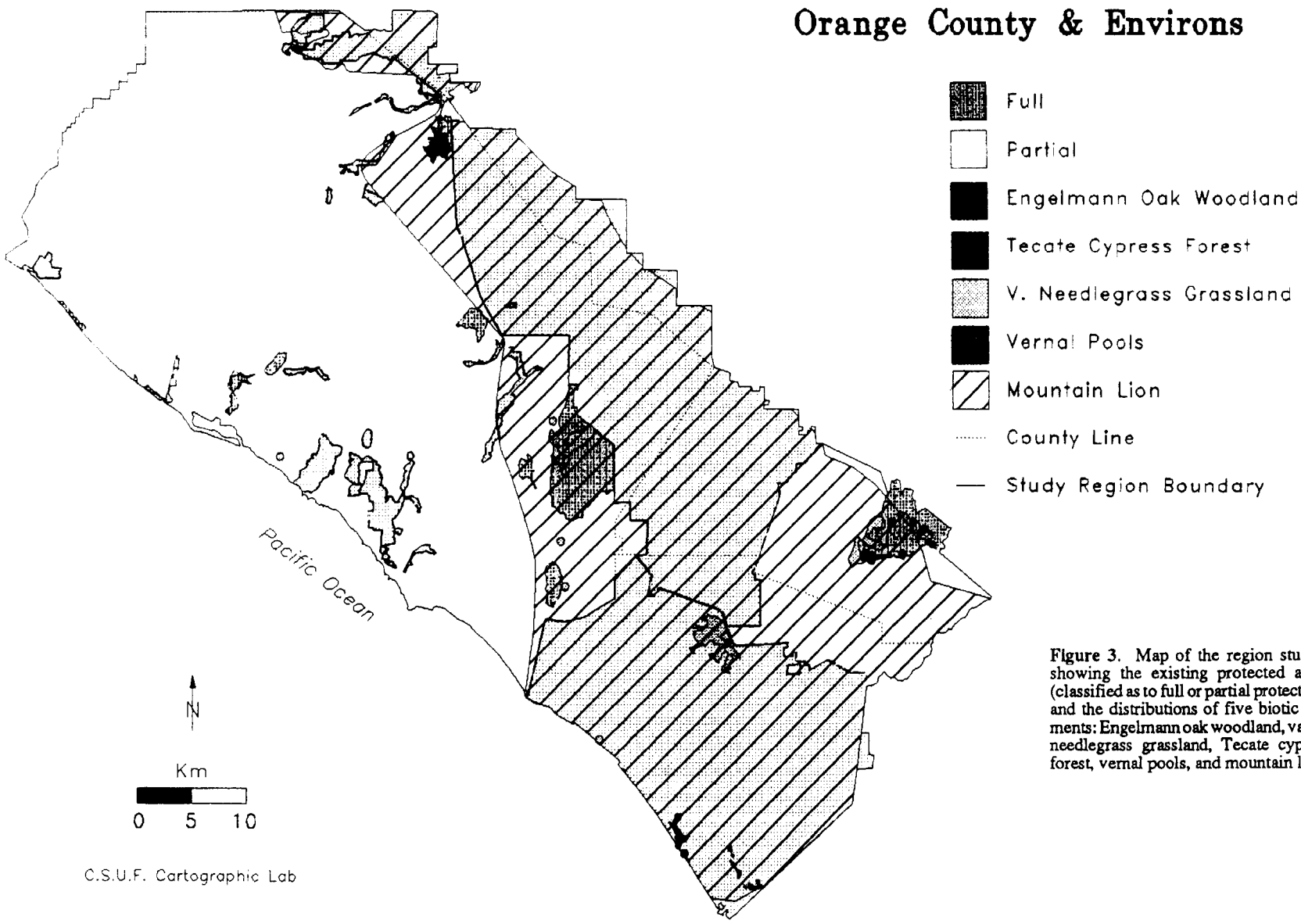

Figure 3. Map of the region studied showing the existing protected areas (classified as to full or partial protection) and the distributions of five biotic elements: Engelmann oak woodland, valley needlegrass grassland, Tecate cypress forest, vernal pools, and mountain lion.

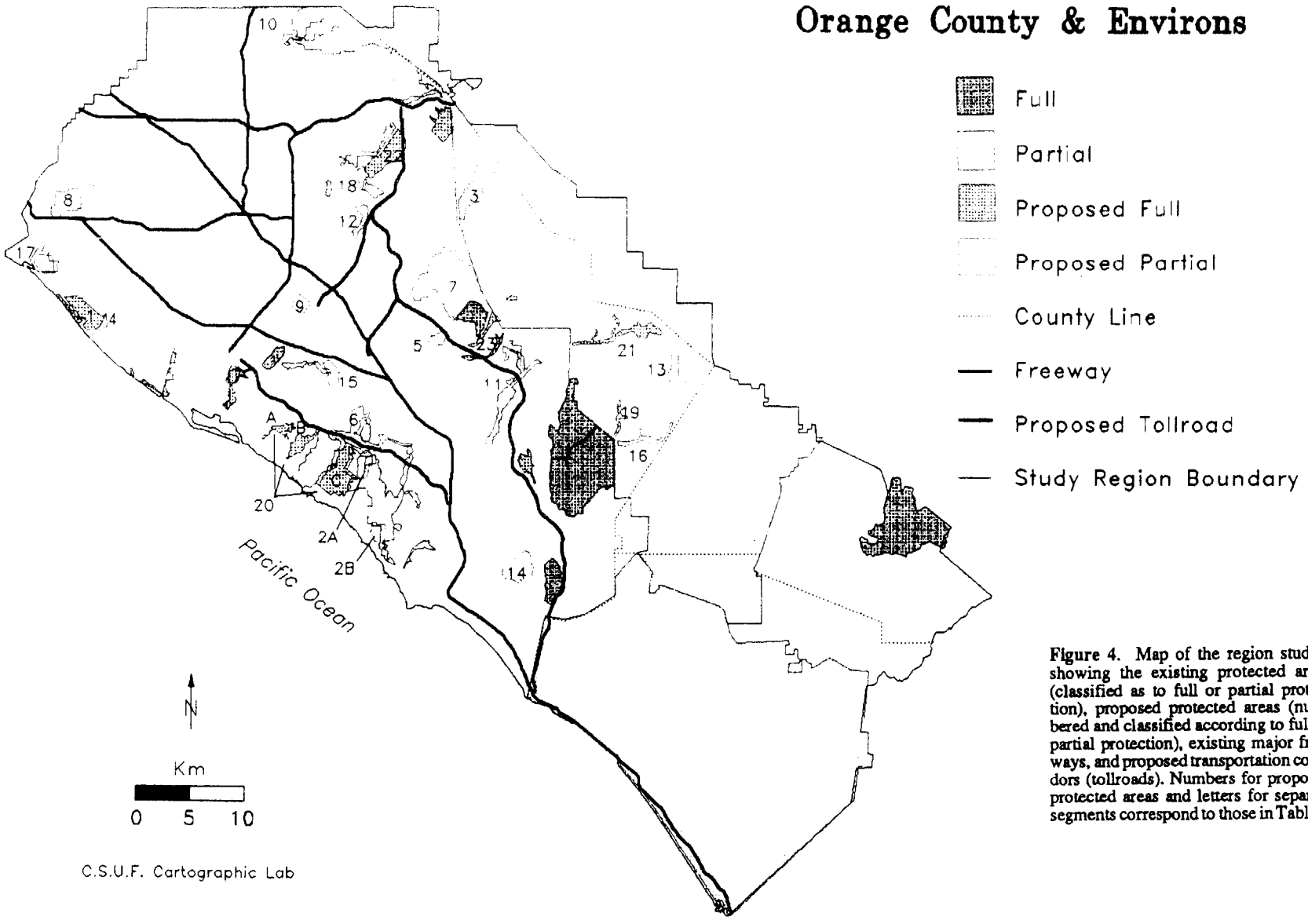

Figure 4. Map of the region studied showing the existing protected areas (classified as to full or partial protection), proposed protected areas (numbered and classified according to full or partial protection), existing major freeways, and proposed transportation corridors (tollroads). Numbers for proposed protected areas and letters for separate segments correspond to those in Table 4.

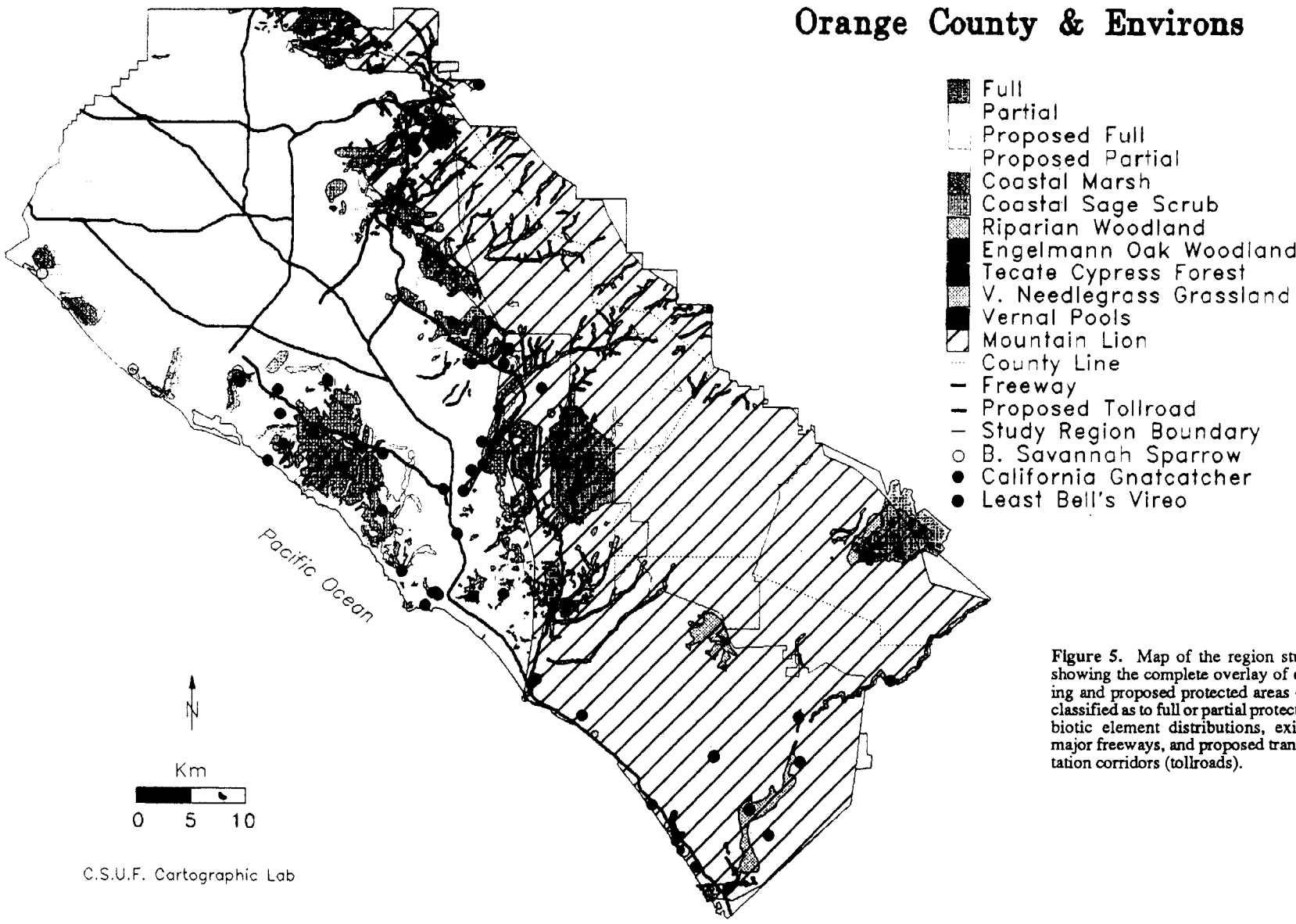

Figure 5. Map of the region studied showing the complete overlay of existing and proposed protected areas (both classified as to full or partial protection), biotic element distributions, existing major freeways, and proposed transportation corridors (tollroads).

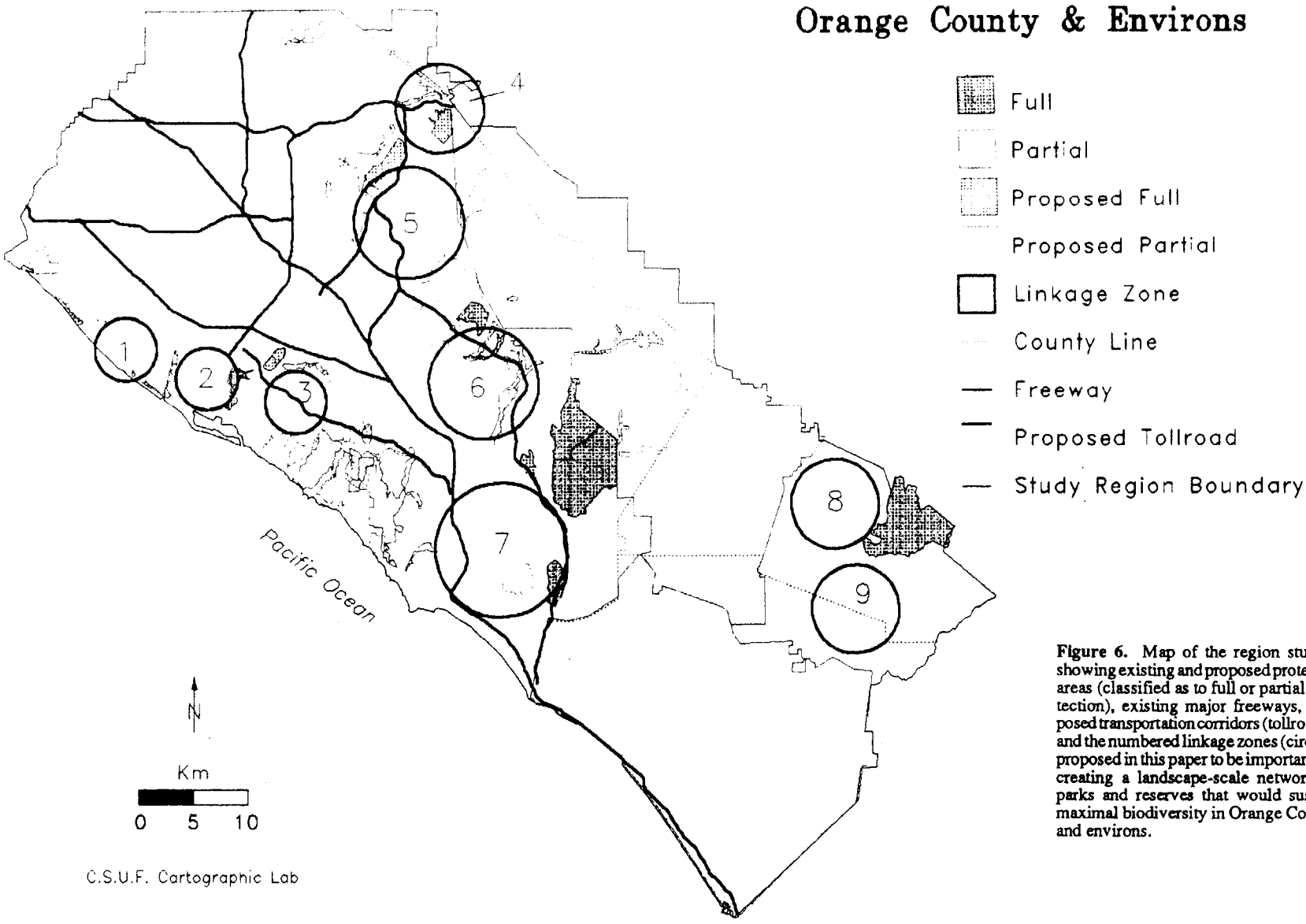

Figure 6. Map of the region studied showing existing and proposed protected areas (classified as to full or partial protection), existing major freeways, proposed transportation corridors (tollroads), and the numbered linkage zones (circles) proposed in this paper to be important for creating a landscape-scale network of parks and reserves that would sustain maximal biodiversity in Orange County and environs.

Effects of Roads on Hydrology, Geomorphology, and Disturbance Patches in Stream Networks

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Abstract: *We outline a view of how road networks interact with stream networks at the landscape scale and, based on examples from recent and current research, illustrate how these interactions might affect biological and ecological processes in stream and riparian systems. At the landscape scale, certain definable geometric interactions involving peak flows (floods) and debris flows (rapid movements of soil, sediment, and large wood down steep stream channels) are influenced by the arrangement of the road network relative to the stream network. Although disturbance patches are created by peak-flow and debris-flow disturbances in mountain landscapes without roads, roads can alter the landscape distributions of the starting and stopping points of debris flows, and they can alter the balance between the intensity of flood peaks and the stream network's resistance to change. We examined this conceptual model of interactions between road networks and stream networks based on observations from a number of studies in the H. J. Andrews Experimental Forest, Oregon (U.S.A.). Road networks appear to affect floods and debris flows and thus modify disturbance patch dynamics in stream and riparian networks in mountain landscapes. We speculate that these changes may influence the rates and patterns of survival and recovery of disturbed patches in stream networks, affecting ecosystem resilience and we outline an approach for detecting such effects based on a patch dynamics perspective. A field sampling scheme for detecting the magnitude of various road effects on stream and riparian ecology could involve (1) landscape stratification of inherent stream network susceptibility to floods or debris flows, (2) overlay of road and stream networks and creation of areas with various densities of road-stream crossings, emphasizing midslope road-stream crossings, and (3) designations of expected high- and low-impact stream segments based on numbers of upstream road-stream crossings where sampling of selected biological variables would be conducted.*

Efectos de Carreteras en la Hidrologia, Geomorfologia y Parches de Perturbación en Redes de Arroyos

Resumen: *Desglozamos una perspectiva sobre la interacción entre redes carreteras y redes de arroyos a escala de paisaje e ilustramos como estas interacciones pueden afectar procesos biológicos y ecológicos en sistemas de arroyos y riparios en base a ejemplos que parten de investigaciones recientes y en proceso. A escala de paisaje, ciertas interacciones geométricas definibles y que involucran flujos-pico (inundaciones) y flujos de detritus (movimientos rápidos de suelo, sedimentos y piezas grandes de madera en canales con pendiente pronunciada) son influenciadas por los arreglos de la red de carreteras en relación con la red de arroyos. A pesar de que los parches de perturbación son creados por perturbaciones en los flujos-pico y en los flujos de detritus en paisajes montañosos sin carreteras, las carreteras pueden alterar las distribuciones de puntos de inicio y final de flujos de detritus en el paisaje y pueden alterar el balance entre la intensidad de los picos de inundación y la resistencia del arroyo al cambio. Examinamos este modelo conceptual de interacciones entre la red de arroyos y la red de carreteras en base a observaciones de una cantidad de estudios del Bosque Experimental Andrews, en Oregon. Las redes de carreteras aparentemente afectan las inundaciones y los flujos de detritus, esto modifica la dinámica de los parches de perturbación en redes de arroyos y zonas riparias de paisajes montañosos. Especulamos que estos cambios pueden influenciar las tasaa y patrones de*

Paper submitted February 8, 1999; revised manuscript accepted September 6, 1999.

supervivencia y recuperación de parches perturbados en redes de arroyos, afectando la resistencia del ecosistema y detallamos una aproximación para detectar estos efectos en base a una perspectiva de dinámica de parches. Un esquema de muestre de campo para detectar la magnitud de varios efectos de las carreteras en la ecología de arroyos y zonas riparias podría involucrar (1) la estratificación de la susceptibilidad inherente de la red de arroyos a inundaciones o flujo de detritus en el paisaje, (2) la sobreposición de redes de arroyos y carreteras y la creación de cruces a mitad de la pendientes, y (3) la designación de segmentos esperados de bajo y alto impacto donde se realicen muestreos de variables biológicas selectas en base a números de cruces entre arroyos y carreteras que se encuentren arroyo arriba.

Introduction

Road networks have a great variety of effects on watersheds. Most existing studies of road effects on ecosystems are fine in scale and focus on terrestrial ecosystems (Forman & Alexander 1998). Landscape-scale studies of roads have emphasized "zones of influence" of roads extending laterally into terrestrial ecosystems (e.g., Forman & Deblinger, 2000). We offer a complementary approach that considers the effects of road networks on stream and riparian networks. This perspective is based on experience in steep mountain watersheds with high precipitation, forest cover, and road networks constructed for forestry land use, but the principles may apply to other ecosystems.

Early work in geomorphology (Horton 1945; Leopold et al. 1964) laid the groundwork for studies of network structure and associated hydrologic and geomorphic processes, and recent studies (e.g., Montgomery & Dietrich 1988, 1992) explain aspects of complex natural stream channel networks from elementary physical principles. Geomorphology studies in mountain stream networks, especially along the Pacific coast of the United States, emphasize a spatially and temporally explicit view of geomorphic processes, exploiting the availability of digital elevation data and capabilities of geographic information systems to examine landforms, streams, and geomorphic processes.

Stream networks collect episodic inputs of sediment and wood, provided by landslides and other processes, and transport this material episodically through a channel network (Jacobson 1995; Benda & Dunne 1997*a*, 1997*b*). Over time, especially during floods, the physical features of the stream—channels, bars, and floodplains—are created and modified by interactions among sediment, water, and wood (Lyons & Beschta 1983; Grant 1986; Wondzell & Swanson 1999). Thus the patch dynamics of stream networks and riparian forests reflect the history of hydrologic and geomorphic processes (Swanson et al. 1997; Benda et al. 1998).

Two key processes—floods (peak flows) and debris flows—have major influences on riparian vegetation patch dynamics in mountain landscapes, but they produce somewhat different spatial patterns of disturbance in stream and riparian networks. A peak streamflow event is triggered by a pulse of water input from precipitation and/or snowmelt routed through hillslopes and channels to produce a flood wave. Because flood waves are temporally continuous phenomena, peak flow events must be defined arbitrarily from the hydrograph, but the magnitude of each peak (its maximum height) can be determined precisely by field observations or stream gaging. Also, peak flows propagate downstream great distances and have longitudinally extensive zones of impact. Typically, a flood wave creates visibly disturbed patches in the stream network only where its damaging force exceeds local resistance to change; this balance between flood wave force and local resistance is influenced by several factors. Narrow bedrock zones or areas where the stream has been "hardened" (e.g., by roadfill) are less susceptible to disturbance, whereas stream segments below bends or in widened reaches have deposits of relatively fine sediment and colonizing vegetation that are less resistant to modification by the stream's energy (Grant & Swanson 1995).

Debris flows are rapid movements of soil, sediment, and organic matter (large wood) down steep stream channels. Debris flows most commonly originate from debris slides, which are rapid movements (velocities of approximately 10 m per second) of soil, sediment, and associated vegetation down hillslopes. In contrast to peak flows, debris flows produce discrete tracks of channel and riparian disturbance whose number and density per unit area can be precisely estimated, but the volumes of sediment moved may be difficult to measure because (among other difficulties) they may be removed by streamflow. Debris flow tracks can be mapped because they have distinct starting points, a relatively clearly defined zone of primary impact, and an identifiable stopping point. Individual tracks may reach tens of meters in width and several kilometers in length (Swanson et al. 1998; Snyder 2000; Nakamura et al. 2000). The location and proximal cause of individual debris flows also can be interpreted in the field, so they lend themselves to analyses of numbers, locations, and the types of patches created in a stream network.

Flood peaks and debris flows are hydrologic and geomorphic processes with landscape-scale expressions in the stream network that create aquatic and riparian patch dynamics critical to stream ecosystems (Pringle et al. 1988). The creation, destruction, and modification of

stream geomorphic features such as channels, bars, and floodplains are tightly coupled with biotic features including riparian vegetation and lotic and benthic communities (Pringle et al. 1988; Swanson et al. 1988; Gregory et al. 1991). Stream organisms such as salmonids may be tied to the historical disturbance pattern over evolutionary time (Reeves et al. 1995), over multiple generations of spawning at a given site (Geist & Dauble 1998), or even at the scale of an individual spawning salmon (Montgomery et al. 1996). Infrequent, intense flooding is believed to produce larger, more severely disturbed stream and riparian patches than frequent, less intense flooding (Gregory et al. 1991; Michener & Haeuber 1998; Swanson et al. 1998). A reduction in severe, infrequent floods (e.g., by reservoir operations) reduces off-stream habitat for endangered fishes, whereas experimental floods increase it (Schmidt et al. 1998; Pitlick & Van Steeter 1998; Van Steeter & Pitlick 1998). In other words, native stream organisms appear to be linked integrally to the natural disturbance regime (sensu Reeves et al. 1995, Swanson et al. 1997) and the natural streamflow regime (sensu Poff et al. 1997).

Road networks constructed for forest harvest in the Pacific Northwest appear to have increased the magnitude and frequency of peak flows, debris slides, and debris flows relative to those in areas that are fully forested and fire-disturbed. Road construction is associated with increased frequency of landslides and other forms of erosion in steep forest landscapes (Swanson & Dyrness 1975; Nolan et al. 1995). A variety of mass movement and fluvial processes have been noted along road networks after intense flooding in this landscape (Wemple 1998). Increases in peak discharges have been significantly associated with forest harvest and road construction in both small experimental basins (< 1 km^2) and in large basins (60–600 km^2) over the past 4–6 decades (Jones & Grant 1996; Thomas & Megahan 1998). The causes of increased peak discharges are controversial, but one of several possible mechanisms is that roads have changed the routing of water from hillslopes to streams (Montgomery 1994; Wemple et al. 1996).

We hypothesize that road network effects on flood peaks and debris flows modify patch dynamics in stream and riparian networks. Herein, we outline how road networks interact with stream networks at the landscape scale and, based on examples from recent and current research, illustrate how these interactions might affect biological and ecological processes in stream and riparian systems. Our approach produced a distinctly different picture of the spatial distribution of ecological responses to road networks than that of the road zone-of-influence approach used for assessing effects on terrestrial ecosystems. We sought to present a conceptual framework that is relevant for ecologists and conservation biologists in the process of assessing current ecosystem conditions and planning landscape-scale restoration activities. We hope that this framework will encourage scientists from many disciplines to work toward spatially explicit studies of road effects on whole stream networks.

Conceptual Model of Interactions between Road and Stream Networks

Our conceptual model is a series of premises. Landscapes contain patchwork and network structures defined by vegetation, soil, and other properties reflecting landform evolution, natural disturbances, and land management (Swanson et al. 1997). Patches consist of vegetation of various types or histories of disturbance by natural or management processes. We focused on two types of networks: natural physical networks, including streams, riparian zones, and ridges, and artificial networks, or roads (Fig. 1).

Flows of matter (water, mass movements, sediment, organisms) and energy follow gravitational flowpaths down hillslopes to channels and along channels in the stream network. Although other materials and transport processes (e.g., movement of suspended load, bedload, and coarse woody debris) might be considered, we focused on flood peaks and debris flows because they are best known and they illustrate many of the principles of interactions between road and stream networks in a landscape.

The stream drainage network is ordered: flows from smaller segments coalesce in successively larger segments. The road network consists of segments and junc-

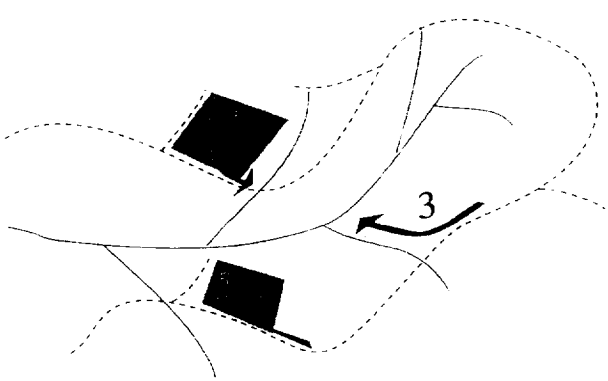

Figure 1. Three types of interactions may occur in a landscape among patches (gray polygons), a road network (dashed line), and a stream network (solid line): (1) patch to road, (2) road to patch, and (3) road to stream. In steep, forested mountain landscapes, patches may be stands of younger vegetation created by a natural disturbance such as wildfire or windthrow or by a human disturbance such as forest harvest.

tions and may be ordered in the sense that spur or dead-end roads sprout from trunk roads; usage intensity is highest and most constant along trunks and lowest and more episodic along spurs (Fig. 1). Some processes are affected by traffic levels (e.g., production of fine sediment, Reid & Dunne 1984), whereas others may not be affected by traffic (e.g., mass movements).

Stream and road networks are similar in five respects: they occupy a small portion of the landscape (commonly only a small percentage of total area), they are widely distributed, and they are "designed" to transport material and energy across a landscape. Stream and road networks also have a high edge length per unit area, hence opportunity for interaction with neighboring patches. Also, streams and roads commonly occurs at similar densities in mesic or wet-climate mountain landscapes where logging has occurred (Wemple et al. 1996). Road and stream networks differ in that streams flow downslope, whereas roads cross steep slopes (Fig. 2), and roads themselves are not channels, although they often include a ditch that may function as a channel.

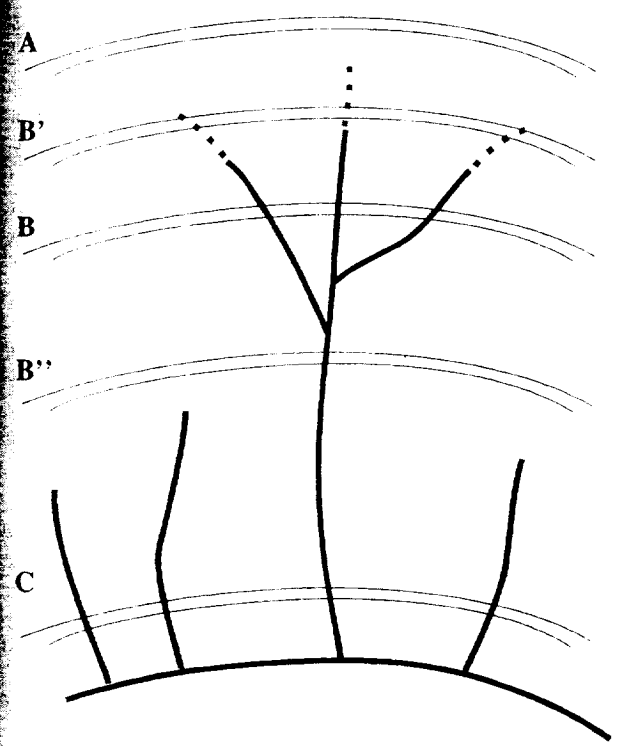

Figure 2. Effects of hillslope position and road design features on road-stream interactions. Roads (double lines) often cross steep tributary streams (dark solid lines) or ephemeral streams (dashed lines) at perpendicular angles in middle and lower hillslope positions (B', B, B''), thus directly affecting peak flows and debris flows. Valley floor roads often run parallel to mainstem streams (C), thus affecting lateral movement of the stream channel and its connectivity to the riparian zone.

Road location in the landscape, specifically hillslope position, strongly influences the type and frequency of interactions between roads and streams (Fig. 2). Roads near ridges have little direct interaction with streams (Montgomery 1994), but roads often cross small tributary streams at perpendicular angles in midslopes and lower slopes, and they commonly are parallel to main stream segments along valley floors (Fig. 2). Consequently, road-stream crossings may be concentrated in middle and lower hillslope positions.

This arrangement of roads relative to stream networks and gravitational flowpaths sets up certain definable geometric interactions involving flows of water and sediment. Energy, organisms, and material may move between patches and network segments or between road segments and stream segments (Fig. 1). Many types of interactions can occur (Fig. 3). A given road segment may act as a barrier, a net source, a net sink, or a corridor relative to flows of water and/or sediment.

Complex combinations of interactions can occur between road segments and flows of water (Fig. 4) or sediment (Fig. 5). Roads may act as corridors for flows of water on road surfaces (A and B, Fig. 4) or in roadside ditches (C, Fig. 4) and as sources of water to stream networks through culverts (D, Fig. 4) or gullies (E, Fig. 4) (Wemple et al. 1996). Roads also may act as sinks for sediment, intercepting slides (A, Fig. 5), as sources of slides (B, Fig. 5), or as corridors transmitting debris flows in stream channels (C, Fig. 5) (Wemple 1998). Encounters with roads may modify the magnitude and direction of flows of water and debris flows, and water flows may transform into debris flows or vice-versa.

The number or density of road-stream crossings provide a useful point of departure for evaluating interactions between road and stream networks at a landscape scale. Because stream and road drainage densities define the number of road-stream crossings (Fig. 6), they define a framework to examine how road design and topographic relief affect road influences on debris flows,

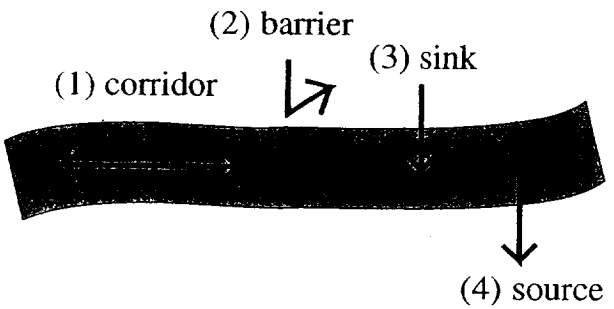

Figure 3. Four basic types of flow interactions with a road segment (shaded).

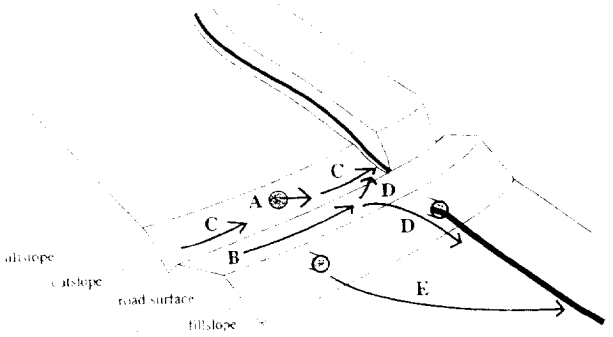

Figure 4. Five types of interactions involving water between a midslope road parallel to contour and a stream (heavy solid line): (A) subsurface flow interception, (B) surface flow on roads, (C) flow routing along ditches to streams, (D) flow along road surface to streams, and (E) flow in gullies to streams.

peak flows, and other measures of the stream network's response to roads.

Roads alter the balance between the intensity of peak flows and the stream and riparian network's resistance to change, whereas they alter the landscape distributions of the starting and stopping points of debris flows. Hence, the two processes may produce somewhat distinct patterns of affected stream network lengths. Systemic, high-severity hydrologic processes such as extreme flood peaks produce a set of disturbance patches controlled by site-specific patterns of resistance to change within the stream network. Road network interactions intensify and redistribute flood energy, thereby producing additional disturbance patches. This pattern of patches

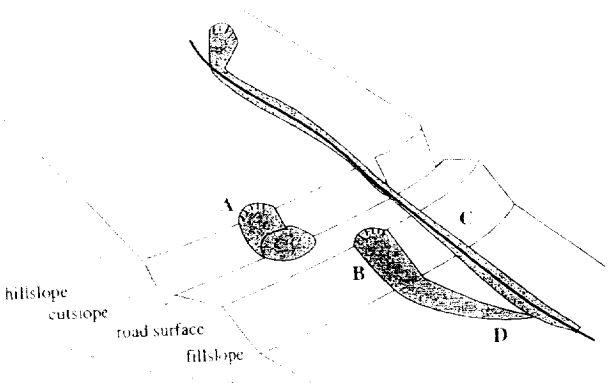

Figure 5. Types of interactions involving debris flows between a midslope road parallel to contour and a stream (heavy solid line): (A) cutslope slides, (B) fillslope slides, (C) debris flows that pass roads, and (D) fillslope slides that become debris flows.

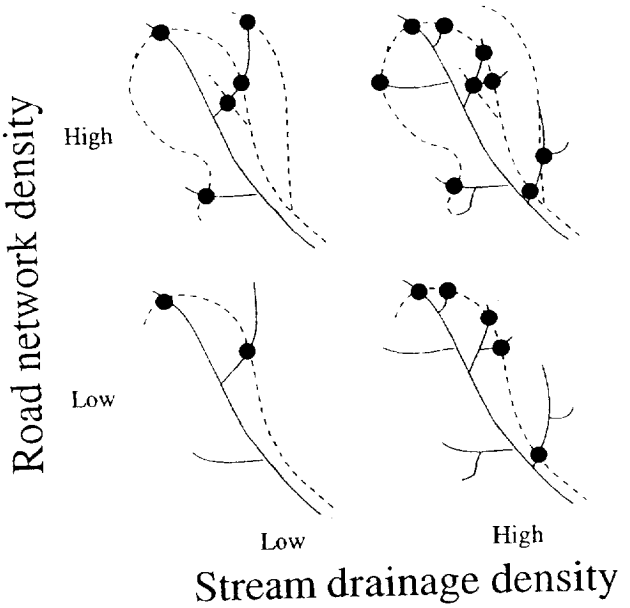

Figure 6. Effects of increasing drainage densities of the road network (dashed line) and the stream network (solid line) on the number of road-stream crossings (black dots) in a landscape.

represents the stream segments downstream of high densities of road-stream crossings where flood energy may disturb the riparian zone (Fig. 7); the actual pattern of flood disturbance patches also will be controlled by factors such as valley floor width, the age and type of vegetation, and the amount of wood and sediment.

On the other hand, localized, high-severity geomorphic processes such as debris flows produce a set of disturbance patches of discrete length extending from initiation sites that may be unaffected by roads. Road network interactions produce additional patches downstream from road-stream crossings where debris flows commonly are initiated (e.g., Swanson et al. 1998; Fig. 8). This pattern of scattered linear patches represents the stream segments where natural debris flows and those associated with roads expend large amounts of energy, scouring the stream bed and removing riparian vegetation, sediment, and wood. Many debris flow tracks end in piles of large wood and boulders deposited by the debris flow; in some cases, roads can stop debris flows, shortening their tracks.

Evidence from Andrews Forest, Oregon

We examined our conceptual model of interactions between road and stream networks based on a number of studies in the H. J. Andrews Experimental Forest, Oregon. The Andrews Forest, located on the western slope

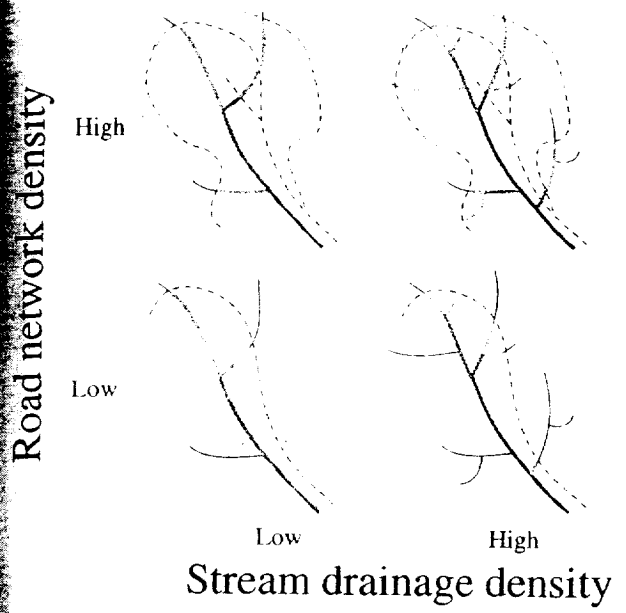

Figure 7. Spatial pattern of peak-flow disturbance patches (greater effect in darker shaded tones) created in a stream network below crossings of the road network (dashed lines) and stream network (solid or gray lines). Higher road and stream drainage densities increase the stream network length with high potential for road-related disturbances. The diagram illustrates a situation in which all road-stream crossings have equal and additive influences on peak flows and all stream segments respond equally. In a real landscape, the actual spatial pattern of stream network susceptibility to road effects on peak flows would be more patchy.

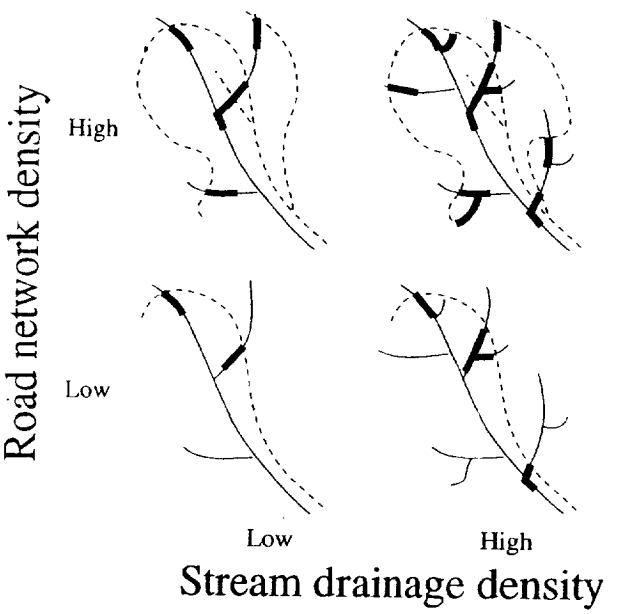

Figure 8. Spatial pattern of debris flow disturbance patches (heavy solid lines) created in a stream network below crossings of the road network (dashed lines) and stream network (thin solid lines). Higher road and stream drainage densities produce larger affected percentages of the stream network. The zones of primary disturbance by debris flows are emphasized, but areas downstream of these patches also may be disturbed. The effect of road-stream crossings in real landscapes is overstated because not every road-stream crossing generates debris flows. Debris flows also occur in the absence of roads, creating additional patches not shown here.

of the Cascade Range in Oregon, has a 50-year history of research on biophysical processes (McKee 1998). The Andrews Forest comprises one drainage basin with steep slopes on highly weathered volcanic substrates. Vegetation cover is mostly old-growth Douglas-fir (*Pseudotsuga menziesii*) forest. Twenty-five percent of the landscape has been harvested and converted to Douglas-fir plantations since 1950. The basin has a relatively high density of forest roads (approximately 2 km/km^2), most of which were constructed in the 1950s and 1960s (Wemple et al. 1996). We examined studies on peak flows and debris flows, evaluating the major forms of evidence of interactions between road and stream networks, the nature of the mechanisms involving roads, and the direction, magnitude, timing and locations of effects on stream channels.

Peak Flows

Three forms of evidence support the assertion that the road network is significantly hydrologically connected to the stream network in the Andrews Forest. First, in small experimental basins, partial logging (25% of basins) with roads appears to have increased large flood peaks (those that occur annually or less often) to the same or greater extent and for longer periods than 100% forest harvest (Jones & Grant 1996; Thomas & Megahan 1998; J. A. Jones, unpublished data). This implies that roads can affect the manner in which incoming precipitation is routed through a basin to produce a flood (Jones & Grant 1996). Second, surveys of road drainage systems indicate that significant portions of the road network have the potential to act as extensions of the stream drainage network (Wemple et al. 1996). Third, Wemple (1998) quantified the amounts of water carried by road segments and showed that this water could be delivered to the stream network to coincide with the flood peak.

Two mechanisms involving peak flows produce interactions between road and stream networks. The cutbanks of roads collect water flowing slowly down a hillslope below the soil surface. Some segments of the

drainage ditches alongside the roads carry water rapidly and directly to streams or to culverts that concentrate water flow and carve gullies down hillslopes to streams (Wemple et al. 1996; Wemple 1998). Interactions between road and stream networks involving water flow seem to have the potential to synchronize water flow through the basin during a storm event, thus increasing the height of the flood peak (Jones & Grant 1996).

The magnitude of increase in flood peaks attributable to interactions between road and stream networks is difficult to separate from the coincident effects of forest harvest. In small harvested basins in western Oregon where road densities are 1–3 km/km^2, roads may increase the height of the peak by at most a few tens of percentage points for floods occurring annually or less frequently (Jones & Grant 1996; Thomas & Megahan 1998; J. A. Jones, unpublished data). In large basins where forest harvest also is confounded with road construction, the combined effects of forest harvest (<25% of basin areas) and road construction appear to have increased floods that occur annually or less frequently by, at most, 100% over the past 50 years (Jones & Grant 1996; Thomas & Megahan 1998). This increase is small relative to the interannual fluctuations in flood size, but it may represent a shift in the distribution of all floods to higher levels than before road construction and harvest occurred.

Debris Flows

The primary evidence of road and stream network effects on debris flows in the Andrews Forest area is the spatial pattern of debris flow tracks from inventory of 50 years of debris flows and debris slides (Swanson & Dyrness 1975; Snyder 2000; Nakamura et al. 2000). Field observations indicate that debris flows frequently are initiated or augmented by debris slides associated with roads; one out of three first- through third-order stream channels crossed by a road at the midslope position were associated with debris-flow initiation (Snyder 2000).

Two mechanisms involving debris flows produce interactions between road and stream networks. Many forest roads in the Andrews were constructed by excavating part of the hillslope and using this material to support the downhill side of the road ("cut-and-fill" roads). During heavy rain events many small landslides originate from the downslope side of such road segments (the "fillslope"). When these slides occur close to streams, they often reach the streams and become debris flows (Swanson & Dyrness 1975; Wemple 1998; Nakamura et al. 2000). During heavy rains, debris flows also may be triggered by small landslides from forested hillslopes. A second form of road-stream interaction occurs when one of these debris flows moves down a stream channel, encounters a road, and either carries the road fill material further down the stream or stops on the road (Wemple 1998; Swanson et al., unpublished data).

The major effect of roads on streams produced by debris flows is severe disturbance of the stream channel, including removal or rearrangement of all material in some stream segments and deposits of sediment and wood in others. Debris flow tracks were 14 times more frequent per unit area of road than of undisturbed forest in the Andrews Forest and neighboring Blue River basins (Snyder 2000). Debris flow disturbances to streams occur mainly during extreme floods. The most severe effects occur in small, steep stream segments, but some sediment also may be transported to stream segments downstream of these highly disturbed areas, creating additional though less severe disturbances (Snyder 2000; Johnson et al. 2000; Nakamura et al. 2000.

Biological Implications for Stream Networks

Stream networks in both unroaded and roaded landscapes experience both patchy and pervasive disturbances. A key biological implication of floods and debris flows is that they affect only a few percentage of the total area (Miles & Swanson 1986) but tens of percentage of the stream network (Snyder 2000) in mountainous landscapes. Although roads can increase the frequency and extent of these types of disturbances, several factors make it difficult to isolate the extent of road influence on stream and riparian patch dynamics. Disturbance associated with major floods is extremely varied in severity and intensity in complex stream and riparian systems, even when the overall flood disturbance seems pervasive (Swanson et al. 1998; Johnson et al. 2000; Nakamura et al. 2000). Many studies of hydrologic, geomorphic, and ecological processes in stream networks have been conducted in roaded basins, and few studies have been conducted in large areas without roads. No studies we know of have related riparian or benthic habitat patch dynamics and ecology directly to road network distributions. We outline an approach to such studies, emphasizing areas that need research.

A key ecological implication of hydrologic and geomorphic disturbance patterns is that undisturbed areas may function as refuges from disturbance and sources of colonists in the post-disturbance recovery period (Sedell et al. 1990). The patchy character of flood flow and debris flow disturbances (Johnson et al. 2000; Nakamura et al. 2000) leaves numerous refuges in headwater channels undisturbed by debris flows and in undisturbed portions of mainstem channels. Thus, the network structure of stream and riparian systems contributes to their resilience to flood disturbance, and dispersal from undis-

turbed sites can help speed recovery in disturbed zones. If roads increase the frequency and intensity of flood peaks and debris flows, this may increase the extent of debris flows in small streams and possibly the extent of riparian-zone disturbance along main channels, and it may reduce the extent of refuges. Hence, road-network effects on the spatial pattern of disturbance may influence the rates of survival and recovery of disturbed patches in stream networks, which affects ecosystem resilience.

Observed debris-flow tracks typically disturb stream and riparian areas in only a few tributaries in the upper parts of stream networks (Nakamura et al. 2000) (Figs. 3 & 4). Because many tributaries within basins affected by debris flow do not experience such severe disturbance, they serve as refuges during floods. For example, Hunter (1998) observed low densities of amphibians in debris flow tracks created in the previous winter's flood, but amphibian populations in channels that had not experienced debris flows changed little after the flood.

Extreme flood peaks also typically disturb only some portions of the stream network. Flowing water alone is unlikely to damage riparian vegetation, but when a flood carries floating woody debris, especially batches of "congested wood" (Braudrick et al. 2000), vegetation is likely to be toppled or removed (Johnson et al. 2000). Long, narrow patches of disturbed vegetation and undisturbed habitat are common in unconstrained stream segments (e.g., in wide valley floors). These undisturbed patches provide refuges from flood disturbance arrayed both laterally away from the main channel and longitudinally along the channel (Swanson et al. 1998; Fig. 5).

Although we have separated peak flows from debris flows in this discussion, they are confounded. Flood peaks may initiate debris flows, and they may magnify, redistribute, or mute the disturbances produced by debris flows. Debris flows from tributary channels may enter main channels and interact with flood flows, providing batches of woody debris that serve as tools to produce patches of riparian disturbance (Wondzell & Swanson 1999; Johnson et al. 2000; Nakamura et al. 2000).

Biological responses to a disturbance event may be affected by the hillslope position of road-stream interactions. In the Andrews Forest and vicinity, roads in middle hillslope positions were net sources of sediment to the stream network, whereas valley floor roads were net sinks, and the frequency of erosion and deposition features associated with roads was an order of magnitude higher in valley floors than near ridges (Wemple 1998). Stream segments below midslope roads were more likely to be disturbed by debris flows than similar segments without roads (Snyder 2000). Less disturbance may occur in stream segments downstream of valley floor roads than those downstream from midslope roads (Wemple 1998). Roads constructed on valley floors, however, may limit organisms' access to floodplain and secondary channel areas that might otherwise serve as refuges and may limit dispersal of organisms to recolonize flood-disturbed areas.

Assessing Effects of Roads on Stream Networks

Our observations, hypotheses, and perspectives on interactions of road and stream networks, based on field studies conducted in the Pacific Northwest, have several implications for evaluating roads in the context of research, management, and conservation studies. Basins such as Lookout Creek in the Andrews Forest are heterogeneous; they contain areas of naturally high and low rates of peak flow and debris flow production that may affect distributions of habitat and organisms in time and space. Against this backdrop of natural processes and patterns, we propose that the effects of roads on peak flows and debris flows will be greatest downstream of individual road-stream crossings and downstream of areas of high densities of such crossings. Therefore, a field sampling scheme for detecting the magnitude of various road effects on stream and riparian ecology could involve (1) landscape stratification of inherent stream network susceptibility to floods or debris flows, (2) overlay of road and stream networks and creation of areas with various densities of road-stream crossings, emphasizing midslope road-stream crossings, and (3) designations of expected high- and low-impact stream segments based on numbers of upstream road-stream crossings where sampling of selected biological variables would be conducted. It is critical that such locations be selected and interpreted based on their positions in the whole stream network in order to account for the effects of the spatial arrangement of disturbance patches and refugia.

Further Work

We have not attempted to prove that road-stream interactions involving peak flows and debris flows modify the ecology of stream networks, but rather to set out a framework for understanding how such interactions might occur. Field studies may help test how stream disturbances created by extreme floods are related to road-network effects on peak flows and debris flows.

Although we focused on two processes, peak flows and debris flows, other hydrologic and geomorphic processes are influenced by road-stream interactions. Sediment and wood transport is inherently tied to flood- and debris-flow processes and is modified by roads (Reid 1981; Reid & Dunne 1984; Megahan 1987; Bilby et al. 1989; Wemple 1998; Braudrick & Grant 2000; Braudrick et al. 2000; Johnson et al. 2000). Also, interconnected road and stream networks have other functions, notably an ability to facilitate flows along nongravitational path-

ways. For example, evidence presented in Parendes and Jones (this issue) indicates that propagules of exotic plants may be dispersed along forest roads and hence along the stream network from road-stream crossings. These multiple functions of roads have potentially widespread effects on stream networks and deserve further study.

Acknowledgments

This work was supported in part by a grant from the National Science Foundation for the Andrews Long-Term Ecological Research program (DEB 96-32921), cooperative agreements from the U.S. Forest Service Pacific Northwest Research Station, and a grant from the Bureau of Land Management. We thank S. Acker, D. Bates, J. Cissel, G. Grant, S. Johnson, D. Montgomery, R. Forman, S. Wondzell, and two anonymous reviewers for helpful comments and discussions.

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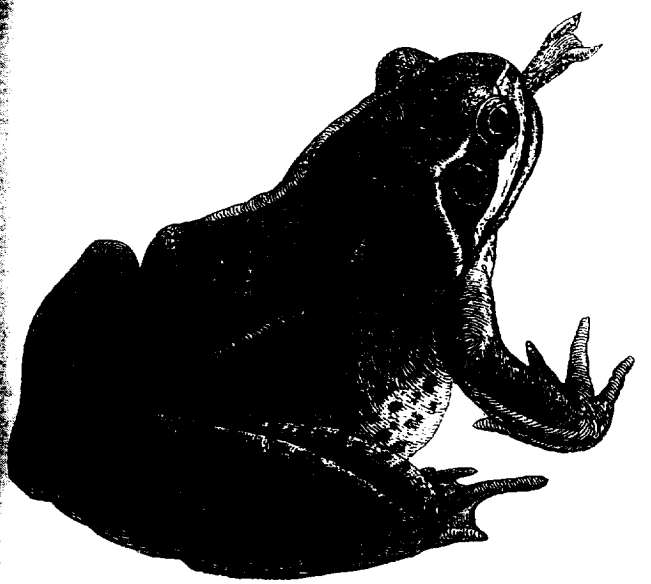

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Use of highway undercrossings by wildlife in southern California

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Received 13 June 2001; received in revised form 15 February 2003; accepted 20 March 2003

Abstract

Roads, especially large highways, can have significant impacts on wildlife movement and survival. This is especially true for wide-ranging species, such as mammalian carnivores. Some of these impacts may be mitigated if wildlife can find and utilize passageways under highways. To determine if underpasses and drainage culverts beneath highways are used by wildlife as movement corridors, we monitored 15 such passages near Los Angeles, California using remotely triggered cameras and gypsum track stations. We found that passages were used by a variety of species, including carnivores, mule deer, small mammals, and reptiles. Many types of undercrossings were utilized, indicating that passages beneath highways, even when not originally designed for wildlife, can provide important safe avenues for animals to cross roads. For mammals of conservation concern, including native carnivores and deer, passage dimensions, surrounding habitat, and the extent of human activity were assessed to determine if these factors influenced passage use by these species. Our results show that while many native mammals used passages beneath highways, the presence of suitable habitat on either side of the passage was a particularly important factor predicting use. For deer and coyotes, passage dimensions were also important and should be considered with the presence of suitable habitat when wildlife passages are planned or evaluated. To increase the likelihood of utilization and to help prevent animals from crossing road surfaces, we suggest that simple improvements such as habitat restoration near crossing points and animal-proof fencing that serves to funnel wildlife to passages, can facilitate animal movement between fragmented habitats that are bisected by roads.
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Keywords: Wildlife corridor; Mammals; Carnivores; Habitat fragmentation; Culverts

1. Introduction

As roads and human development have extended into once pristine natural areas, habitat fragmentation has become an ever-increasing threat to the survival of many species (Wilcox and Murphy, 1985; Harris and Gallagher, 1989; Saunders et al., 1991). Perhaps most threatened are large mammals, such as carnivores and ungulates, that regularly move over great distances. It has been suggested that the adverse effects of habitat fragmentation by roads might be mitigated by constructing wildlife, or conservation, corridors (Soulé, 1991) connecting otherwise isolated patches of habitat on opposite sides of roadways (Saunders and Hobbs, 1991; Beier and Loe, 1992). It is thought that drainage culverts, tunnels and freeway underpasses, though created for other purposes, may already serve this function (Noss, 1987a; Harris and Gallagher, 1989; Edelman, 1991; Soulé and Gilpin, 1991; Rodriguez et al., 1996; Rosenburg et al., 1997). However, few quantitative data are available on the extent to which such passages are used by wildlife (Simberloff et al., 1992). Likewise, the characteristics that promote and discourage the use of potential crossing points by wildlife—e.g., passage dimensions, surrounding habitat type, presence of fences, and the extent of nearby human activity—are poorly understood (Foster and Humphrey, 1995; Yanes *et al.*, 1995; Clevenger and Waltho 2000).

In California, especially in the southern coastal areas where urban sprawl has created a patchwork of developed and natural areas, determining the extent to which

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0006-3207/03/$ - see front matter © 2003 Elsevier Ltd. All rights reserved.
doi:10.1016/S0006-3207(03)00166-6

passages are used by wildlife has become a top conservation priority. In the vicinity of the Santa Monica Mountains National Recreation Area (SMMNRA) in western Los Angeles and eastern Ventura Counties, several relatively unspoiled natural regions, including three mountain ranges (Santa Monica, Santa Susana, San Gabriel), parts of two National Forests (Los Padres, Angeles) and the SMMNRA still support a rich diversity of vertebrate species. However, numerous multi-lane highways pass through the area, creating potential barriers between habitat patches. For this reason, it is widely acknowledged that habitat linkages are necessary to allow animals to cross major roadways between remaining patches of natural habitat (Lieberstein et al., 1987; Soulé, 1989; Santa Monica Mountains Conservancy, 1990; Edelman, 1991). In addition, information on wildlife movement relative to freeways in this area would be relevant for many other fragmented urban landscapes.

The purpose of this study was to obtain quantitative data on the extent to which passages beneath highways in this fragmented landscape are used by wildlife. Our specific objectives were: (1) to evaluate animal use of selected underpasses, tunnels, and drainage culverts that cross beneath three major highways; and (2) to assess characteristics of the passages most frequented by species of conservation concern, including native carnivores and mule deer, and domestic cats and dogs. As habitat fragmentation continues in areas occupied by native carnivores and deer, these species become increasingly threatened because they move over great distances to find food and mates, and to disperse. Carnivores are especially threatened because of their low population densities and large home range requirements. Domestic carnivores such as cats and dogs, on the other hand, can have adverse effects on wildlife through direct predation (Churcher and Lawton, 1987; Soulé et al., 1988), harassment, and the spread of disease. Thus, knowledge of passage attributes that can facilitate desired movement by deer and carnivores as well as possible use by non-native carnivores is a top conservation concern and has important management value. In addition, the limited data now available on whether or not species of conservation concern even utilize existing passages to cross roadways is of great interest among conservationists and land and transportation planners.

2. Study area and methods

2.1. Study area

The study was conducted along three major highways located on the eastern edge of Ventura County, California, just west of the San Fernando Valley and adjacent to the Los Angeles metropolitan area (Fig. 1). The three highways—US Highway 101, State Route 23, and US Highway 118—border the Simi Hills on the south, west, and north, respectively. US 101 and 118 act as potential barriers to animal movements to and from surrounding wilder regions, the Santa Susana Mountains

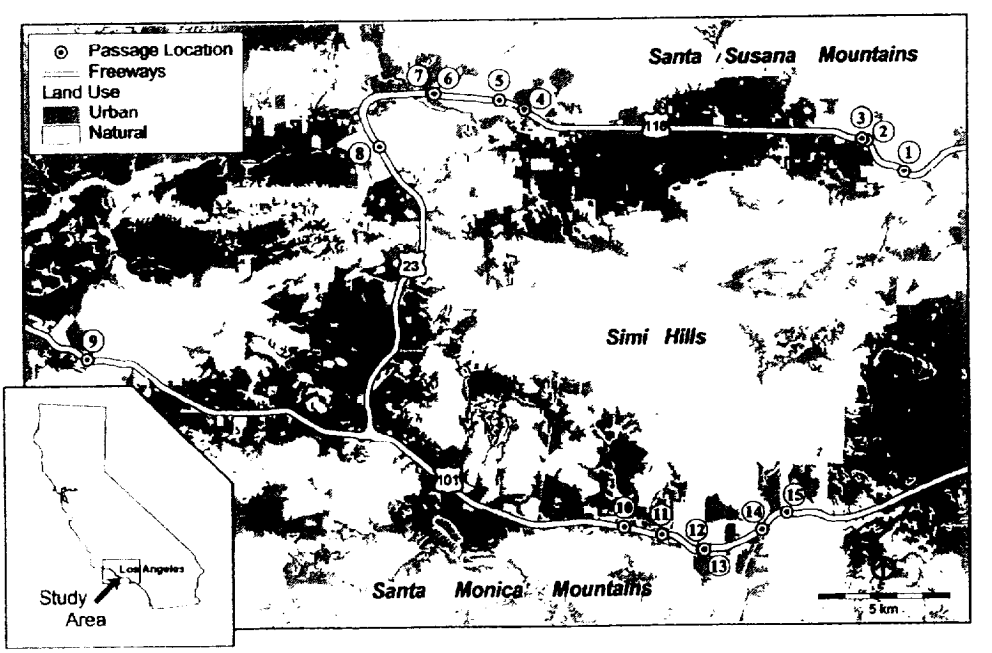

Fig. 1. Map showing natural habitat and urban development, highways and the 15 passages studies. Adjacent passages are indicated by a single point.

to the north and the Santa Monica Mountains to the south (Soulé, 1989; Santa Monica Mountains Conservancy, 1990; Edelman, 1991).

The region through which these highways pass is a complex of low hills and flat-bottomed valleys. The Simi Hills and the Santa Monica Mountains are a mixture of highly urbanized and relatively natural lands. In contrast, the Santa Susana Mountains consist of mostly intact natural landscapes, with urbanization encroaching along its fringes, and they link to the north and east to two extensive wild regions: the Los Padres National Forest in the western Transverse Mountain Range and the Angeles National Forest in the San Gabriel Mountains.

The natural areas support a diversity of biological communities, including chaparral vegetation (*Adenostoma fasciculatum*, *Ceanothus* spp., *Rhamnus ilicifolia*), coastal sage scrub (*Artemisia californica*, *Salvia leucophylla*, *Malosma laurina*), coast live oak (*Quercus agrifolia*) woodland, and riparian woodlands (*Salix lasiolepis*, *Platanus racemosa*).

2.2. Animal use

Along the three highways, 15 potential wildlife passages in the form of underpasses (surface roads or wide streams crossing under the highway), drainage culverts (square or pipe culverts) and livestock tunnels, were monitored (Fig. 1). Some of the potential crossing points had been previously identified as potential "wildlife corridors" (Santa Monica Mountains Conservancy, 1990; Edelman, 1991) but none was made specifically to facilitate wildlife movement. Other passages were identified from flood control maps provided by the Public Works agencies of Ventura and Los Angeles Counties. Passage size varied considerably (Table 1). On average, square culverts were 97 m long, 4.2 m wide and 3.7 m high, pipe culverts were 176 m long, 2.6 m wide and 2.9 m high, and underpasses were 44 m long, 42 m wide and 5.2 m high.

Each passage was monitored for four consecutive days each month from 1 July 1999 through 30 June 2000, with the exception of passage 15. Passage 15 was filled with water during January and February at the height of the rainy season, and could not be monitored during that period. The order in which passages were sampled each month was determined randomly.

Two techniques were used to monitor animal use, remotely triggered cameras (Rappole et al., 1986; Carthew and Slater, 1991; York et al., 2001) and gypsum powder track stations (methods modified from Crooks and Soulé, 1999; Haas, 2000). Passive infrared trail monitoring units (TrailMaster TM550: Goodson and Associates, Inc., 10614 Widmer, Lenexa, KS 66215) were used at four passages (8, 12, 14, 15) where the probability of vandalism was judged to be minimal and where heavy water flow in the rainy season precluded monitoring animal tracks. Each unit consisted of an automatic flash camera triggered by the body heat or motion of an animal passing within 20 m and within a horizontal arc of 20° and a vertical arc of 4° of the infrared sensor. Sensors operated continuously, but were set to take only one photograph per minute. At each of the four passages with camera systems, at least three camera units were used to ensure adequate monitoring in the middle of the passage and at each entrance.

Where the probability of vandalism was judged high (passages 1–7, 9–11, 13), cameras were not used.

Table 1
Attributes of the 15 passages monitored in this study. Habitat type is the percentage of habitat within a 250-m semi-circle around both ends of each passage

Attributes	Tunnels, culverts and underpasses														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Crossing type	□	⊕	⌒	⊕	⌒	□	□	⊕	□	⌒	□	⊕	⌒	□	⊕
Dimensions															
Length (m)	58.3	144.9	45.1	196.1	48.9	73.5	249.6	133.4	45.0	84.4	54.3	189.2	44.3	98.9	218.1
Width (m)	4.6	3.9	47.6	2.1	41.8	3.2	4.3	2.2	2.5	30.0	5.5	1.6	46.7	4.8	3.0
Height (m)	4.7	3.8	5.0	2.2	4.9	4.6	3.2	2.6	2.6	6.0	2.9	1.6	4.9	4.0	4.3
Cross-sect. area (m^2)	21.6	11.6	238.0	3.6	204.8	14.7	13.8	4.5	6.5	180.0	16.0	2.0	228.8	19.2	10.5
Habitat type (%)															
Natural	100	54	38	50	100	38	38	100	69	8	0	46	46	50	60
Landscaped	0	8	20	23	0	12	12	0	0	15	0	0	0	0	0
Developed	0	38	42	27	0	50	50	0	31	77	100	54	54	50	40
Human activity															
No. of crossings	120	46	331	0	38	49	2	0	0	482	17	0	491	0	0

Human activity includes all human crossings whether on foot, on horseback or by vehicle. Passage type: □ = square culvert/ tunnel; ⊕ = drainage culvert; ⌒ = spanning bridge underpass.

Instead, passage use was monitored by placing three strips of agricultural gypsum powder across the floor of each passage to capture animal tracks. The strips of gypsum, each about 3 mm thick and 1 m wide, were laid across the entire width of each passage by sifting the powder through a mesh colander. We placed one strip in the middle of each passage and one at each entrance in order to detect both visits and crossings. As with the cameras, tracks in the gypsum were monitored for four days per month. Each day all tracks were identified (Murie, 1974), recorded and erased with a feather duster to prevent recount. We also recorded the direction of travel and, to further assist with species identification, the prints' length and width, and for canid and felid tracks, stride (the distance between two consecutive tracks) and straddle (the distance separating the outermost sides of the left and right track). To verify track identifications, one passage (8) was monitored simultaneously with both cameras and gypsum. All track identifications at this passage were in agreement with accompanying photographs.

From each set of tracks or photographs, we categorized the animal's use as: (1) a verified crossing, (2) a probable crossing, or (3) an assessment of the entrance only. When tracks or photographs of an animal were present at both ends of the passage and in the middle, the animal's use of the passage to traverse the width of the roadway was considered verified. When tracks or photographs were recorded at both end stations, but not in the middle, or at the middle station and at one of the ends, completion of the traverse was judged probable. In most such instances all tracks were in a single direction, suggesting that the animal had not turned back and that the missing tracks had been lost due to wind or human disturbance. When tracks or photographs were obtained at one end of a passage only, an animal was considered to have assessed the passage but not to have passed through it. Because our intent was to detect utilization and not to evaluate absolute levels of use by any particular species, we did not attempt to distinguish between individual animals. Hence, it is likely that some individuals were counted more than once.

2.3. Passage characteristics as predictors

For each passage, three dimensions (length, width, height), the nature of the surrounding habitat, and the amount of human activity were recorded as predictor variables for animal use (Table 1). From width and height, cross-sectional area of each passage was calculated. At each passage, photographs and tracks of humans, horses, bicycles, and other vehicles were also counted. Collectively, these served as a measure of human activity.

Habitat surrounding each passage was quantified by sampling within a 250-m semicircle around each entrance. For this purpose, habitat was placed into three categories: (1) natural, which consisted of intact vegetation (both native and naturalized); (2) developed or urban areas; or (3) landscaped, which consisted of human-altered areas without buildings, e.g. golf courses and landfills. For passages along US 101 and State Route 23, habitat type was determined from Digital Orthophoto Quarter Quadrangles (DOQQ), from which aerial percent coverage of each habitat category was determined. Because DOQQ coverage did not extend to US 118, Satellite Pour l'Observation de la Terre (SPOT) images were used to obtain the percent cover for passages along this freeway. Because some landscapes were being altered during the study period, at each site percentages were verified in the field by estimating the predominant habitat type (i.e. natural, developed, or landscaped) at 15° intervals within a 250-m semicircle surrounding each passage entrance. An overall percentage of each habitat category at the passage was then calculated by dividing the total number of observed dominant habitat types by 24 (the total number of bearings). Where percentages of the DOQQ and SPOT images differed from those obtained from field verifications, the percentages obtained in the field were used to determine habitat cover at the passage.

Before analyzing animal use data, we first searched for confounding associations among the various passage attributes using correlation analysis. Passage use by each species was approximated to a normal distribution via an arcsine square-root transformation. Spearman's rank correlation was used to quantify the relationship between the use of passages by wildlife and predictor variables. Low number of observations precluded statistical analyses for mountain lions. Where logical, analyses were conducted on records of several species grouped into classes, e.g. (a) large carnivores (coyotes, bobcats, and mountain lions) and (b) mid-sized mammals (raccoons, opossums, and striped and spotted skunks). Because sample sizes were small and nonparametric tests were used, we adopted $\alpha = 0.10$ as a measure of statistical significance.

3. Results

3.1. Animal use

During the year of study, 2723 detections were recorded as tracks and photos (Table 2). Of these records, 531 (19.5%) were of native large and mid-sized mammals, 1640 (60.2%) were of humans, 155 (5.7%) were of domestic animals, and 397 (14.6%) were of small mammals. Wild mammals known to have passed through one or more passages at least once included: deer mice (*Peromyscus* spp.), woodrats (*Neotoma* spp.), ground squirrels (*Spermophilus beecheyi*), cottontail rabbits

(*Sylvilagus auduboni*), opossums (*Didelphis virginianus*), striped skunks (*Mephitis mephitis*), spotted skunks (*Spilogale putorius*), raccoons (*Procyon lotor*), coyotes (*Canis latrans*), bobcats (*Lynx rufus*), mountain lions (*Puma concolor*), and mule deer (*Odocoileus hemionus*). For large and mid-sized mammals (excluding domestic species), we recorded 391 (73.6%) verified or probable crossings and 140 (26.4%) assessments of the entrance. For species of conservation interest, passage use varied between sites and species (Table 3). Raccoons were most commonly detected using passages and used all sites except one. Coyotes, bobcats, and domestic dogs and cats each used about half of the 15 sites studied. Deer and mountain lions were only detected at a few sites.

3.2. Passage attributes as predictors of wildlife use

There were four significant correlations between the various passage attributes. Length was negatively correlated with cross-sectional area ($r_s = -0.639$, $P < 0.01$).

Table 2
Nature and frequency of use of culverts, tunnels and underpasses, all passages combined

Species	Crossings			Investigations	Total records	Verified and probable crossings (as % of total records)
	Verified	Probable	Total			
Human	1332	36	1368	59	1427	95.9
Bike	156	12	168	5	173	97.1
Vehicle	36	0	36	0	36	100.0
Horseback	4	0	4	0	4	100.0
Total human activity	1528	48	1576	64	1640	96.1
House cat	24	10	34	25	59	57.6
Dog	57	8	65	18	83	78.3
Cow	12	0	12	1	13	92.3
Total domestic animals	93	18	111	44	155	71.6
Mountain lion	1	0	1	0	1	100.0
Bobcat	31	5	36	17	53	67.9
Coyote	49	10	59	12	71	83.1
Deer	26	0	26	2	28	92.9
Total large mammals	107	15	122	31	153	79.7
Raccoon	127	80	207	58	265	78.1
Opossum	17	7	24	5	29	82.8
Striped skunk	12	11	23	11	34	67.6
Spotted skunk	0	5	5	2	7	71.4
Cottontail rabbit	1	9	10	33	43	23.3
Total mid-sized mammals	157	112	269	109	378	71.1
Total rodents	133	106	239	158	397	60.2

Table 3
Frequency of passage use by species, including verified and probable crossings

Species	Passages															Total Passages Used
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Deer	2	0	0	0	9	0	0	0	0	0	0	0	15	0	0	3
Coyote	13	19	1	0	20	2	0	1	0	0	0	0	3	0	0	7
Bobcat	8	1	0	0	6	2	0	16	0	0	1	0	0	2	0	7
Mountain lion	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Raccoon	3	12	0	9	1	7	17	1	1	87	22	19	2	15	11	14
Opossum	0	1	5	0	0	7	2	1	5	1	0	2	0	0	0	8
Spotted skunk	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	1
Striped skunk	2	3	0	0	2	4	0	0	0	0	0	12	0	0	0	5
House cat	4	6	11	0	1	3	0	0	0	1	7	0	1	0	0	8
Domestic dog	9	4	36	0	7	3	0	1	0	0	1	0	4	0	0	8

Table 4
Spearman's rank correlation coefficient matrix for predictor variables and frequency of crossings through passages, probable and verified crossings combined

Species	Length	x.s.Area	Natural	Developed	Human activity
Coyote	−0.405	0.442	0.414	−0.454 *	0.553 **
Bobcat	−0.124	0.107	0.476 *	−0.462 *	−0.005
All large carnivores	−0.373	0.404	0.451 *	−0.442	0.372
Raccoon	0.523 **	−0.211	−0.559**	0.676 ***	−0.094
Opossum	−0.030	−0.176	−0.288	0.123	−0.055
Spotted skunk	0.247	−0.433	−0.094	0.281	−0.287
Striped skunk	0.068	−0.143	0.166	−0.117	0.122
All mid-sized mammals	0.447 *	−0.242	−0.665 ***	0.674 ***	−0.073
Deer	−0.523 **	0.551 **	0.367	−0.235	0.490 *
Rodents	−0.075	−0.291	0.528 **	−0.463 *	−0.114
Domestic dog	−0.571 **	0.619 **	0.172	−0.299	0.659 ***
House cat	−0.514 **	0.635 **	−0.318	0.154	0.765 ***

Statistically significant relationships are indicated with asterisks (*$P<0.10$, **$P<0.05$, ***$P<0.01$).

Human activity was negatively correlated with length ($r_s=-0.531$, $P<0.05$) and positively correlated with cross-sectional area ($r_s=0.806$, $P<0.01$). Not surprisingly, human activity was largely restricted to shorter passages with large cross-sectional areas (underpasses and tunnels) and was rarely associated with culverts. Because culverts are typically long and underpasses much shorter, the strong negative correlation between length and cross-sectional area was expected.

Three larger carnivore species—mountain lions, bobcats and coyotes—traversed the passages. Coyote use showed a significant positive correlation with human activity (Table 4). However, for both bobcats and coyotes, we observed negative relationships ($0.05<P<0.10$) between passage use and percentage of developed habitat, suggesting a tendency by these animals to avoid passages surrounded largely by developed habitat (Table 4). Moreover, for bobcats the relationship between passage use and percentage of natural habitat was positive and statistically significant. The single record of a mountain lion precluded a statistical test. For all three native carnivore species combined, the relationship between passage use and extent of natural habitat was again positive ($0.05<P<0.10$).

Raccoon use of the passages was negatively correlated with extent of natural habitat and positively correlated with both extent of developed habitat and with passage length (Table 4). No statistically significant relationships were found between passage attributes and activity of opossums or either of the two skunk species, presumably the result of small sample sizes. For all mid-sized mammals (raccoons, opossums, and skunks) passage length and passage use were positively correlated ($0.05<P<0.10$).

Mule deer only used three large passages and never used small passages, such as culverts, even though some small passages were large enough for their use. Mule deer use of passages was negatively correlated with passage length and positively correlated with cross-sectional area (Table 4). No statistically significant relationship was found between mule deer use of passages and habitat type. However, of the three sites used by deer, all were characterized by significant amounts of nearby natural habitat (Table 1).

For both domestic dogs and cats, the use of passages was negatively correlated with passage length and positively correlated with both cross-sectional area and the amount of human activity (Table 4). Corridor use by dogs and cats was not significantly related to habitat.

4. Discussion

Our data clearly demonstrate regular use of underpasses and drainage culverts beneath highways by wildlife, including species of conservation concern. We suggest that maintaining or modifying passages can be important for protecting native species in areas bisected by high-speed roadways. Although culverts are typically installed to accommodate water flow, installation of such passages solely for wildlife use may also be justified, particularly where no other passages exist and habitat is suitable. If this is done, consideration must be given to passage dimensions, especially if the passage is intended for use by deer. However, protecting suitable habitat in the vicinity of crossing points is especially important, particularly for larger carnivores and deer. In general, a culvert or underpass, regardless of its dimensions, is of little value as a wildlife corridor if it does not connect suitable habitat.

In this study, we demonstrated use of corridors by wildlife and not benefits associated with that use. Corridor use alone does not necessarily impart conservation

value, and some have suggested that corridors can even be detrimental to wildlife conservation efforts (Simberloff and Cox, 1987; Simberloff et al., 1992). However, because the species we monitored are susceptible to fragmentation impacts and because roadways within their habitats are significant sources of mortality (Ng, 2000; Riley et al., 2003), we believe that the ecological benefits of highway undercrossings will outweigh possible impacts in our study area.

A significant aspect of the corridor debate focuses on whether or not animals will actually use corridors, if they are provided (Simberloff and Cox, 1987; Noss, 1987b; Simberloff et al., 1992; Hess, 1994; Beier and Noss, 1998). Much recent empirical work has adopted an experimental approach and focused on small-bodied species (e.g. Dunning et al., 1995; Andreassen et al., 1996; Haddad, 1999; Haddad and Baum, 1999; Danielson and Hubbard, 2000). Our work, examining road undercrossing use by large-bodied species in natural landscapes, complements this literature by demonstrating that large and medium-sized carnivores, deer, and other species will regularly use passages beneath highways. Larger carnivores, specifically bobcats and coyotes, traversed passages of a wide variety of sizes, from the largest spanning bridge underpasses to the smaller pipe culverts (Table 3). Assuming that corridors do impart conservation value, these findings are important for conservation by clearly demonstrating wildlife use of underpasses.

Coyote use of passages was significantly and negatively correlated with development. At the same time, though, we also found coyotes most likely to use passages associated with high degrees of human activity. Indeed, we commonly recorded coyotes using passages that had trails or roads within them, and that were regularly frequented by people. However, encounters between humans and coyotes are probably limited, since coyotes are most likely to frequent the passages at times when humans are least likely to be there. In fragmented landscapes, coyotes are often seen in urban areas that are immediately adjacent to natural habitat (Atkinson and Shackleton, 1991; Rosmos, 1998; Sauvajot et al., 2000; Riley et al., 2003). Consequently, our findings probably reflect coyote prevalence on urban fringes and a willingness to use areas of human activity rather than an attraction to them.

We had one record of a mountain lion using passage 1. Although a single record does not allow us to make conclusions about habitat or dimensions, it documents the potential use of passages for facilitating movements of these animals. The numbers and movement patterns of mountain lions in the Los Angeles area are not well understood (but see Beier, 1993), and more information about the status and distribution of mountain lions in this region is critical to understand the effects of roads and habitat connectivity on this species.

Raccoons, opossums, and skunks are opportunistic species that live in a wide variety of habitats, including in suburbs and cities (Rosatte et al., 1990; Riley et al., 1998). These species may benefit from human activities, both because of the addition of anthropogenic food sources and the increased availability of water. In our study, raccoons were detected at the passages more frequently than any other wild mammal species and were more common in passages surrounded by human development than in those adjoining wild land. The prevalence of raccoons was in part because they actually used the passages as foraging habitat and not necessarily as movement corridors. Many raccoons were encountered in culverts that contained water and sometimes entire families were photographed foraging in the water.

Consistent with other studies (Reed, 1981; Foster and Humphrey, 1995; Crooks and Jones, 1998; Haas, 2000), we found that passage dimensions significantly influenced passage use by deer. All mule deer crossings occurred at spanning bridge underpasses with large cross-sectional areas. Although we found no statistically significant correlation between deer use and habitat, deer were only encountered at passages surrounded largely by natural habitat. Crooks and Jones (1998) also found deer using underpasses with more natural habitat and less residential development.

We found house cats using underpasses and culverts in or near urbanization. Thus, while underpasses may be used by native carnivores, they can also provide access for house cats which in turn may have deleterious impacts on other native species. For example, in areas of high human density, domestic animals, particularly house cats, have been associated with the decline and extinction of bird and small mammal populations in fragmented habitats (Soulé et al., 1988; Bolger et al., 1997; Crooks and Soulé, 1999).

Overall, our results indicate that underpasses, culverts, and other cross-highway structures facilitate wildlife attempting to cross major roads. We believe that such structures, even if not originally designed for wildlife, can be important parts of regional conservation strategies. We also observed numerous instances of animals being killed while attempting to cross road surfaces (Ng, 2000; Riley et al., 2003). To increase the likelihood of passage use by wildlife and to keep animals off roadways, we recommend installing animal-proof fencing to funnel animals away from road surfaces and into crossing structures. Although our results demonstrate that existing passages will be used, more effective crossing structures could certainly be developed if wildlife movement was the primary design objective.

Acknowledgements

This study was generously supported by the Southwest Parks and Monuments Association; the Foundation for

the Preservation of the Santa Susana Mountains; and the University Corporation and Office of Graduate Research at California State University, Northridge. Logistic support, vehicles, and cameras were provided by the National Park Service, Santa Monica Mountains National Recreation Area (SMMNRA). Access to study passages was provided by the Rancho Simi Recreation and Parks District, California Department of Transportation (Caltrans), the Los Angeles and Ventura County Flood Control Districts, and the Simi Valley Landfill. We are extremely grateful for help provided by E. York, C. Haas, D. Jones, P. Schiffman, P. Wilson and by the many dedicated interns and volunteers of the National Park Service, SMMNRA: L. Lee, L. Kellogg, C. Thompson, M. Hanson, L. Bragg, L. Aschim, K. Asmus, J. Chraft, P. Roby, S. Breidenthal, A. Paden, and G. Pasrich. Finally, we acknowledge helpful comments on earlier drafts of this manuscript from two anonymous reviewers and from M. Schwartz.

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Review of Ecological Effects of Roads on Terrestrial and Aquatic Communities

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Abstract: *Roads are a widespread and increasing feature of most landscapes. We reviewed the scientific literature on the ecological effects of roads and found support for the general conclusion that they are associated with negative effects on biotic integrity in both terrestrial and aquatic ecosystems. Roads of all kinds have seven general effects: mortality from road construction, mortality from collision with vehicles, modification of animal behavior, alteration of the physical environment, alteration of the chemical environment, spread of exotics, and increased use of areas by humans. Road construction kills sessile and slow-moving organisms, injures organisms adjacent to a road, and alters physical conditions beneath a road. Vehicle collisions affect the demography of many species, both vertebrates and invertebrates; mitigation measures to reduce roadkill have been only partly successful. Roads alter animal behavior by causing changes in home ranges, movement, reproductive success, escape response, and physiological state. Roads change soil density, temperature, soil water content, light levels, dust, surface waters, patterns of runoff, and sedimentation, as well as adding heavy metals (especially lead), salts, organic molecules, ozone, and nutrients to roadside environments. Roads promote the dispersal of exotic species by altering habitats, stressing native species, and providing movement corridors. Roads also promote increased hunting, fishing, passive harassment of animals, and landscape modifications. Not all species and ecosystems are equally affected by roads, but overall the presence of roads is highly correlated with changes in species composition, population sizes, and hydrologic and geomorphic processes that shape aquatic and riparian systems. More experimental research is needed to complement post-hoc correlative studies. Our review underscores the importance to conservation of avoiding construction of new roads in roadless or sparsely roaded areas and of removal or restoration of existing roads to benefit both terrestrial and aquatic biota.*

Revisión de los Efectos de Carreteras en Comunidades Terrestres y Acuáticas

Resumen: *Las carreteras son una característica predominante y en incremento de la mayoría de los paisajes. Revisamos la literatura científica sobre los efectos ecológicos de las carreteras y encontramos sustento para la conclusión general de que las carreteras están asociadas con efectos negativos en la integridad biótica tanto de ecosistemas terrestres como acuáticos. Las carreteras de cualquier tipo ocasionan siete efectos generales: mortalidad ocasionada por la construcción de la carretera; mortalidad debida a la colisión con vehículos; modificaciones en la conducta animal; alteración del ambiente físico; alteración del ambiente químico; dispersión de especies exóticas e incremento en el uso de áreas por humanos. La construcción de carreteras elimina a organismos sésiles y a organismos de lento movimiento, lesiona a organismos adyacentes a la carretera y altera las condiciones físicas debajo ella misma. Las colisiones con vehículos afectan la demografía de muchas especies tanto de vertebrados como invertebrados; las medidas de mitigación para reducir la pérdida de animales por colisiones con vehículos han sido exitosas solo de manera parcial. Las carreteras alteran la conducta animal al ocasionar cambios en el rango de hogar, movimientos, éxito reproductivo, respuesta de escape y estado fisiológico. Las carreteras cambian la densidad del suelo, temperatura, contenido de agua en el suelo, niveles de luz, polvo, aguas superficiales, patrones de escurrimiento y sedimentación, además de agregar metales pesados (especialmente plomo), sales, moléculas orgánicas, ozono y nutrientes a los ambientes que atraviesan. Las carreteras promueven la dispersión de especies exóticas al alterar los hábi-*

Paper submitted February 8, 1999; revised manuscript accepted July 21, 1999.

...al estresar a las especies nativas y proveer corredores para movimiento. Las carreteras también pro...ven el incremento de la caza y la pesca, el hostigamiento pasivo de animales y modificaciones del ...ge. No todas las especies ni todos los ecosistemas son afectados por las carreteras de igual forma, pero en ...eral la presencia de carreteras está altamente correlacionada con cambios en la composición de especies, ...tamaños poblacionales y los procesos hidrológicos y geomorfológicos que afectan a la estructura de siste...as acuáticos y reparios. Se necesita más investigación experimental para complementar estudios correlati...os post-hoc. Nuestra revisión hace énfasis en que en trabajos de conservación es importante evitar la con...ucción de nuevas carreteras en áreas carentes de ellas o en áreas con pocas carreteras, además de remover ...restaurar carreteras existentes con la finalidad de beneficiar tanto a la biota acuática como la terrestre.

Introduction

Among the most widespread forms of modification of the natural landscape during the past century has been the construction and maintenance of roads (Diamondback 1990; Bennett 1991; Noss & Cooperrider 1994). As conservation biologists seek to understand the forces that influence the viability of populations and the overall health of ecosystems, it is important that we understand the scope of the ecological effects of roads of all types, especially important as conservation biologists are asked to participate in the development and implementation of strategies to protect or restore elements of biological diversity and integrity.

Roads of all kinds affect terrestrial and aquatic ecosystems in seven general ways: (1) increased mortality from road construction, (2) increased mortality from collision with vehicles, (3) modification of animal behavior, (4) alteration of the physical environment, (5) alteration of the chemical environment, (6) spread of exotic species, and (7) increased alteration and use of habitats by humans. These general effects overlap somewhat. In some cases animals modify their behavior and avoid roads because of concentrated human activity along roads. Roads may facilitate the spread of invasive species by disrupting native communities and changing physical habitats. Roads may fragment populations through roadkill and road avoidance. Despite the difficulty of categorizing discretely the causal basis in every example, these seven categories provide a useful framework for assessing what is known and unknown about the ecological effects of roads.

Selective road removal, relocation, or remediation may provide ecological benefits in certain situations. Yet, although roads are commonly identified as important correlates or indicators of loss of ecological health (e.g., Noss & Cooperrider 1994), the specific mechanisms by which biota are affected are often complicated or uncertain. Therefore, mitigation or treatment of specific effects, whether during road design or in post-construction remediation, can be costly and fraught with uncertainty.

Mortality from Road Construction

Road construction kills any sessile or slow-moving organism in the path of the road. The extent to which road construction contributes to direct mortality has not been estimated as has direct mortality from other forms of habitat destruction (e.g., Petranka et al. 1993). The fact that road construction kills individual organisms is obvious, however. The magnitude of such construction is not trivial; the 13,107,812 km of road lanes of all types in the conterminous United States, with an average width of 3.65 m per lane, have destroyed at least 4,784,351 ha of land and water bodies that formerly supported plants, animals, and other organisms (U.S. Department of Transportation 1996). The actual number is likely much higher because this estimate does not include shoulder pavement and land peripheral to the roadbed that is cleared during construction.

Construction may physically injure organisms adjacent to the path of construction. Roads built for extraction of white fir result in damage to trees that is visible up to 30 m from the road (Trafela 1987). Such damage contributes to a decline of up to 30% in forest productivity per rotation, due in part to a decline in growth of damaged trees. Construction also alters the physical conditions of the soil underneath and adjacent to the road. Riley (1984) showed that road construction increases soil compaction up to 200 times relative to undisturbed sites. These changes likely decrease the survival of soil biota that are not killed directly. Direct transfer of sediment and other material to streams and other water bodies at road crossings is an inevitable consequence of road construction (Richardson et al. 1975; Seyedbagheri 1996). High concentrations of suspended sediment may directly kill aquatic organisms and impair aquatic productivity (Newcombe & Jensen 1996).

Mortality from Collision with Vehicles

Mortality of animals from collision with vehicles is well documented. Many reviews of the taxonomic breadth of the victims of vehicle collision have been published (e.g., Groot Bruinderink & Hazebroek 1996). Few if any terrestrial species of animal are immune. Large mammals ranging in size from moose (*Alces alces*) to armadillos (*Dasypus novemcinctus*) are the best-documented roadkills, probably due to interest in their demography and to their size (Bellis & Graves 1971; Puglisi et al. 1974;

Reilly & Green 1974; Holroyd 1979; Wilkins & Schmidly 1980; Bashore et al. 1985; Davies et al. 1987; Bangs et al. 1989; Palomares & Delibes 1992).

Roadkill among many other species includes American Kestrels (*Falco sparverius*; Varland et al. 1993), Barn Owls (*Tyto alba*; Newton et al. 1991), Northern Saw-whet Owls and Eastern Screech Owls (*Aegolius acadicus and Otis asio*, Loos & Kerlinger 1993), tropical forest birds (Novelli et al. 1988), garter snakes (Dalrymple & Reichenbach 1984), granivorous birds (Dhindsa et al. 1988), American crocodile (*Crocodylus acutus*; Kushlan 1988), green iguanas (*Iguana iguana*; Rodda 1990), desert snakes (Rosen & Lowe 1994), toads (van Gelder 1973), plus a wide range of invertebrates, especially insects (H. C. Seibert & Conover 1991).

This form of mortality can have substantial effects on a population's demography. Vehicle collision is the primary cause of death for moose in the Kenai National Wildlife Refuge in Alaska (Bangs et al. 1989) and for Barn Owls in the United Kingdom (Newton et al. 1991), the second highest form of mortality for Iberian lynx (*Felis pardina*) in southwestern Spain (after hunting; Ferreras et al. 1992), and the third highest form for white-tailed deer (*Odocoileus virginianus*) in New York (Sarbello & Jackson 1985) and wolves (*Canis lupus*) in Minnesota (Fuller 1989). Roadkill is a limiting factor in the recovery of the endangered American crocodile in southern Florida (Kushlan 1988) and is contributing to the endangerment of the prairie garter snake (*Thamnophis radix radix*; Dalrymple & Reichenbach 1984). Roadkill is often nonspecific with respect to age, sex, and condition of the individual animal (e.g., Bangs et al. 1989).

Amphibians may be especially vulnerable to roadkill because their life histories often involve migration between wetland and upland habitats, and individuals are inconspicuous and sometimes slow-moving. Roads can be demographic barriers that cause habitat and population fragmentation (Joly & Morand 1997). In the Netherlands, for example, roads with high traffic volume negatively affect occupancy of ponds by moor frogs (*Rana arvilis*; Vos & Chardon 1998). In Ontario, the local abundance of toads and frogs is inversely related to traffic density on adjacent roads, but the incidence of roadkill relative to abundance is higher on highly trafficked roads (Fahrig et al. 1995). Thus, even though populations in high-traffic areas have apparently already been depressed from cumulative road mortality, they continue to suffer higher proportionate rates of roadkill.

Mitigation measures have been employed in different locations with varying degrees of success (e.g., Yanes et al. 1995). For example, underpasses on Interstate 75 have been only partially successful in reducing roadkill of Florida panthers (*Felis concolor coryi*; Foster & Humphrey 1991). Despite mitigation efforts, roads are likely to be a persistent source of mortality for many species. In general, mortality increases with traffic volume (e.g., Rosen & Lowe 1994; Fahrig et al. 1995). Some species are less likely to be killed on high-speed roads than on medium-speed roads because the former usually have vegetation cleared back further from the road's shoulder, creating less attractive habitat and greater visibility for both animals and drivers. Other species, however, are attracted to the modified habitat alongside and in the meridians of high-speed roads (Cowardin et al. 1985), making them population sinks.

Modification of Animal Behavior

The presence of a road may modify an animal's behavior either positively or negatively. This can occur through five mechanisms: home range shifts, altered movement patterns, altered reproductive success, altered escape response, and altered physiological state.

Black bears (*Ursus americanus*) in North Carolina shift their home ranges away from areas with high road densities (Brody & Pelton 1989), as do grizzly bears in the Rocky Mountains (*Ursus horribilis*; McLellan & Shackleton 1988). Elk (*Cervus elaphus*) in Montana prefer spring feeding sites away from visible roads (Grover & Thompson 1986), and both elk and mule deer (*Odocoileus hemionus*) in Colorado in winter prefer areas >200 m from roads (Rost & Bailey 1979). Wolves will not establish themselves in areas with road densities greater than a region-specific critical threshold (Jensen et al. 1986; Thurber et al. 1994), probably as a result of a relationship between road density and hunting pressure. Mountain lion (*Felis concolor*) home ranges are situated in areas with lower densities of improved dirt roads and hard-surface roads (Van Dyke et al. 1986), suggesting that either mountain lions avoid these areas or road construction tends to avoid their prime habitat. Elephants (*Loxodonta africana*) in northeastern Gabon preferentially locate in forests away from both roads and villages (Barnes et al. 1991). Both Black Vultures (*Coragyps atratus*) and Turkey Vultures (*Cathartes aura*), on the other hand, preferentially establish home ranges in areas with greater road densities (Coleman & Fraser 1989), probably because of the increase in carrion.

Roads may also alter patterns of animal movement. Caribou (*Rangifer tarandus*) in Alaska preferentially travel along cleared winter roads that lead in the direction of their migration (Banfield 1974). Although the road may enhance caribou movement, it results in increased mortality from vehicle collisions and predation by wolves. After calving, female caribou with calves avoid roads (Klein 1991). The land snail *Arianta arbustorum* avoids crossing roads, even those that are unpaved and as narrow as 3 m (Baur & Baur 1990), and extend their movements along road verges. Reluctance to cross roads is also seen in white-footed mice (*Peromyscus*

leucopus; Merriam et al. 1989) and many other rodent species (Oxley et al. 1974), even when the road is narrow and covered only with gravel. Cotton rats (*Sigmodon hispidus*) and prairie voles (*Microtus ochrogaster*) avoid roads as narrow as 3 m (Swihart & Slade 1984). Black bear almost never cross interstate highways in North Carolina (Brody & Pelton 1989) but will cross roads with less traffic volume. Roads act as barriers to gene flow in the common frog (*Rana temporaria*) in Germany, leading to significant genetic differentiation among populations (Reh & Seitz 1990). Other animals that show a reluctance to cross roads include pronghorn antelope (*Antilocapra americana*; Bruns 1977) and mountain lions (Van Dyke et al. 1986).

Some animals seem unaffected by the presence of roads at least at some spatial scales. Based on a study of 20 wolverines, Hornocker and Hash (1981) concluded that the sizes and shapes of home ranges of wolverines where they are still found in northwestern Montana are independent of the presence of highways. Similarly, the presence of highways explained none of the allelic differentiation among populations of brown hares (*Lepus europaeus*) in Austria (Hartl et al. 1989).

Roads may affect an animal's reproductive success. Productivity of Bald Eagles (*Haliaeetus leucocephalus*) in Oregon (Anthony & Isaacs 1989) and Illinois (Paruk 1987) declines with proximity to roads, and they preferentially nest away from roads. Golden Eagles (*Aquila chrysaetos*) also prefer to nest away from human disturbances, including roads (Fernandez 1993). The reduced nesting success of eagles in proximity to roads may be more a function of the presence of humans than of the road itself: nesting failure by Golden Eagles in Scotland correlates with how easy it is for people to approach but not with proximity to roads themselves (Watson and Dennis 1992). Relative to habitat availability, Sandhill Cranes (*Grus canadensis*) avoid nesting near paved and gravel public roads (Norling et al. 1992); they do not avoid private roads with low-traffic volume (Norling et al. 1992) and can habituate to roads over time (Dwyer & Tanner 1992). Mallards (*Anas platyrhynchos*) in North Dakota, on the other hand, prefer road rights-of-way for nesting (Cowardin et al. 1985), perhaps because of a lower level of predation there.

Roads can also alter escape responses. Pink-footed Geese (*Anser brachyrhynchus*) in Denmark are more easily disturbed when feeding near roads, flying away when humans approach within 500 m, a greater distance than when feeding in areas without roads (Madsen 1985). Both the Lapwing (*Vanellus vanellus*) and Black-tailed Godwit (*Limosa limosa*) are more easily disturbed near roads and have disturbance distances of 480–2000 m depending on traffic volume (Van der Zande et al. 1980). Less well known is the effect of roads and vehicles on an animal's physiological state. MacArthur et al. (1979) showed that heart rate and therefore metabolic rate and energy expenditure of female bighorn sheep (*Ovis canadensis*) increase near a road independent of any use of the road. Roads contribute to fragmentation of populations through both increased mortality and modification of behavior that makes animals less likely to cross roads. Fragmentation may be accelerated by roads when spatially critical habitat patches (e.g., "stepping stones") become unoccupied as a result of increased local mortality or reduced recolonization.

Disruption of the Physical Environment

A road transforms the physical conditions on and adjacent to it, creating edge effects with consequences that extend beyond the time of the road's construction. At least eight physical characteristics of the environment are altered by roads: soil density, temperature, soil water content, light, dust, surface-water flow, pattern of runoff, and sedimentation.

Long-term use of roads leads to soil compaction that persists even after use is discontinued. Soil density on closed forest roads continues to increase, particularly during winter months (Helvey & Kochenderfer 1990). Increased soil density can persist for decades: logging skid trails in northeastern California over 40 years old have soil that is 20% more compacted than soil in nearby areas that have not been used as trails (Vora 1988).

The reduction of water vapor transport on a road with a hard surface increases the surface temperature of a road compared to bare soil, an effect that increases with thickness of the road surface (Asaeda & Ca 1993). The heat stored on the road surface is released into the atmosphere at night, creating heat islands around roads. Animals respond to these heat islands: small birds (Whitford 1985) and snakes, for example, preferentially aggregate on or near warm roads, increasing their risk of being hit by cars and, at their northern range limits, reducing energetic demands for breeding.

During the dry season, the moisture content of soils under roads declines even if the roads are not in use (Helvey & Kochenderfer 1990), probably in response to changes in soil porosity. Roads through forests also increase the amount of light incident on the forest floor. The amount of increase depends on how much of the original canopy and lower strata remain, which depends in turn on the width of the road and roadside verge. The increase in light increases the density of species that preferentially grow where light levels are high, such as early-successional, disturbance-adapted species such as the North American orchid *Isotria medeoloides* (Mehrhoff 1989).

Road traffic mobilizes and spreads dust, which when settled on plants can block photosynthesis, respiration, and transpiration and can cause physical injuries to plants (Farmer 1993). These effects are sufficient to alter

plant community structure, especially in communities dominated by lichens and mosses (Auerbach et al. 1997). Although most sediment enters water bodies through overland flow or mass failure, dust from highly trafficked roads can serve as a source of fine sediments, nutrients, and contaminants to aquatic ecosystems (Gjessing et al. 1984).

Roads and bridges can alter the development of shorelines, stream channels, floodplains, and wetlands. Because of the energy associated with moving water, physical effects often propagate long distances from the site of a direct road incursion (Richardson et al. 1975). Alteration of hydrodynamics and sediment deposition can result in changes in channels or shorelines many kilometers away, both down- and up-gradient of the road crossing. The nature of such responses to channel and shoreline alteration is not always predictable; it may depend on the sequence of flood and sedimentation events after the alteration is made. Roads on floodplains can redirect water, sediment, and nutrients between streams and wetlands and their riparian ecosystems, to the detriment of water quality and ecosystem health. Roads are among the many human endeavors that impair natural habitat development and woody debris dynamics in forested floodplain rivers (Piegay & Landon 1997).

Road crossings commonly act as barriers to the movement of fishes and other aquatic animals (Furniss et al. 1991). Although many headwater populations of salmonid fishes are naturally migratory, they often persist today as fragmented headwater isolates, largely because of migration barriers created by road crossings and other human developments that fail to provide for fish passage (Kershner et al. 1997; Rieman et al. 1997). Salmonids and other riverine fishes actively move into seasonal floodplain wetlands and small valley-floor tributaries to escape the stresses of main-channel flood flows (Copp 1989), but valley-bottom roads can destroy or block access to these seasonally important habitats (Brown & Hartman 1988). Persistent barriers may encourage local selection for behaviors that do not include natural migration patterns, potentially reducing both the distribution and productivity of a population.

Roads directly change the hydrology of slopes and stream channels, resulting in alteration of surface-water habitats that are often detrimental to native biota. Roads intercept shallow groundwater flow paths, diverting the water along the roadway and routing it efficiently to surface-water systems at stream crossings (Megahan 1972; Wemple et al. 1996). This can cause or contribute to changes in the timing and routing of runoff (King & Tennyson 1984; Jones & Grant 1996; Ziemer & Lisle 1998), the effects of which may be more evident in smaller streams than in larger rivers (Jones & Grant 1996). Hydrologic effects are likely to persist for as long as the road remains a physical feature altering flow routing—often long after abandonment and revegetation of the road surface. By altering surface or subsurface flow, roads can destroy and create wetland habitats.

Changes in the routing of shallow groundwater and surface flow may cause unusually high concentrations of runoff on hillslopes that can trigger erosion through channel downcutting, new gully or channel head initiation, or slumping and debris flows (Megahan 1972; Richardson et al. 1975; Wemple et al. 1996; Seyedbagheri 1996). Once such processes occur, they can adversely affect fishes and other biota far downstream for long periods of time (Hagans et al. 1986; Hicks et al. 1991). Roads have been responsible for the majority of hillslope failures and gully erosion in most steep, forested landscapes subject to logging activity (Furniss et al. 1991; Hagans et al. 1986). Because most of these more catastrophic responses are triggered by the response of roads during infrequent, intense storm events, lag times of many years or decades pass before the full effects of road construction are realized.

Chronic effects also occur, however. The surfaces of unpaved roads can route fine sediments to streams, lakes, and wetlands, increasing the turbidity of the waters (Reid & Dunne 1984), reducing productivity and survival or growth of fishes (Newcombe & Jensen 1996), and otherwise impairing fishing (Buck 1956). Existing problem roads can be remediated to reduce future erosion potential (e.g., Weaver et al. 1987; Harr & Nichols 1993). The consequences of past sediment delivery are long-lasting and cumulative, however, and cannot be effectively mitigated (Hagans et al. 1986).

Alteration of the Chemical Environment

More has been written about the effects of roads on the chemical environment than on all other effects combined. Maintenance and use of roads contribute at least five different general classes of chemicals to the environment: heavy metals, salt, organic molecules, ozone, and nutrients.

A variety of heavy metals derived from gasoline additives and road deicing salts are put into the roadside environment. The most widely documented is lead, but others include aluminum, iron, cadmium, copper, manganese, titanium, nickel, zinc, and boron (Garcia-Miragaya et al. 1981; Clift et al. 1983; Gjessing et al. 1984; Oberts 1986; Araratyan & Zakharyan 1988).

Heavy metal contamination exhibits five patterns. First, the amount of contamination is related to vehicular traffic (Goldsmith et al. 1976; Dale & Freedman 1982; Leharne et al. 1992). Second, contamination of soils, plants, and animals decreases exponentially away from the road (Quarles et al. 1974; Dale & Freedman 1982). Most studies indicate that contamination declines within 20 m but that elevated levels of heavy metals often occur 200 m or more from the road. The pattern of decline is influenced

by prevailing wind patterns (Haqus & Hameed 1986). Once metals reach aquatic environments, transport rates and distances increase substantially (Gjessing et al. 1984).

Third, heavy metals can be localized in the soil, either close to the surface if downward transport has not occurred (Indu & Choudhri 1991) or deep below the surface if pollution levels in the past exceeded those in the present (Byrd et al. 1983). Transportation and localization is largely affected by the physical properties of the soil (Yassoglou et al. 1987). Metals and other persistent chemicals fixed to soils may become remobilized once they are inundated or transported to freshwater environments by wind, water, or gravity.

Fourth, heavy metals accumulate in the tissues of plants (Datta & Ghosh 1985; Beslaneev & Kuchmazokova 1991) and animals (Collins 1984; Birdsall et al. 1986; Grue et al. 1986). As with soil, contamination of plant tissue occurs up to at least 200 m from a road and is greatest for individuals along roads with high traffic volume.

Fifth, heavy metal concentrations in soil decline over time where use of leaded gasoline has been stopped and surface-water flow carries the metal ions away (Byrd et al. 1983; Tong 1990). After they leave the terrestrial environment, however, the mobilized metals may cause additional harm to aquatic biota. Also, some of the processes of metal demobilization may be reversed rapidly if environmental conditions, such as acidity of the soils, sediments, or water, change (Nelson et al. 1991).

Deicing salts, particularly NaCl but also $CaCl_2$, KCl, and $MgCl_2$, contribute ions to the soil, altering pH and the soil's chemical composition (Bogemans et al. 1989). As with lead, discontinuation of the use of deicing salts allows plants damaged by salt stress to recover (Leh 1990). The effects on aquatic biota of temporary surges of salt that often accompany runoff from roads to surface and groundwaters have received little study. Deicing salts on roadways elevate chloride and sodium concentrations in streams (Molles & Gosz 1980; Hoffman et al. 1981; Peters & Turk 1981; Mattson & Godfrey 1994) and in bogs, where road salts can alter patterns of succession in aquatic vegetation (Wilcox 1986). Accumulation of salts from chemicals used for road deicing or dust control can disrupt natural stratification patterns and thus potentially upset the ecological dynamics of meromictic lakes (Hoffman et al. 1981; Kjensmo 1997).

Organic pollutants such as dioxins and polychlorinated biphenyls are present in higher concentrations along roads (Benfenati et al. 1992). Hydrocarbons may accumulate in aquatic ecosystems near roads (Gjessing et al. 1984). In one stream along a British highway, numerous contaminants were present at elevated levels in the water column and sediments, including copper, zinc, and various hydrocarbons, but polycyclic aromatic hydrocarbons associated with stream sediments accounted for most of the observed toxicity to aquatic amphipods (Maltby et al. 1995). Comparatively little research has focused on the questions of the fate and effects of the organic chemicals associated with roads.

Vehicles produce ozone, which increases the concentration of this harmful molecule in the air, especially in areas where vehicle exhaust accumulates (Flueckiger et al. 1984). Roads are also especially important vectors of nutrients and other materials to aquatic ecosystems, because the buffering role normally played by riparian vegetation (Correll et al. 1992) is circumvented through direct runoff of materials in water and sediment where roads abut or cross water bodies. Water moving on and alongside roadways can be charged with high levels of dissolved nitrogen in various forms, and sediment brings a phosphorus subsidy when it reaches surface waters. Road deicing salts are an additional source of phosphorus (Oberts 1986). The degree to which roads directly contribute to eutrophication problems in aquatic ecosystems has been little investigated. Because roads deliver nutrients that originate in the contributing slope area, the nutrient burden is probably largely controlled by surrounding vegetation and land use. An increased density of road crossings of water bodies can be expected to increase delivery of nutrients.

The alteration of the chemical environment by roads results in a number of consequences for living organisms. First, in the terrestrial environment the chemical composition of some woody plants changes in response to pollution. These changes include increased concentrations of chemicals produced by plants, such as terpenoids, which help them resist the toxic effects of pollution (Akimov et al. 1989) and salts (Bogemans et al. 1989), and decreased production of other chemicals, such as soluble protein and chlorophyll *a*, which are necessary for plant function (Banerjee et al. 1983).

Second, organisms may be killed or otherwise displaced as a result of chemical exposure. Virtually all measures of soil biotic diversity and function decline in contaminated soil, including abundance, number of species, species composition, index of species diversity, index of equability, and bulk soil respiration (Muskett & Jones 1981; Guntner & Wilke 1983; Krzysztofiak 1991).

Third, the growth (Petersen et al. 1982) and overall physical health (Flueckiger et al. 1984; Moritz & Breitenstein 1985) of many plants is depressed, even to the point of death (Fleck et al. 1988). The sensitivity of plants to pollutants may change during development; for example, seedlings are more sensitive to salt than are adults (Liem et al. 1984), which influences juvenile recruitment. Pollutants may affect plant health by damaging fine roots, mycorrhizae (Majdi & Persson 1989), and leaves (Simini & Leone 1986) and by changing salt concentrations in plant tissues (Northover 1987). Secondary effects on plant health include decreased resistance to pathogens (Northover 1987), causing further declines. In aquatic environments, plant (and animal) assemblages

may change due to direct and indirect responses to nutrient increases and due to growth suppression or mortality caused by other chemicals introduced by roads.

Fourth, plants (Graham & Kalman 1974; Nasralla & Ali 1985; Dickinson et al. 1987; Guttormsen 1993) and animals (Robel et al. 1981; Collins 1984; Harrison & Dyer 1984; Krzysztofiak 1991; Marino et al. 1992), including those cultivated or raised for agriculture, may accumulate toxins at levels that pose health hazards, including those for humans that consume exposed organisms (Jarosz 1994).

Fifth, increased concentrations near roadsides of some pollutants, particularly salt, attract large mammals, putting them more at risk of being killed by vehicles (Fraser & Thomas 1982). Spills of edible products from trucks and trains also attract wildlife to roadsides. Finally, evolutionary processes may be affected through altered selection pressures that result in local differentiation of populations of both plants (Kiang 1982) and animals (Minoranskii & Kuzina 1984).

Spread of Exotic Species

Roads provide dispersal of exotic species via three mechanisms: providing habitat by altering conditions, making invasion more likely by stressing or removing native species, and allowing easier movement by wild or human vectors. It is often difficult to distinguish among these factors. Soils modified during road construction can facilitate the spread of exotic plants along roadsides (Greenberg et al. 1997). Some exotic plants establish themselves preferentially along roadsides and in other disturbed habitats (Wester & Juvik 1983; Henderson & Wells 1986; Tyser & Worley 1992; Wein et al. 1992). The spread of exotic diseases (Dawson & Weste 1985; Gad et al. 1986) and insects (Pantaleoni 1989; Schedl 1991) is facilitated by increased density of roads and traffic volume. Road construction that alters the canopy structure of forests promotes invasion by exotic understory plants, which affects animal communities (Gaddy & Kohlsaat 1987). Some roadside verges have been invaded by maritime plants because of their ability to tolerate saline soil (Scott & Davison 1982). Feral fruit trees are found preferentially along roadsides, and some populations are maintained solely by seeds in fruit waste thrown from vehicles (Smith 1986).

Exotic species are sometimes introduced along roadsides for the purpose of erosion control (Niordson 1989). Native species are now more widely preferred for this purpose, but Dunlap (1987) argues that in some cases the need for rapid establishment of plant cover requires the use of exotic species.

In another form of deliberate introduction, roads provide easy access to streams and lakes for fishery managers to stock nonnative hatchery fish (Lee et al. 1997), which adversely affect native biota and disrupt aquatic ecosystems in many ways (Allan & Flecker 1993). Unsanctioned, illegal, and unintentional introductions of fishes, mollusks, plants, and other aquatic organisms also occur frequently (Allan & Flecker 1993), and they are facilitated by public road access to water bodies.

The dispersal of a biological agent such as a pathogen along a roadway can affect both terrestrial and aquatic ecosystems far from the road. In northern California and southwest Oregon, for example, vehicle traffic and roadway drainage along logging and mining roads during the wet season disperse spores of an exotic root disease (*Phytophthora lateralis*) that infects the endemic Port Orford cedar (*Chamaecyparis lawsoniana*; Zobel et al. 1985). Transfer of the water-borne spores from forest roads into headwater stream crossings can result in the infection and nearly complete mortality of Port Orford cedars along a much larger network of downstream channel margins and floodplains, even deep inside otherwise roadless areas. The progressive loss of this important conifer species from riparian ecosystems may engender substantial long-term consequences for the integrity of stream biota, including endangered salmon species, for which the Port Orford cedar provides shade, large and long-lasting coarse woody debris, and stabilization of channels and floodplains.

Changes in Human Use of Land and Water

Roads facilitate increased use of an area by humans, who themselves often cause diverse and persistent ecological effects. New roads increase ease of access by humans into formerly remote areas. Perhaps more important, roads often increase the efficiency with which natural resources can be exported. At least three different kinds of human use of the landscape, made increasingly possible by roads, can have major ecological effects: hunting and fishing, recreation, and changes in use of land and water.

Roads open up areas to increased poaching and legal hunting. Hunting reduces population sizes of many game species, including brown bear (*Ursus arctos*; Camarra & Parde 1990), Iberian lynx (Ferreras et al. 1992), wolves (Fuller 1989), black bear (Manville 1983), and Egyptian mongooses (*Herpestes ichneumon*; Palomares & Delibes 1992). Roads also increase both legal and illegal fishing in streams and lakes. Native fish populations in previously inaccessible areas are often vulnerable to even small increases in fishing effort. Increased fishing then often gives rise to public demand for fish stocking as an attempt to artificially compensate for the effects of unsustainable harvest, at the further expense of native fishes and other species (e.g., Gresswell & Varley 1988).

Visitors increase when roads make areas more accessible, leading to increased passive harassment of animals—such as elk on Mount St. Helens in Washington State (Czech 1991) and the Oregon Coast Range (Witmer & DeCalesta 1985), brown bear in Europe (Del Campo et al. 1990), and mountain goats (*Oreamnos americanus*) in Montana (Pedevillano & Wright 1987)—and damage to plant communities (Matlack 1993).

Roads are often built into areas to promote logging, agriculture, mining, and development of homes or industrial or commercial projects. Such changes in land cover and land and water use result in major and persistent adverse effects on the native flora and fauna of terrestrial (Van Dyke et al. 1986; Karnefelt & Mattsson 1989; F. Seibert 1993) and freshwater ecosystems (Schlosser 1991; Allan & Flecker 1993; Roth et al. 1996).

Numerous studies have demonstrated declines in stream health associated with roads. Because the nature and extent of land use within a region tend to be highly correlated with road networks, however, it is often difficult or impossible to separate the direct ecological effects of roads from those of the accompanying land-use activities. For example, Eaglin and Hubert (1993) reported that trout biomass and streambed habitat quality in Wyoming streams declined in relation to the number of road crossings and to the proportion of area logged in the contributing catchment. Findlay and Houlahan (1997) found that herptile species diversity in wetlands declined in relation to the density of roads within 2 km of the perimeter. Among streams in the Pacific Northwest, the status or abundance of bull trout populations has been inversely correlated to road density (Rieman et al. 1997; Baxter et al. 1999); these studies used roads as the best available general proxy of cumulative effects associated with land use and human access. On the other hand, some studies (e.g., Roth et al. 1996) have demonstrated correlations of stream biotic integrity with land-use patterns across large catchments but did not investigate the specific roles that roads might play in mediating the causes and effects.

It appears that roads can serve as useful indicators of the magnitude of land-use changes, but it remains unclear to what degree the associated ecological responses result directly from roads themselves. If roads are largely responsible, effects could be ameliorated through altered road design, placement, remediation, or road removal. Strong interactions between roads and land use are likely, however. Forest roads in Idaho, for example, are less prone to erosion when the surrounding landscape remains in natural forest cover (Seyedbagheri 1996).

Discussion and Conclusions

Roads have diverse and systemic effects on many aspects of terrestrial and aquatic ecosystems. The ecological effects of roads can resonate substantial distances from the road in terrestrial ecosystems, creating habitat fragmentation and facilitating ensuing fragmentation through support of human exploitative activities (Fig. 1a). Habitat deterioration is not widely appreciated as an aspect of ecological fragmentation in aquatic ecosystems. At the scale of an extensive landscape or stream network, however, roads produce a pattern of aquatic habitat loss that differs from the terrestrial pattern yet nevertheless results in the ecological fragmentation of aquatic ecosystems (Fig. 1b). We coin the term *hyperfragmentation* to describe the multidimensional view of ecological fragmentation and habitat loss that emerges when the consequences of roads or any habitat alteration for terrestrial and aquatic ecosystems are considered simultaneously (Fig. 1c). Hyperfragmentation is the result of a spatial footprint of ecological effect that propagates across the landscape differently in freshwater and

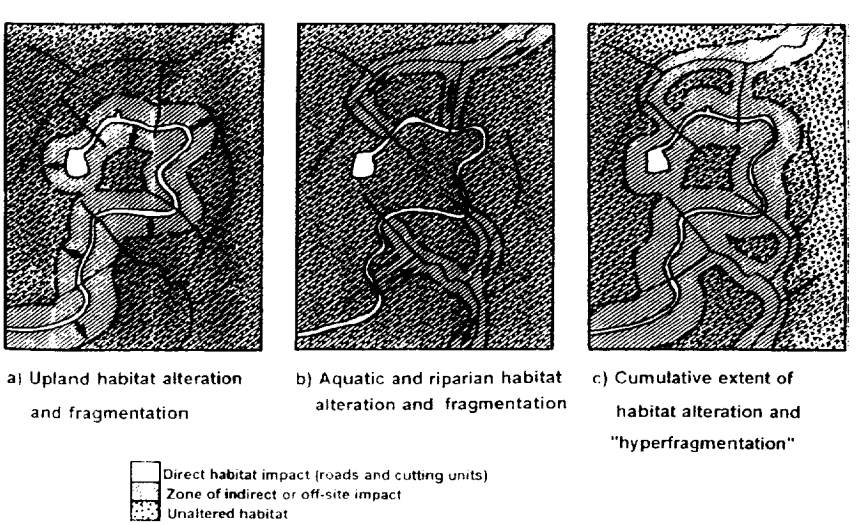

Figure 1. Spatial pattern of direct and indirect habitat alteration caused by human disturbance in a forested watershed: (a) classical forest edge effects contributing to terrestrial habitat fragmentation, (b) downstream-propagating hydrologic and biotic effects leading to large-scale fragmentation of freshwater habitats and populations, (c) combined terrestrial-aquatic view of landscape alteration that we term hyperfragmentation *because it considers multiple ecosystem dimensions on the same landscape. Arrows indicate predominant spatial vector of effects.*

aquatic ecosystems than in terrestrial systems. Even where only a small percentage of the land's surface is directly occupied by roads, few corners of the landscape remain untouched by their off-site ecological effects. The breadth of these effects cannot be appreciated unless one takes a broadly transdisciplinary view of ecosystems and biological communities.

Road design, management, and restoration need to be more carefully tailored to address the full range of ecological processes and terrestrial and aquatic species that may be affected. Deliberate monitoring is necessary to ensure that projects have robust ecological benefits and minimal adverse effects and that they are cost-efficient relative to their actual benefits (e.g., Weaver et al. 1987). Of course, such assessments require time and money that are usually unavailable. Most funds used to remediate problem roads are earmarked for actual field operations and are not available to support such assessment and monitoring. Few of the experts building roads or "restoring" them are trained to recognize and address the full spectrum of ecological issues that we have identified. Moreover, by their nature roads have systemic ecological effects that, even if recognized, cannot be overcome.

If a broad view of the ecological effects of roads reveals a multiplicity of effects, it also suggests that it is unlikely that the consequences of roads will ever be completely mitigated or remediated. Thus, it is critical to retain remaining roadless or near-roadless portions of the landscape in their natural state. Because of the increasing rarity of roadless areas, especially roadless watersheds, conservation efforts cannot rely entirely on protection of existing natural areas. But neither can conservation efforts depend entirely on tenuous and unexamined assumptions about the capability of site- and species-specific mitigation and remediation measures to reduce the ecological consequences of existing and proposed roads.

Acknowledgments

We thank M. Hourdequin for organizing the symposium at the 1997 annual meeting of the Society for Conservation Biology at which we originally presented much of this material and for her patience during the preparation of this manuscript. We also thank R. Noss and an anonymous reviewer for improvement of the paper. The second author's contribution to this paper and his participation in the symposium were supported by The Pacific Rivers Council.

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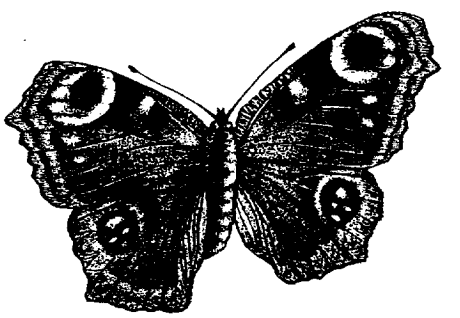

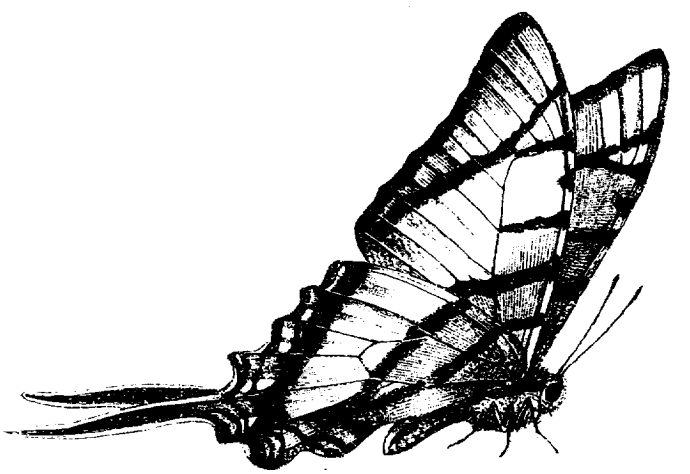

Recovery Research for the Endangered Pacific Pocket Mouse: An Overview of Collaborative Studies[1]

Wayne D. Spencer[2]

Abstract

The critically endangered Pacific pocket mouse (*Perognathus longimembris pacificus*), feared extinct for over 20 years, was "rediscovered" in 1993 and is now documented at four sites in Orange and San Diego Counties, California. Only one of these sites is considered large enough to be potentially self-sustaining without active intervention. In 1998, I gathered a team of biologists to initiate several research tasks in support of recovery planning for the species. The PPM Studies Team quickly determined that species recovery would require active translocations or reintroductions to establish new populations, but that we knew too little about the biology of *P. l. pacificus* and the availability of translocation receiver sites to design such a program. Recovery research from 1998 to 2000 therefore focused on (1) a systematic search for potential translocation receiver sites; (2) laboratory and field studies on non-listed, surrogate subspecies (*P. l. longimembris* and *P. l. bangsi*) to gain biological insights and perfect study methods; (3) studies on the historic and extant genetic diversity of *P. l. pacificus*; and (4) experimental habitat manipulations to increase *P. l. pacificus* populations. Using existing geographic information system (GIS) data, we identified sites throughout the historic range that might have appropriate soils and vegetation to support translocated *P. l. pacificus*. Reconnaissance surveys of habitat value were completed in all large areas of potential habitat identified by the model. Those sites having the highest habitat potential are being studied with more detailed and quantitative field analyses. The surrogate studies helped us design individual marking and monitoring methods and will be used to test translocation methods before applying them to *P. l. pacificus*. Genetic results suggest that *P. l. pacificus* populations were naturally fairly isolated from one another prior to modern development, that genetic diversity will continue to erode in the small populations that remain, and that individuals from extant populations could probably be mixed if maximizing genetic diversity in any newly established populations is an important recovery goal. Local populations should be increased *in situ* before they can supply donor animals for translocations. Experimental habitat management (shrub thinning) at one occupied site yielded a short-term, positive, behavioral response of mice to thinned habitat plots. However, the overall population seems to be in decline, and long-term population responses to habitat manipulations are not yet evident. The approach of the PPM Study Team has been to proceed cautiously and scientifically to obtain critical information and to design a translocation program, but we are prepared to recommend swift action to prevent extinction despite "insufficient data." At this point, political and economic obstacles to species recovery seem larger than obstacles presented by scientific uncertainty.

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[1] An abbreviated version of this paper was presented at the Planning for Biodiversity Symposium, DATE AND PLACE.

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Introduction

Recovery planning for endangered species requires a pragmatic use of science that recognizes we cannot always expect significant sample sizes or fully informed decisions. In recovery research, the goal of sustaining and increasing populations must sometimes overrule clean experimental design; and decisions must often be made based on untested hypotheses, lest we observe extinction while we await more data. The overall guiding principal should be: proceed cautiously with good science, but be prepared to act swiftly and decisively to avoid extinction, using whatever imperfect information you have.

Recovery planning for the Pacific little pocket mouse (*Perognathus longimembris pacificus*; commonly referred to as PPM) offers a useful example of this approach. This paper briefly summarizes background information on the species, its history of decline, and initial studies in support of species recovery. I then review methods and preliminary results of some recent research tasks coordinated under the informal umbrella of the "PPM Studies Program." Finally, I review current status of these studies and summarize future directions for the program.

Background

Perognathus longimembris pacificus is the smallest subspecies of he little pocket mouse (*Perognathus longimembris*), a nocturnal, burrow-dwelling, mostly granivorous, heteromyid rodent species restricted to arid southwestern North America (Hall 1981, Williams 1986, Williams and others 1993). It is unusual as the only subspecies or species of *Perognathus* found on the Pacific coast, rather than in arid inland deserts and grasslands. Historically, this subspecies occurred on fine, sandy soils within about 4 to 6 km of the Pacific coast of southern California, from near the Mexican border to El Segundo in Los Angeles County (Grinnell 1933, Meserve 1976, Patten and others 1998, von Bloeker 1931). Since the 1930's, most historic habitat has been removed and fragmented by urban development and agriculture, with the last known population being extirpated by development in Newport Beach during the early 1970s (Patten and others 1998). After approximately 20 years, during which time the species was not detected, a small population (tentatively estimated at 25-36 individuals) was rediscovered on the Dana Point Headlands in 1993 (Brylski 1993).

The subspecies was emergency listed as endangered by the U.S. Fish and Wildlife Service (USFWS) in 1994 due to immediate threats to this tiny, remnant population (USFWS 1998). Subsequently, three additional population sites have been discovered on Marine Corps Base Camp Pendleton, San Diego County (Ogden 1995, 1997; MBA 1997). Despite extensive survey efforts throughout the range, these four sites (*Figure 1*) represent the full extent of the current known subspecies range (USFWS 1998, Spencer and others 2000a, 2000b).

Criteria for species recovery include permanent protection of ten independently viable populations (USFWS 1998). Currently, three of the four occupied sites (Dana Point, San Mateo North, and San Mateo South) are less than 12 ha each in size, and their populations are thought to number under 50 individuals each (Spencer and others 2000a, 2000b). Such small sizes predispose these populations to extirpation by stochastic events, catastrophes, inbreeding depression, or other factors (Noss and Csuti 1997). At present these three sites cannot confidently be called viable. The

fourth and largest site (Oscar One/Edson Range) approaches 900 ha in total area (a mosaic of occupied, suitable patches and generally unoccupied, unsuitable matrix) and supports hundreds of individuals (Pavelka personal communication, Dodd and Montgomery 1998, Spencer and others 2000a). Although the Oscar One/Edson Range site is also vulnerable to extirpation, it is considered sufficiently large to be sustainable over at least the near term, barring catastrophe.

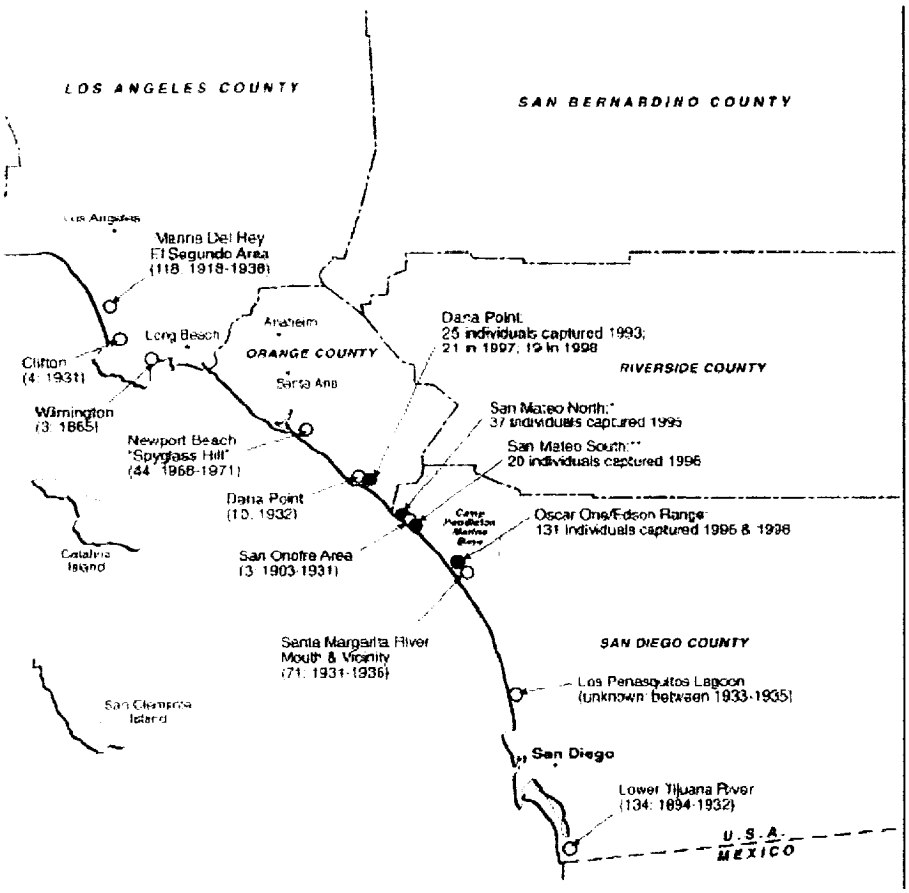


Figure 1—Historic (open circles) and extant (closed circles) locations occupied by *P. l. pacificus*. For historic locations, parentheses indicate the number of specimens in museum collections and the years of their collection. For extant populations, the numbers of individuals captured in recent years are shown. No capture-recapture estimates of population size are yet available.

Initial Studies and Founding of the PPM Studies Program

Since the listing of the species, various studies were initiated to monitor *P. l. pacificus* populations, improve field study methods, evaluate potential project impacts, and improve understanding of the species' biology. The USFWS has been studying the *P. l. pacificus* population, monitoring methods, and microhabitat selection at the Oscar One/Edson Range site since 1997; and S. Dodd and S.

Montgomery have performed yearly population monitoring at Dana Point since 1997. Dodd and Montgomery (1998) also investigated effects of trap spacing and trapping duration on monitoring effectiveness at the Oscar One site.

In 1997, the Foothill/Eastern Transportation Corridor Agencies entered into a Memorandum of Agreement (MOA) with the USFWS and California Department of Fish and Game to fund several research tasks specifically called for by the species' Recovery Plan (USFWS 1998). In response, I assembled a team of biologists (including C. Schaefer, S. Montgomery, and S. Dodd), which in July 1998 initiated four specific research tasks called for by the MOA: (1) evaluate the feasibility of translocating *P. l. pacificus* to establish new populations, (2) determine dispersal characteristics of *P. l. pacificus*, (3) evaluate effects of Argentine ants on *P. l. pacificus*, and (4) develop a *P. l. pacificus* translocation protocol. We also assembled a scientific peer review committee to review progress reports and study designs throughout the process. Participants on the committee have included Drs. James Patton, William Longland, Jay Diffendorfer, Howard Shellhammer, Nicholas Holler, Michael Wooten, and Richard Reading.

During 1998, the study team reviewed existing literature pertaining to the four initial research tasks, interviewed scientific experts, and performed very limited pilot studies. Based on this information we concluded (Spencer and others 2000a) that (1) a translocation or reintroduction program is probably necessary to achieve species recovery in the long term, but we knew too little to attempt such a program in the short term; (2) knowledge of *P. l. pacificus* dispersal characteristics would be useful, but a study specifically designed to answer dispersal questions would be prohibitively expensive, technologically impractical, and might do more harm than good to extant populations; (3) Argentine ants are unlikely to be a major limiting factor on *P. l. pacificus* due to differing habitat affinities (Argentine ants require moist ground conditions and are generally associated with irrigated landscapes in southern California [Suarez and others 1998, T. Case personal communication], whereas *P. l. pacificus* require well-drained and open vegetation communities.); and finally, (4) we felt we could not design a translocation program until critical information gaps were filled.

Table 1 summarizes information on *P. l. pacificus* available in 1998 relative to the information needed to design a translocation program, according to Nielsen (1988) and USFWS (1998). The information gaps evident in *Table 1* were used to define several research tasks deemed of highest immediate priority to further recovery: (1) a systematic review of potential translocation receiver sites based on habitat suitability and land uses, (2) a controlled laboratory study using a non-listed subspecies of P. longimembris to derive a preferred individual marking technique, (3) an intensive, multiyear study of a non-listed subspecies to test field techniques before using them on *P. l. pacificus*, to gain basic biological information on the species, and to test potential translocation methods, and (4) a population genetics study to establish baseline measures of genetic diversity within and between extant and historic P. l. pacificus populations. Once results of these studies make it possible to perform more intensive field studies on *P. l. pacificus* that would do more good than harm, we recommended (5) an intensive multiyear study of *P. l. pacificus* to obtain essential demographic and other natural history data. Finally, (6) we also recommended experimental habitat management, particularly controlled burning or shrub thinning, to improve habitat quality and *P. l. pacificus* population sizes at one or more occupied sites.

Table 1—*Translocation feasibility considerations for* P. l. pacificus *as of 1998 based on USFWS (1998) and Nielson (1988). A "yes" under "sufficient information?" indicates sufficient information exists to assess whether translocations are necessary or feasible, but does not imply that information is sufficient to design a translocation program.*

Consideration	Sufficient information?	Notes and comments
Reason for translocation	Yes	Recovery criteria probably cannot be met without a translocation/reintroduction program.
Status of wild populations	Yes	Severely in danger of extinction. Most potential habitat has been surveyed: four known occupied locations, representing three or four isolated populations. All remaining populations small.
Biology	No	Insufficient information on habitat requirements, demographics, space-use, dispersal patterns, etc. Sparse information available on related subspecies.
Size and density of wild populations	No	Rough estimates (individuals captured within a single season) available for four sites: Oscar One/Edson Range = 131[1]; San Mateo South = 20; San Mateo North = 37; Dana Point = 21 to 36. No capture/recapture population estimates.
Movements and distribution	No/Yes	Little available information on movements of *P. l. pacificus* or related subspecies. Geographic distribution fairly well established.
Male:female ratio	Yes	Dana Point: 1.1:1 to 1.4:1; San Mateo North: 0.8:1.
Annual recruitment	No	No information on *P. l. pacificus*; limited information on related subspecies.
Mortality rate and causes	No	No information on rates; some causes known or suspected from limited observations.
Health and condition of populations	No	Little information besides external observation of wild-caught specimens in hand. Most individuals appear healthy and free of external parasites.
Genetic variability and integrity	No	No information. To be determined by this study.
Status of remaining habitat	No	Although it is known that few potential habitat areas remain, systematic review needed to identify potential translocation receiver sites (this study).
Depredation rates in target areas	No	Limited information on presence or abundance of predators in potential receiver sites.
Translocation strategy	No	To be determined by this study.
Capture technique and technology	Yes	Capture methods in donor sites are relatively simple to define.
Number and location of release sites	No	Systematic review of potential receiver sites is needed to determine adequacy (this study). Recovery criteria will be used to define number and relative distribution of desirable sites.
Post-release support of translocated animals	No	To be determined by this study.

[1]Includes 111 unique captures on Oscar One (USFWS 1998) plus 20 unique individuals on Edson Range (Montgomery and Dodd 1998 unpublished data). Additional captures represent an unknown number of additional individuals because they were not marked to identify recaptures.

The remainder of this paper focuses on methods and preliminary results of those primary research tasks conducted to date, focusing on the translocation receiver site study, laboratory marking study, field marking study, population genetics study, and shrub thinning study.

Methods

Translocation Receiver Site Study

The search for sites to receive translocated populations uses a coarse-filter/fine-filter approach. We first developed a simple habitat evaluation model based on existing geographic information system (GIS) data layers to identify, at a coarse scale, large areas near the coast having appropriate combinations of soil and vegetation to possibly support translocated *P. l. pacificus*. S. J. Montgomery and S. Dodd then surveyed these areas in the field to better rank habitat conditions using a quick evaluation method developed for this purpose (coarse filter). Those sites having the highest rankings based on the field reconnaissance will be subject to more intensive, quantitative studies (fine filter). These efforts are restricted to coastal Orange and San Diego Counties, because soils maps are not available for Los Angeles County, and remaining native coastal areas there seem generally unsuitable for establishing new *P. l. pacificus* populations due to inappropriate soils, habitat degradation, abundant exotic species, and other factors (W. Spencer, personal observations; P. Behrends, S. Montgomery, and M. Pavelka, personal communications; Ogden and Dames and Moore 1999).

The GIS habitat model was used to screen out areas of Orange and San Diego Counties that are clearly unsuitable for *P. l. pacificus* reintroduction, and to identify areas deserving field evaluation. The model was therefore designed to be conservative, tending to overestimate potential habitat value for *P. l. pacificus* to minimize chances of missing a suitable site. This conservative approach recognizes that available digital information for soils and vegetation is coarse in scale relative to *P. l. pacificus* habitat selection, and may have inaccuracies.

The model ranks *P. l. pacificus* habitat potential based on three criteria: distance from the Pacific coast, soil type, and vegetation type. Nearly all historic observations of *P. l. pacificus* are within 4 km of the Pacific coast, with a few as far as 6 km, so inland limits of the study area were conservatively set at 8 km of the coast (measured from the main shoreline or the eastern shore of larger bays).

W. Spencer and M. Pavelka—in collaboration with Dr. Robert Graham, Professor of Soil Mineralogy and Pedology at U.C. Riverside—ranked all soil types mapped within this study area (USDA 1973, 1978) as having very high, high, low, or no potential to support *P. l. pacificus* based on surface horizon texture, soil depth, and other factors (e.g., presence of a hardpan, high gravel or cobble content). Care was taken to consider all physical factors likely to affect burrowing or foraging abilities of little pocket mice, as well as the potential for higher quality soils to exist as inclusions within lower-ranked soil polygons. The highest-ranking soils were classified based on results of detailed soils analyses performed by the USFWS at occupied versus unoccupied microhabitats at the Oscar One *P. l. pacificus* site (Pavelka, Winchell, and Graham, unpublished data). Those results suggest that *P. l. pacificus* are very discriminating of soil characteristics at a finer scale (measured on 20 x 20-m grids) than that of existing soils maps, and that they strongly select for

deep (> 30 cm), fine-grained, loamy sands (not sandy loams) having less than about 7 percent by volume of clay and less than 4 percent by weight of gravel and rock.

Vegetation types were ranked as having high, low, or no potential to support *P. l. pacificus* using regional GIS vegetation maps (SANDAG and Ogden 1997 for San Diego County; Orange County Planning and Development Services Department 1993 for Orange County). *P. l. pacificus* have historically been associated with open coastal scrub and grassland habitats having a diversity of annual herbs, so these vegetation communities were ranked high. *P. l. pacificus* probably cannot persist in denser shrub communities, wetlands, or woodlands. However, the regional vegetation maps are coarse in scale, and some upland areas mapped as generally unsuitable natural vegetation may contain small areas of open scrub or grassland. Therefore all natural vegetation types were considered to have at least a low potential to support *P. l. pacificus*. Areas mapped as agriculture, developed, disturbed, rock, or open water were ranked as having no potential.

The soil and vegetation rankings were combined to create overall habitat rankings within 8 km of the coast (*table 2*) based on the following logic: Evidence to date suggests that soils are the primary determinant of habitat quality, at least within areas of natural vegetation near the coast. As long as the soils are highly suitable to support *P. l. pacificus*, low suitability vegetation (e.g., chaparral) may reduce *P. l. pacificus* habitat potential somewhat, but vegetation management (e.g., burning or thinning) might be used to increase habitat quality. Therefore, the presence of low quality vegetation on high quality soils only slightly reduces the overall habitat potential to support *P. l. pacificus*. However, if the soils are low quality for *P. l. pacificus*, the vegetation community type or vegetation management will probably have little effect on *P. l. pacificus* habitat potential; consequently, the overall rating reflects the soil potential (low). If either soils or vegetation are inappropriate (e.g., clay soils or agricultural fields), the site has no *P. l. pacificus* potential.

Table 2—*Habitat potential to support* P. l. pacificus *based on soils and vegetation. See text for how soils were ranked (a complete list of soil rankings is available from W. Spencer upon request). For vegetation suitability, all coastal scrub, grassland, and dune vegetation communities were ranked high; all other natural vegetation communities were ranked low; all developed, disturbed, agricultural, rock, and open water areas were ranked none.*

	Soil suitability			
Vegetation suitability	Very high	High	Low	None
High	very high	high	low	none
Low	high	moderate	low	none
None	none	none	none	none

Once maps of the overall habitat potential rankings were created, relatively large (> 20 ha) blocks of moderate to very high habitat value were outlined as field evaluation sites. S. J. Montgomery and S. Dodd then evaluated these sites in the field during 1999-2000 using a rapid evaluation data sheet to record vegetation, soil, and other site characteristics. The 5-10 sites receiving the highest scores during these coarse-level field evaluations are currently subject to more intensive, quantitative

(fine-filter) study to determine their potential to support translocated *P. l. pacificus* populations.

Laboratory Marking Study

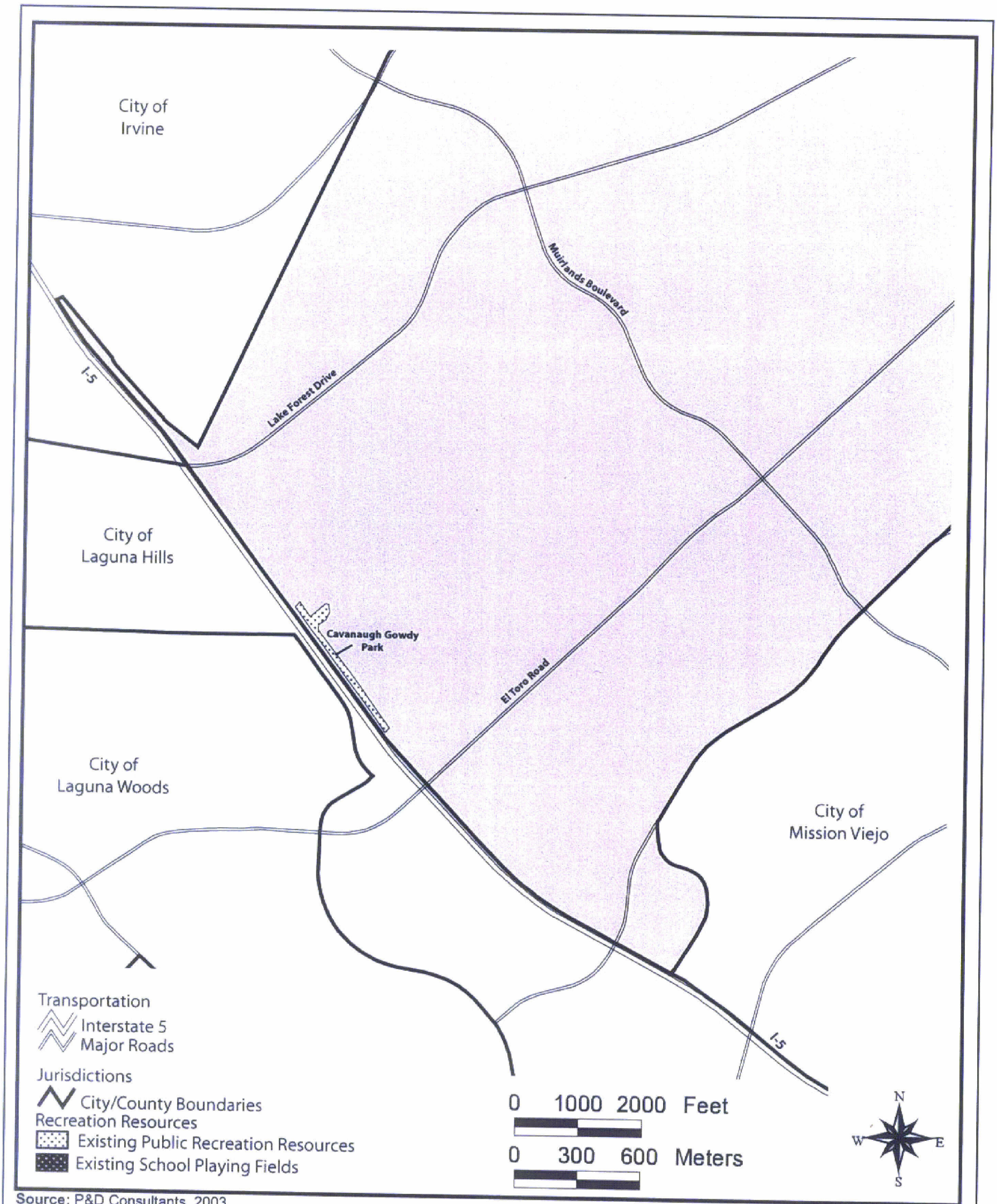
We tested four permanent, individual marking methods on a captive population of a non-listed subspecies, *P. l. longimembris*: (1) subcutaneous passive integrated transponder (PIT) tags, (2) toe clipping, (3) tiny, custom-designed ear tags, and (4) color-coded surgical sutures. *P. l. longimembris* was chosen as a logical surrogate for *P. l. pacificus* due to close phylogenetic and body size relationships and its non-sensitive status. S. Dodd captured 36 *P. l. longimembris* in Sherman live traps near Yucca Valley, San Bernardino County, California—28 during June 1999 and 8 more during May 2000. The animals were housed individually in 19 x 21 x 32-cm plastic cages supplied with natural desert soils, in a room having a skylight (for natural day/night cycles) and an air filter.

Captive animals were assigned to one of the four marking techniques or to a control group by random draw. Marking was done with the assistance and oversight of a veterinarian (Dr. Anthony Michael). Six animals were marked in one ear with custom-designed aluminum ear tags bearing 3-digit numbers etched into their surface. Six animals were marked with a 2-digit toe clip code (one digit on a front paw and one on a rear paw) using the standard mammalogical method (Baumgartner 1940, Melchior and Iwen 1965). Toes were clipped distal to the ultimate toe joint, only far enough back to remove the nail and the cells producing nail growth, using either a baby nail clipper or surgical scissors. Six animals were marked with two color-coded monofilament sutures (size 4-0 monofilament nylon surgical sutures, one black, one blue) stitched through the loose skin on the nape of the neck, tied with a triple surgeon's knot, and cut to leave 1.0 to 1.5 cm of loose thread projecting from the knot. Seven animals were tagged subcutaneously between the scapulae with PIT tags, which measure 11.5 x 2 mm. Six tags were injected using a 12-gauge hypodermic syringe, and one tag was inserted by hand via a surgical incision across the nape after shaving a patch of hair. Nine animals served as unmarked controls. They were removed from cages, weighed, and examined according to the same schedule as the marked animals.

After marking, the test and control groups were regularly weighed and examined for adverse health effects or behaviors. The examination schedule was every other day for the first two weeks, then weekly for ten more weeks, and at least monthly thereafter.

Field Marking Study

The study team initiated a field surrogate study during 1999-2000 to investigate long-term mark retention and health effects in the wild, collect basic natural history and demographic data, and to test various translocation techniques (e.g., use of enclosure fences, artificial burrow design). We established two permanent study grids near the village of Snow Creek in the Coachella Valley, Riverside County, California (San Bernardino Base and Meridian; USGS 7.5' White Water Quadrangle, Section 21 of Township 3 South, Range 3 East). Habitat on the site is relatively homogeneous creosote- (*Larrea tridentata*) dominated desert scrub on a north-sloping bajada, which is densely occupied by the non-listed subspecies, *P. l. bangsi*.



Source: P&D Consultants, 2003.

Existing Recreation Resources in the SOCTIIP Study Area in the City of Lake Forest

historically and today (see Swei and others, in press, and citations therein for complete laboratory and analytical methods).

Shrub Thinning Experiment

A variety of theoretical and empirical evidence suggests that vegetation has become too dense at some of the occupied *P. l. pacificus* sites for optimal habitat condition, and that thinning the vegetation by fire or other means might increase habitat value and *P. l. pacificus* population sizes. Experimental habitat thinning was therefore initiated within the Dana Point *P. l. pacificus* reserve during 1999. It was not possible to obtain permission for a controlled burn at the site, so shrub cover was thinned by hand on experimental plots.

Eleven trapping grids (40 traps arranged in 4 x 10 arrays with 3-m spacing) were established and trapped during the spring and summer of 1999 (pre-thinning) and 2000 (post-thinning): three control grids and eight experimental grids. The three control grids were established in known, occupied *P. l. pacificus* habitat having relatively low shrub cover; the eight experimental grids were established in areas of dense shrub cover not known to harbor *P. l. pacificus*, but having appropriate soils. The experimental grids overlapped four roughly rectangular shrub-thinning plots of about 30 x 60 m each, such that 1/2 of each of the experimental grids was in an area to be thinned, and 1/2 in an area not to be thinned (hereafter, thinned and unthinned subgrids).

Before thinning, shrub canopies on the experimental plots covered a mean of about 83 percent (range 75-87 percent), measured at 21-60 cm above ground using point-intercept transects. During January 2000, shrub cover was thinned on the four plots to a mean of 32 percent (range 26-36 percent). Thinning was done by removing individual shrubs at ground level, using chainsaws and pruning tools to avoid soil disturbance. Concentrations of woody duff and litter were also lightly raked to uncover mineral soils.

Traplines were run for seven consecutive nights, once during spring (late April-early May) and once during summer (mid August). Captured *P. l. pacificus* were individually marked by clipping hair and using indelible colored markers (during 1999) or by toe clipping (during 2000). Use by *P. l. pacificus* of the control, thinned, and unthinned grids was compared between the pre-thinning (1999) and post-thinning (2000) periods using Chi-square. Spring and summer trapping sessions were pooled within each year, and the sample frequencies were calculated as the cumulative sum of all unique individuals captured on a grid. Thus, a recapture of an individual on the same grid was not counted as an independent observation, but a recapture on another grid was, because individuals could choose to move from one grid (e.g., a control grid) to another (e.g., a thinned grid) during the study.

Results

Translocation Receiver Site Study

Figures 2 and *3* illustrate output of the GIS habitat suitability model for the northern and southern halves of the study area, respectively. The maps also indicate general areas investigated in the field for their potential to support translocated *P. l. pacificus*. These maps surely overestimate the actual extent of high and very high

quality habitat, due to the conservative model assumptions and the gross nature of the digital map information relative to the scale at which *P. l. pacificus* select habitats. Although the model correctly identified all extant *P. l. pacificus* population sites as having very high habitat quality, it missed some areas of apparently high suitability, due to inaccuracies in the soils data. Nevertheless, the maps proved useful in focusing field efforts in areas with the highest likelihood of having suitable soils and vegetation to support translocated *P. l. pacificus*. Reconnaissance surveys indicate that six or seven sites may have sufficient acreage of fine, sandy soils and appropriate vegetation to support translocated *P. l. pacificus* populations.

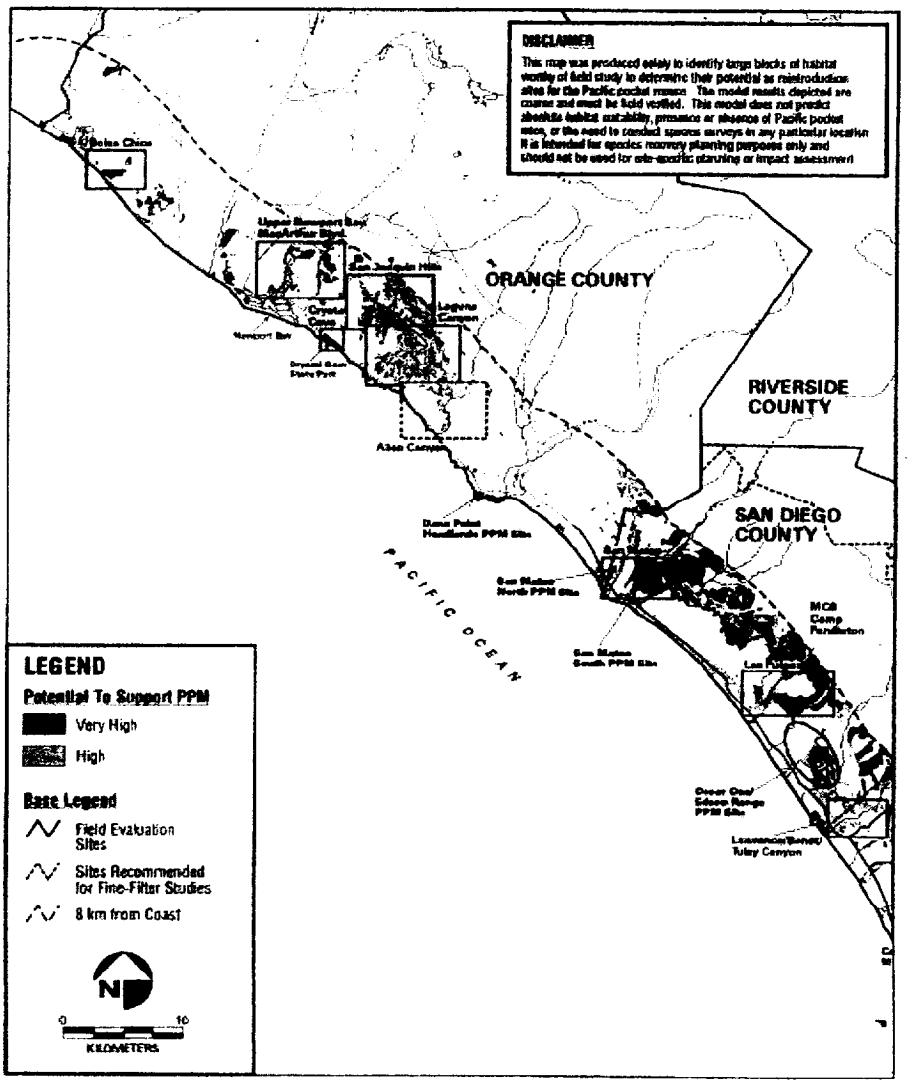


Figure 2—Areas in Orange County and Northern San Diego County having potential to support translocated *P. l. pacificus* populations, based on the GIS habitat suitability model. Boxes indicate general areas assessed in the field. Note that these maps greatly overestimate actual habitat suitability in many areas, due to conservative

model assumptions and coarse data input scales. They may also miss areas of potential due to inaccuracies in model input data.

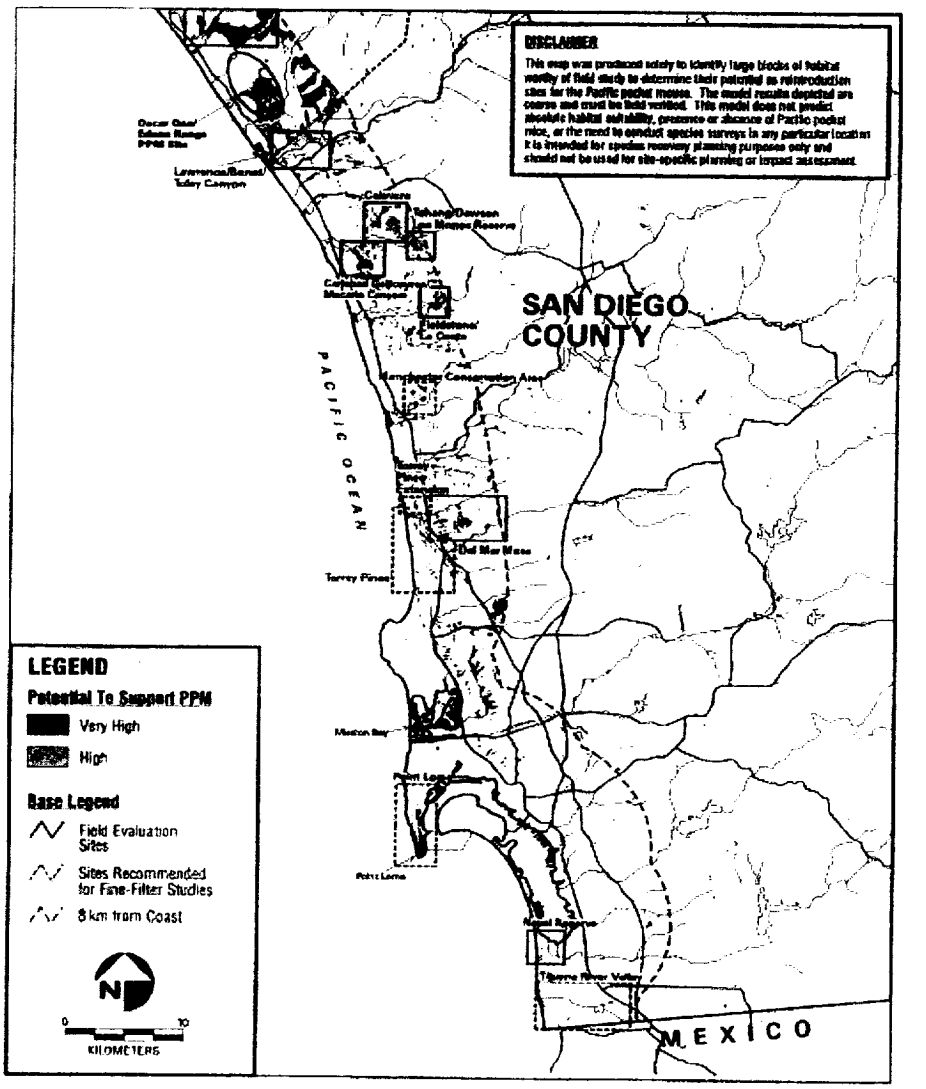


Figure 3—Areas in San Diego County south of Camp Pendleton having potential to support translocated *P. l. pacificus* populations, based on the GIS habitat suitability model. Boxes indicate general areas assessed in the field. Note that these maps greatly overestimate actual habitat suitability in many areas, due to conservative model assumptions and coarse data input scales. They may also miss areas of potential due to inaccuracies in model input data.

Laboratory Marking Study

Of the various marking techniques tested, toe clipping seemed clearly the least harmful, and possibly the most reliable for uniquely identifying animals over their

life span. The suture technique and ear tags experienced high rates of tag loss (100 percent and 50 percent, respectively) and other complications, and are not recommended for further testing. PIT tags seem promising and are recommended for further testing on surrogates. However, the puncture wound for tag insertion is large for such small animals, and once inserted, PIT tags sometimes migrated under the skin or caused rumpling of the skin and hair. PIT tags would offer substantial benefits over toe clipping if they could be made smaller to reduce potential adverse health effects, but they are not recommended for use on *P. l. pacificus* in their currently available dimensions.

Field Marking Study

Table 3 summarizes captures of male and female *P. l. bangsi* on the two grids in 1999 and 2000. Sex ratios recorded on grids using 5-m trap spacing (Grid A during both years and Grid B during 2000) did not differ significantly from each other nor from 1:1 ($\chi^2 = 0$ to 0.5; df = 1; $P > 0.25$ for all comparisons). However, during 1999, when Grid B used 7-m inter-trap spacing, few females were captured and the recorded sex ratio strongly favored males (24 males:9 females = 2.67:1). This ratio almost differed significantly from that recorded on the same grid using the 5-m spacing in 2000 ($\chi^2 = 3.79$; df = 1; $P = 0.051$), and it did differ significantly from an even ratio ($\chi^2 = 6.82$; df = 1; $P < 0.01$). These results support a hypothesis that the 7-m spacing may have under-sampled females on Grid B during 1999 (compare the low number of females captured in this treatment relative to all others in *table 3*). Although we recognize that this conclusion is weak due to a lack of grid replication, reduced female captures at greater trap spacing would be expected if females move less extensively than males, which is true in most pocket mice (review in Jones 1993).

Table 3—P. l. bangsi *captures at the Snow Creek study grids during 1999 and 2000.*

Trap Session	Sex		Total
	Male	Female	
Grid A			
Summer 1999	22	22	44
Spring 2000	15	20	35
Summer 2000	53	40	97
			(4 not sexed)
Grid B			
Summer 1999[1]	24	9	33
Spring 2000	17	15	32
Summer 2000	37	32	71
			(2 not sexed)

[1]Traps on Grid B used 7-m inter-trap spacing in summer 1999; otherwise, all traps had 5-m inter-trap spacing.

Captures on both grids more than doubled between summer 1999 and summer 2000. This reflects a large reproductive output in 2000, with 126 of 162 aged individuals (78 percent) identified as young of the year during summer 2000. In contrast, we identified all individuals captured during April 2000, and all but one individual captured during July-August 1999, as over-wintered adults. The

reproductive season seemed near a peak during April 2000, with most individuals showing signs of sexual activity, including descended testes in males or perforate vagina in females. By July-August of both years, very few individuals showed signs of sexual activity and we were able to distinguish three age classes: adult, subadult, and juvenile.

Pooling both years, a total of 248 individuals were toe clipped, 34 were PIT tagged, and 50 were ear tagged. All ear tags were applied in 1999, because a very high rate of tag loss caused us to discontinue this method in 2000. By the end of the first 1999 trap session, at least a third of the ear-tagged individuals exhibited various levels of ear inflammation and redness, ripping around the tag insertion hole, or drooping ears. One individual had lost its ear tag when it was recaptured 7 days after marking. At least seven more ear tags were lost by the second trapping session (4-5 weeks after tagging).

Toe clipping was the fastest and easiest marking technique under field conditions, and seemed to have little or no adverse effects on animal health. Clipped toes exhibited no or very little bleeding (one or a few drops), which ceased within minutes; and recaptured animals rarely showed inflammation or redness of the wound. Nevertheless, toe clipping is not without problems, as evidenced by about 25 problem incidences (out of 248 toe clipped individuals) due to natural causes or human error: (1) ten cases of naturally missing, deformed, or injured toes, which would make toe clipping potentially confusing; (2) six or seven cases where field workers apparently read the wrong code on a previously toe-clipped animal; (3) three or four cases where the toe tip grew back, apparently due to not clipping far enough back; (4) and four cases where two individuals were mistakenly given the same toe clip code. In addition, the number of unique toe-clip codes is finite (depending upon the number of digits clipped), which poses problems for population monitoring in a fairly long-lived species (up to at least 6 years with about 30 percent over-winter survival; Bailey 1939, Chew and Butterworth 1964, Behrends personal communication).

The hypodermic insertion PIT-tagging procedure worked well in the field with practice. Most mice seemed to experience minor inflammation, scabbing, and sensitivity to touch at the insertion wound. Tags appeared to migrate under the skin, which exhibited bulging on some individuals. Unfortunately, recapture rates were too low (no over-winter recaptures of PIT-tagged individuals) to ascertain health effects of PIT tagging in the field.

Population Genetics

Swei and others (in press) found that all *P. l. pacificus* haplotypes analyzed to date are unique to that subspecies, and all are closely linked genealogically. *P. l. pacificus* has apparently been diverging from its geographically closest relatives (*P. l. brevinasus*, *bangsi*, *internationalis*, and *longimembris*) for some time, although none of these subspecies is reciprocally monophyletic (i.e., no subspecies has a common ancestor not shared with any other subspecies).

Pooling all extant populations of *P. l. pacificus*, the subspecies exhibits similar levels of nucleotide and haplotype diversity as other southern California subspecies of *P. longimembris*, although the sample from Dana Point has markedly low haplotype diversity in comparison to all other subspecies or populations. Of the total

genetic variation among samples of *P. l. pacificus*, about 39.1 percent is variance among individuals within populations, 54.4 percent is between populations within a time period, and 6.5 percent (which is not significantly different from zero) is between modern and historic samples. Thus, the pattern of haplotype differentiation suggests that historical populations (in the 1930s) were already largely isolated from one another, and that current patterns of genetic diversity are due largely to natural isolation of these populations prior to the modern urbanization of coastal California. Indeed, the genetic signatures measured by Swei and others (in press) suggest that, although populations of *P. l. pacificus* were somewhat isolated in recent evolutionary time, they do not yet reflect a loss of genetic diversity due to habitat losses in modern times. Swei and others (in press) concluded that 40 to 70 years of habitat reduction at locations like Dana Point are insufficient to override the population's deeper genetic history, but that we can confidently predict future losses of genetic diversity unless current population declines are reversed.

Measures of gene flow between populations of *P. l. pacificus* are quite low, both in historical and current times. This stands in sharp contrast to higher levels of gene flow measured across greater geographic distances in the Mojave Desert for *P. l. longimembris*. Measures of gene flow between the Dana Point population and all other *P. longimembris* populations are especially and uniformly low. The Dana Point population also has the lowest haplotype diversity of any sample of *P. longimembris* (only 9 unique haplotypes recovered from 27 individuals). Together, these results suggest that the Dana Point population has been relatively small, as well as isolated, for some time. Slightly higher gene flow measures and haplotype diversity were recorded among the three sites on Camp Pendleton (San Mateo North and South and Oscar One).

Swei and others (in press) concluded that, given current levels of fragmentation and low population sizes, genetic diversity will continue to erode within *P. l. pacificus* populations. This suggests that mixing of individuals from different sites may be necessary to meet the recovery goal (USFWS 1998) of maintaining the full remaining genetic variability of the subspecies. Although the haplotypes of extant *P. l. pacificus* populations are largely apportioned among populations, they are all genealogically closely related, and genetic variability seems to be governed by neutral (rather than selective) genetic processes. It is possible that there are selective differences among these populations, which are more likely to be expressed in nuclear than mitochondrial genes, but this seems unlikely given the small geographic range of the subspecies and similarities in ecological conditions at occupied sites. Thus it appears that mixing individuals from different *P. l. pacificus* populations during translocations should not have any deleterious genetic effects (e.g., "outbreeding depression").

Shrub Thinning Experiment

P. l. pacificus seemed to respond quickly and positively to the shrub thinning by redistributing themselves into the newly thinned habitat areas. During 1999 (pre-thinning), 11 individual *P. l. pacificus* were captured, yielding 12 independent grid observations (i.e., one individual was captured on two different grids)—nine observations (nine individuals) were on the known occupied control grids, two were on subgrids to be thinned (including one individual that also used a control grid), and one on a subgrid not to be thinned. In contrast, during the year 2000 (post-thinning), ten individual mice were captured for a total of 18 unique observations—four on control grids, 11 on thinned subgrids, and three on unthinned subgrids. This shift in the distribution of captures is statistically significant ($P = 0.026$), largely due to the great increase in captures on the thinned subgrids. During the year 2000, six of 10 individuals were captured only on thinned subgrids (five were captured on only one subgrid, but one male was captured using three different thinned subgrids). Three of the four individuals captured on control grids were also captured on thinned subgrids. No individuals were captured only on unthinned subgrids—all three individuals captured on unthinned subgrids were also captured using the adjacent thinned subgrid. In fact, all captures on unthinned subgrids were less than 6 m (two trap distances) from the thinned area that these individuals also used. Moreover, all capture locations on unthinned subgrids were connected to the thinned plots via natural inter-shrub openings.

Thus, the pattern of captures before and after the thinning suggests a strong shift in distribution to the newly thinned habitat areas or their edges. This reinforces observations that *P. l. pacificus*, like other species of *Perognathus*, are most abundant in fairly open habitats, although they may prefer to forage in microhabitats in or near shrubs (Brown and Lieberman 1973, Harris 1984, Meserve 1976, Price 1978, Reichman and Price 1993). Although *P. l. pacificus* may forage under shrubs near openings, they do not seem to frequent interior portions of closed-canopy shrub cover, especially when other options are available.

Unfortunately, intensive trapping of the Dana Point site during May-June 2001 captured only four *P. l. pacificus* (2 female, 2 male; USFWS unpublished data). This sample is too small to reveal any patterns relative to the shrub-thinning experiment. Moreover, these results reinforce a general pattern of population decline at Dana Point since the population's discovery in 1993. Whether or not shrub thinning may positively influence population size at this or any other site is therefore not yet determined.

Discussion

The informal collaborative process followed by the PPM Studies Team—with frequent re-evaluation of priorities, methods, and results—has thus far proved effective in addressing the most urgent questions bearing on species recovery. We benefited greatly from an active peer input and review process, which helped to keep the program focused and scientifically valid, while allowing for flexible, pragmatic responses to new information. We have proceeded with a realization that statistical certainty, while desirable, isn't always possible or necessary when prudent actions must be taken to recover rare species.

During 1998, the study team concluded that *P. l. pacificus* translocations were necessary to achieve species recovery, but that existing information was insufficient to design a translocation program. We therefore refocused our research to answer those questions considered most critical to designing a *P. l. pacificus* translocation program. We now feel we have gained sufficient information to begin designing the program as one essential recovery tool. Please note that our goal is translocations to establish new *P. l. pacificus* populations, and thereby to help recover the species from the brink of extinction. No one should interpret our intent as translocation to mitigate proposed take of *P. l. pacificus* or their habitat by development projects.

In the future, we hope to comprehensively update our evaluation of translocation feasibility, design a framework translocation program based on the updated information, and design experiments to test translocation methods (e.g., use of release enclosures and artificial burrows) prior to implementing the program. At this point in the process, I am confidant that continued research and common sense could sufficiently answer the most pressing biological questions bearing on species recovery. Less certain, however, are methods of overcoming political and economic obstacles. For example, subsequent to the drafting of this document, the U.S. Marine Corps denied requests from the PPM Studies Team to continue *P. l. pacificus* studies on Camp Pendleton, due apparently to concerns that the results might constrain military training and readiness. This has postponed indefinitely our ability to answer remaining questions and further species recovery. Such non-scientific obstacles must now take center stage if we are truly to recover populations of this charismatic little mouse.

Acknowledgements

Although I prepared this document and am responsible for any inaccuracies it contains, numerous individuals contributed to these studies in a uniquely collaborative effort. The Transportation Corridor Agencies (TCA) provided much of the funding, with guidance provided by Laura Coley Eisenberg, and later by Ann Johnston and Macie Cleary-Milan. Christina Schaefer served as project manager for the TCA-funded projects and added valuable review and comment throughout. The California Department of Fish and Game, U.S. Fish and Wildlife Service, and Marine Corps Base Camp Pendleton provided additional funding. Shana Dodd coordinated field studies for the Snow Creek surrogate study, the translocation receiver site reconnaissance study, and the Dana Point shrub-thinning study. She also collected *P. l. longimembris* for the laboratory surrogate study. Stephen J. Montgomery, Rebecca Wacklor, and Hal Holland assisted with field data collection. Steve Montgomery also housed the laboratory population, which was maintained and monitored by Kris Beaver, Hal Holland, and Michael Wellik. Dr. James Patton and Andrea Swei performed the genetics analyses. Dr. Robert Graham provided expertise in soil science and assisted in ranking soils for the habitat evaluation model. Dr. Anthony Michael, a veterinarian, volunteered his expertise, time, and materials to assist with the laboratory marking experiment. Wendy Barto and Debbie Turner performed the GIS work with direction from Pat Atchison. GIS data were used with the permission of the San Diego Association of Governments and County of Orange, with special thanks to Gary Meideros. Comments from and discussions with the PPM scientific peer committee (Drs. James Patton, William Longland, Jay Diffendorfer, Howard Shellhammer, Nicholas Holler, Michael Wooten, and Richard Reading) have been invaluable in guiding our studies. Mark Pavelka, Will Miller, Clark Winchell, and

Loren Hays of the U.S. Fish and Wildlife Service have provided data, helpful discussion, and advice on all phases of this work. David Lawhead, William Tippets, and John Gustafson of the California Department of Fish and Game also provided guidance and monetary support for the fieldwork and genetic analyses. William Berry and Deborah Bieber provided coordination with Marine Corps Base Camp Pendleton. Comments by editor Barbara Kus and reviewers Lee McClenaghan and James Patton greatly improved this manuscript.

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Pacific Pocket Mouse Studies Program

Phase I Report:

Task 1- Translocation Feasibility
Task 3- Dispersal Characteristics

Prepared for:

Foothill/Eastern Transportation Corridor Agencies

And

U.S. Fish and Wildlife Service

Prepared by:

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Contributing Researchers
Shana Dodd
Stephen J. Montgomery

FINAL

Pacific Pocket Mouse Studies Program

Phase I Report:
Task 1 – Translocation Feasibility
Task 3 – Dispersal Characteristics

Prepared For:

Foothill/Eastern Transportation Corridor Agency
and
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January 2000

TABLE OF CONTENTS

Section **Page**

ABSTRACT iii

INTRODUCTION 1

TASK 1 – EVALUATE THE FEASIBILITY OF TRANSLOCATING PACIFIC POCKET MICE 11
- Methods 11
- Results and Discussion 12
- Conclusions and Recommendations 23

TASK 3 – DETERMINE DISPERSAL CHARACTERISTICS OF PPM 25
- Methods 25
- Results and Discussion 29
- Conclusions and Recommendations 39

RECOMMENDED PHASE II STUDIES 41
- Relationship of Research to Recovery Goals 41
- Review of Potential Translocation Receiver Sites 43
- Field Studies of Surrogate Subspecies 44
- Population Genetics Study 48
- Modifications to PPM Monitoring Protocols 49

REFERENCES 51

APPENDICES

A. Biology of Little Pocket Mice

B. Peer Review Comments and Study Team Replies

C. Recommended Phase II Scope of Work

LIST OF TABLES

Table		Page
1	Summary of Live-trapping Data Collected on the Dana Point PPM Population	6
2	Translocation Feasibility Considerations for PPM	22
3	Individual PPM Maximum Distance, Total Distance Moved, and Number of Times Captured at Dana Point	31

LIST OF FIGURES

Figure		Page
1	Project Organization Chart	2
2	Historic and Current Locations of PPM	4

ABSTRACT

The Pacific pocket mouse (PPM) (*Perognathus longimembris pacificus*) recovery research team has completed Phase I of two research tasks: (Task 1) evaluate the feasibility of translocating PPM and (Task 3) determine dispersal characteristics of the species. Two other tasks have not yet begun: (Task 2) evaluate effects of Argentine ants and (Task 4) develop a translocation protocol. Phase I primarily entailed reviewing existing information in support of studies to be initiated during Phase II. Very limited pilot studies were also initiated during Phase I to test some specific marking and tracking methods on laboratory and house mice (*Mus musculus*).

For Task 1, the team concluded that (1) a translocation/reintroduction program is probably necessary to achieve species recovery in the long term, but (2) we know too little to attempt such a program in the short term. Specific information gaps and potential impediments to successful translocation include (1) lack of basic biological information necessary to design and monitor a PPM translocation program, (2) potential lack of translocation receiver sites, and (3) unknown effects of translocations on the demographic and genetic needs of extant PPM populations that may serve as translocation donors.

Relative to Task 3, little is known about dispersal characteristics of PPM or related species. However, performing an intensive, focused study of dispersal is not advisable at this time due to limitations on technology and possible adverse effects on the species. Techniques for individually marking and tracking such tiny mammals as the PPM are limited, and the risk of harm to individuals or populations may outweigh the potential benefits resulting from the limited dispersal data that would likely be acquired. The following techniques for tracking PPM, or otherwise obtaining dispersal data on marked individuals, were investigated and are not currently recommended: radio telemetry, harmonic radar, radioisotopes, passive integrated transponder (PIT) tag recording arrays, massive trapping grids, and drift fences. Pilot studies using fluorescent powders applied to burrows of mice indicate that this technique may be useful in delineating home ranges, social spacing systems, and other pertinent information. The team tentatively endorses the use of PIT tags as the best available means of uniquely marking individuals for capture-recapture studies, but some concerns remain regarding the size of PIT tags relative to PPM body size. Use of color-coded surgical sutures may have benefits over other physical marking techniques (e.g., ear tags, tattooing, dying, hair clipping, toe clipping, or leg bands), but it is untested. PIT tags and surgical sutures should be tested on a surrogate species, most suitably a nonlisted subspecies of *P. longimembris*. Given that one or both of these marking techniques is found suitable for use on PPM, some dispersal

data may be obtained incidental to other field studies and population monitoring efforts, especially if trap grids are strategically located.

Based on these results, the team recommends the following future studies: (1) a systematic review of potential translocation receiver sites based on habitat suitability, land ownership, and planned land uses; (2) an intensive, multiyear study of a nonlisted subspecies of *P. longimembris* to test field techniques before using them on PPM, to gain basic biological information on the species, and to test potential translocation methods; (3) an intensive multiyear study of PPM, informed by results of the foregoing surrogate study and designed to obtain essential population demographic, natural history, and other data on PPM; (4) a population genetics study to establish baseline measures of genetic diversity within and between extant and historic PPM populations; and (5) continued monitoring of the extant PPM populations. The team also recommends modifications to PPM monitoring methods, including adding assessment lines to study grids, increasing seasonal sampling to obtain life history data, and adding strategically located trap grids to compare demography between core and marginal habitat areas, and perhaps to obtain some incidental dispersal data.

Although the study team realizes that this aggressive study program is unlikely to be fully funded in the immediate future, we believe these studies are essential to PPM recovery and must be carried out before designing a PPM translocation program.

INTRODUCTION

In July 1998, a team of biologists organized by KEA Environmental (Figure 1) initiated studies recommended by the Draft Recovery Plan (U.S. Fish and Wildlife Service 1998) for the endangered Pacific little pocket mouse *(Perognathus longimembris pacificus;* hereafter PPM). The studies are funded by the Foothill/Eastern Transportation Corridor Agency (TCA) and directed by the U.S. Fish and Wildlife Service (USFWS), who has regulatory authority over actions potentially affecting listed species. The California Department of Fish and Game (CDFG) also serves as an advisory agency and regulates actions that may harm the PPM, a California Species of Special Concern. USFWS and CDFG must mutually permit actions that may affect PPM, including field research within PPM habitat or handling of individuals. A Scientific Peer Review Panel (Figure 1) has also been assembled to advise and review studies. The U.S. Marine Corps Base Camp (MCB) Pendleton is a cooperating federal agency because they control land areas and data critical to PPM recovery and research.

This report summarizes the first six months of research (Phase I), which consisted primarily of literature review, interviews with experts, and related information-gathering efforts. The results of these efforts are being used to recommend field and laboratory studies (Phase II) designed to answer specific questions raised in the recovery plan (USFWS 1998).

Specifically, the PPM recovery research team was asked to address the following tasks:

Task 1. Evaluate the feasibility of translocating PPM as a tool to facilitate recovery of this severely endangered species.

Task 2. Evaluate invasions by exotic Argentine ants *(Linepithema humile)* into potential and occupied PPM habitats, and the direct and indirect effects of Argentine ant invasions on PPM populations.

Task 3. Determine dispersal characteristics of PPM to better understand demographic and genetic interchange between populations and to support development of a translocation program.

Task 4. Develop a translocation protocol in the event that translocations (or reintroductions from captive populations) are determined to be feasible and desirable.

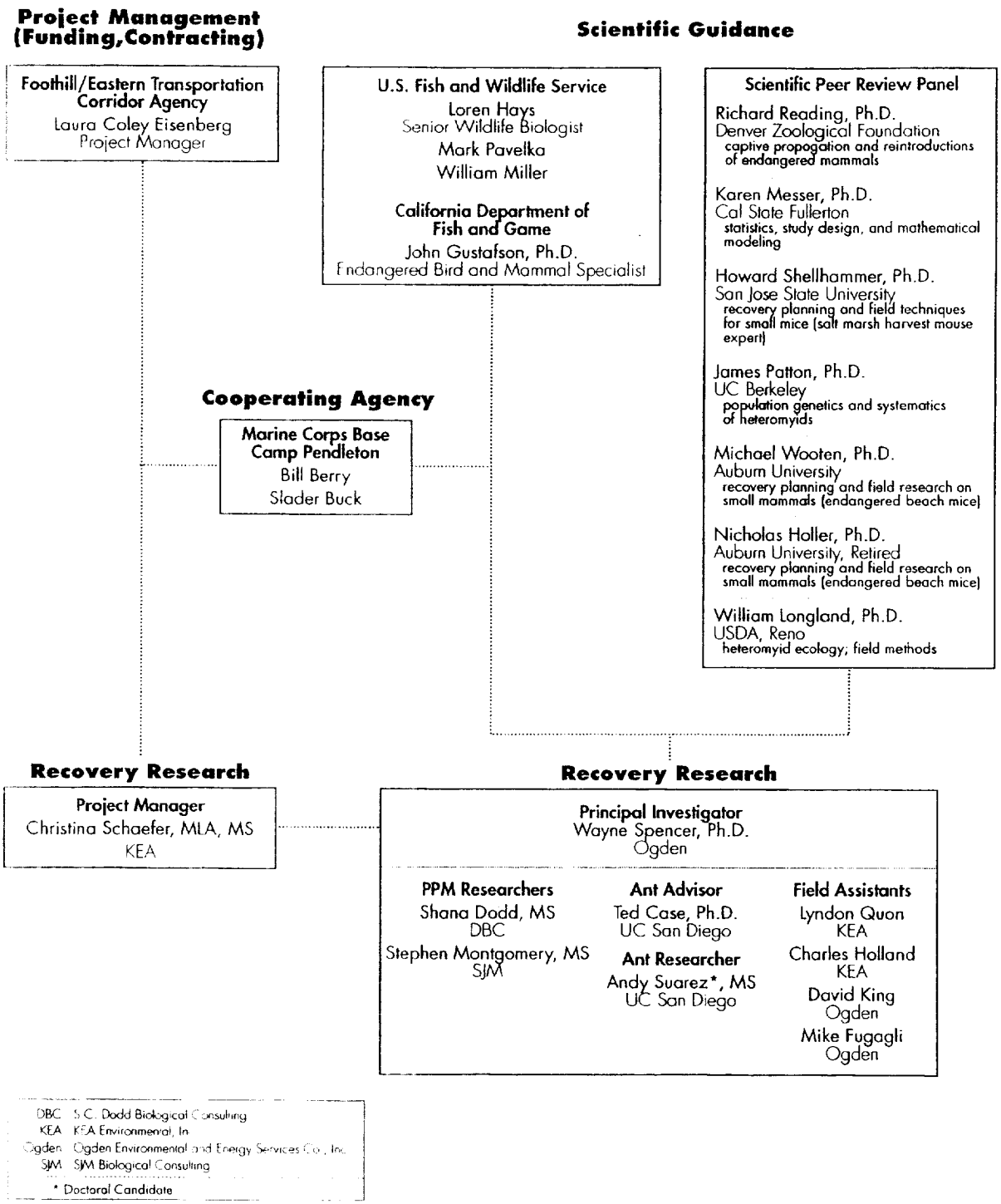


Figure 1
Project Organization Chart

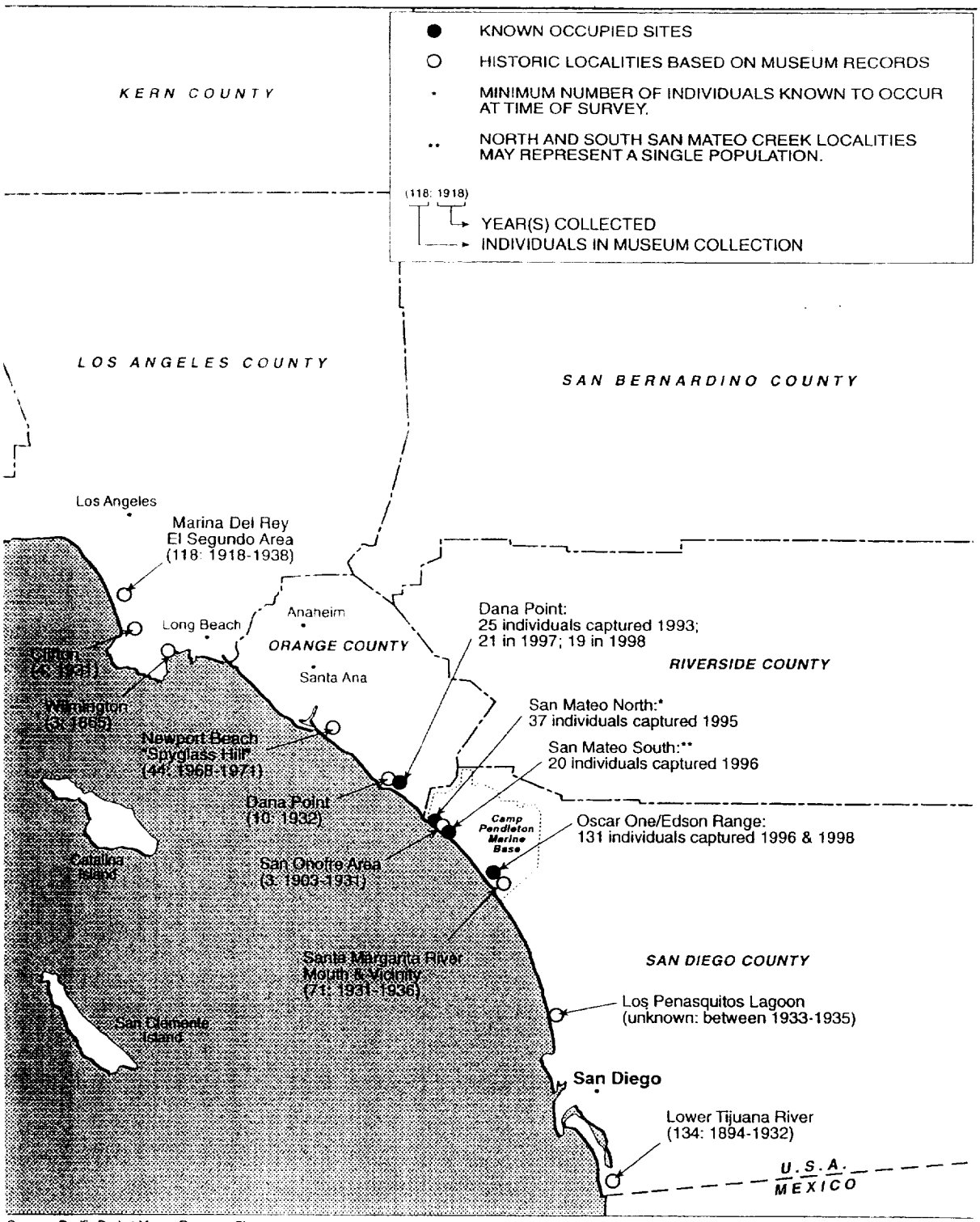
This report summarizes Phase I efforts on Tasks 1 and 3. Phase I of Task 2 (Argentine ant invasions) will be completed by July 1999, and initiation of Task 4 (translocation protocol) is contingent on results of Task 1 (translocation feasibility) and other studies.

For Tasks 1 and 3, this report reviews pertinent information in support of recommendations for Phase II studies. The task reviews are followed by a draft study approach for recommended Phase II studies, including pilot studies on surrogate species to test methods and obtain other pertinent information. This Phase I report and constituent study designs will be revised based on input from the Scientific Peer Committee, USFWS, TCA, CDFG, and MCB Camp Pendleton.

Background

The PPM is the smallest subspecies of the little pocket mouse, a nocturnal, burrow-dwelling, mostly granivorous, heteromyid rodent species restricted to the arid Southwest. Historically, this subspecies occurred on fine, sandy soils within about 4 kilometers of the Pacific coast of southern California, from near the Mexican border to Marina del Rey and El Segundo in Los Angeles County. Since the 1930s, the majority of the PPM's historic habitat has been greatly reduced in area and fragmented by urban development and agriculture. After an approximate 20-year period during which the species was not detected, a small population was rediscovered on the Dana Point Headlands in 1993 (Brylski 1993). The subspecies was emergency listed as endangered by the USFWS in 1994 due to immediate threats to this remnant population of 25 to 36 animals (USFWS 1998). Subsequently, three additional PPM occupied sites have been discovered (two of which may represent one population) on MCB Camp Pendleton, San Diego County, California (Ogden 1995, Ogden 1997, MBA 1997). Despite extensive survey efforts throughout the historic range, these four sites on less than 1,000 total hectares probably represent the full extent of the species current range (USFWS 1998). The historic range and all four recently discovered occupied sites are shown on Figure 2.

PPM occur almost exclusively on fine-grain, sandy soils in the immediate vicinity of the Pacific Ocean (Mearns 1898, von Bloeker 1931, Bailey 1939, Ogden 1997, USFWS 1998). The species has been trapped in a variety of vegetation communities, and soils seem more critical to determining habitat suitability than vegetation composition. However, suitable vegetation is generally characterized as open coastal sage scrub, coastal bluff scrub, or grassland. A high proportion of bare ground (sands) seems preferable. Evidence suggests that PPM avoid areas of dense grass cover (Pavelka 1998-99), presumably due to difficulties locomoting or finding seeds. In scrub communities, PPM are generally restricted to openings between the shrubs, and population densities



Source: Pacific Pocket Mouse Recovery Plan
USFWS 1998, modified

No Scale

Figure 2
Historic and Current Locations of PPM

seen higher in more open scrub habitats than those with denser perennial cover (Brylski 1993; Dodd et al. 1998a, 1998b). The USFWS is currently conducting a soil suitability analysis to determine how soil characteristics (compaction, bulk density, organic carbon content, and particle size) may correlate with the currently observed distribution of PPM within the Oscar One training area on Camp Pendleton. This fine-scale study (PPM habitat selection within a mosaic of occupied and unoccupied microhabitats) will hopefully reveal useful correlations regarding PPM habitat suitability and allow extrapolation to other areas to refine definitions of suitable habitat.

This report does not summarize all existing information on PPM, which can be found in USFWS (1998) and literature cited therein, but addresses only information directly pertinent to the specified research tasks. Additional data are held by MCB Camp Pendleton and are expected to be released in the near future. Appendix A briefly reviews basic biology of little pocket mice *(P. longimembris)*.

Status of Extant PPM Populations

Although population sizes have not been estimated using mark-recapture sampling techniques at any of the four occupied PPM sites, it is likely that three of the four sites support less than 50 individual PPM each during most years. This tentative estimate is based on the numbers of individual animals captured during intensive trapping efforts at each site (20 to 37 individuals at each site in years with the most captures) and habitat extent at each site (3 to 13 hectares each; Dodd 1998a, 1998b, MBA 1997, Ogden 1997). The largest site (Oscar One/Edson Range) currently supports hundreds, or possibly more than 1,000 individuals over a total area estimated as roughly 850 to 900 hectares, but including a mosaic of suitable and unsuitable habitat (Pavelka 1998-99, Montgomery 1998).

At least one of the smaller populations (Dana Point) is totally isolated by development, with no chance for natural dispersal to other habitat areas. The two other small sites (San Mateo North and San Mateo South) have limited opportunity to serve as sources of natural recolonization due to dispersal barriers and distance to other potentially suitable habitats. The largest site (Oscar One/Edson Range) is mostly surrounded by natural habitats, with some potential for PPM to disperse to small, suitable habitat areas.

Although no attempt has yet been made to quantify effective population sizes (N_e) or a minimum viable population (MVP) size for this species, a conservative assessment would suggest that the three smaller PPM sites may not represent viable population areas, at least in the long term. Such small population sizes and geographic areas are subject to increased inbreeding depression, losses in genetic diversity and adaptability, increased likelihood of stochastic, demographic extinction, or

extirpation by environmental catastrophe (e.g., fire, storm, or exotic invasion). The conservation genetic "50/500 rule" ($N_e > 50$ resists genetic losses in the short term and $N_e > 500$ in the long term; Franklin 1980) is a controversial oversimplification (Lande and Barrowclough 1987). Nevertheless, it helps highlight the fact that the PPM is in dire straits, and that active management to increase population sizes and maintain genetic diversity may be necessary to keep it out of the "extinction vortex" (Gilpin and Soule 1986).

The status of PPM at each of the occupied sites is described in more detail here.

Dana Point Headlands

The Dana Point Headlands PPM population was rediscovered in 1993 (Brylski 1993), more than 20 years after the last verified capture of the species in its range and during which time many biologists believed the subspecies to be extinct. It is restricted largely to an approximately 8.9-hectare fenced area of the Dana Point Headlands now designated as a "temporary pocket mouse preserve." Brylski (1993) live-trapped in 1993 to determine PPM distribution on the site. The USFWS did some limited trapping in 1996 (Pavelka 1998-99); and Dodd and others (1998a, 1998b) trapped the site more intensively in 1997 and 1998. Live-trapping procedures in 1997 and 1998 involved trapping a grid of 14 parallel lines (with 3-meter spacing) and additional meandering traplines. The grid was established in areas described by Brylski (1993) as containing the highest quality habitat and PPM density. The meandering traplines were designed to cover the rest of the preserve. Table 1 summarizes live-trapping data collected in 1993, 1997, and 1998.

Table 1. Summary of Live-trapping Data Collected on the Dana Point PPM Population[1]

Data on Captures	1993 Survey	1997 Survey	1998 Survey
Survey Dates	19 Jul - 05 Aug 93	19 Aug - 28 Aug 97	24 Jul - 04 Aug
Number of Unique PPM	25 to 36 [2]	21	19
Trap Effort	817 trap nights	2782 trap nights	3325 trap nights
Age Structure	61% young of the year 39% adult	57% young of the year 43% adult	47% young of the year 53% adult
Males:Females	1.1:1.0	1.2:1.0	1.4:1.0
Area of Occupied Habitat	1.4 hectares	2.8 hectares	3.0 hectares
Minimum Density	17.8 to 25.7 PPM/hectare	7.4 PPM/hectare	6.3 PPM/hectare

[1] Results of 1996 surveys by USFWS excluded due to lower trapping intensity.
[2] This was the range of possible unique PPMs captured in 1993 because initial individuals captured were not marked.

Live-trapping results on the preserve suggest that 1998 population numbers have slightly declined from 1993 numbers. However, several more years of trapping are necessary to determine if this is a real decline, or a superficial result of differing trap methodologies and normal interyear variation in the population. Although the number of animals captured was similar between 1993 and 1998 surveys, the abundance and distribution of capture locations has varied. Different areas on the preserve have had high capture rates in some years and low in others. One interpretation of the results is that the 1993 population occupied the highest-quality habitat on the site, and has since recolonized both disjunct patches of high quality habitat and intermittently lower quality habitat. Under this scenario, periodic extirpation of PPM from these disjunct habitat patches is followed by recolonization from the core population. The PPM movement distances observed during the course of this survey are sufficient for the recolonization of disjunct habitat patches on the Headlands. Additionally, some limited habitat restoration would probably be helpful to increase population numbers. A small patch of dense scrub (where PPM had not been captured) that was burned and left open (shrubless) in 1997 was being used by PPM in 1998.

An unexpected finding was that the number of desert wood rats (*Neotoma lepida)* captured on the preserve increased dramatically from 1997 to 1998 (8 to 33 unique captures, respectively). California ground squirrels (*Spermophilus beecheyi*) were also detected on more occasions in 1998 than in 1997. Although not potential predators of PPM, these species may compete with PPM for resources.

San Mateo North and San Mateo South

Two occupied habitat areas were discovered (or rediscovered) in 1995 at the north end of MCB Camp Pendleton (Ogden 1997, MBA 1997). The two locations are about 2.1 kilometers apart on either side of the San Mateo Creek valley. They both occupy sandy ridge tops supporting open coastal sage scrub habitat and are separated by agricultural fields in the valley below. Historically, prior to agricultural conversion early in this century, the alluvial habitats in the valley were probably extensively occupied by PPM. The two occupied ridge tops may actually represent marginal habitat conditions for this species, which historically occupied sand dune and alluvial habitats near the coast.

In 1995, 37 individual PPM were captured at the San Mateo North site on about 6.5 hectares of occupied habitat (MBA 1997), and 20 individuals were captured at the San Mateo South site on about 13 hectares of occupied habitat (Ogden 1995, 1997). No mark-recapture studies have been performed to determine population numbers, but it seems unlikely that either site supports more than 50 individuals in most years. It is uncertain whether any demographic or genetic interchange

currently occurs between the two sites, but occasional interchange may occur in the long term, despite several barriers to movement (agricultural fields, a road, and the creek).

Oscar One and Edson Range

In 1995, the largest extant PPM population was discovered in an area designated by Camp Pendleton as the Oscar One training area. In 1995, USFWS captured 54 individual PPM on the Oscar One area. More extensive surveys in 1996 included systematic trapping of four permanent study grids (100 traps each with 10-meter spacing), plus presence-absence trapping over a larger area using movable trap lines. The latter presence-absence trapping was designed to better characterize the total occupied area, so traplines were moved once occupancy was confirmed in a local area. On the study grids, the USFWS captured 111 individuals (271 total captures: 58 male, 50 female, 3 unknown sex). The more extensive presence-absence surveys resulted in an additional 221 captures (82 male, 130 female, 9 unknown). Individuals were not marked during this distribution trapping, so the number of unique individuals captured is unknown; however, because traplines were regularly moved once occupancy was locally confirmed, recaptures were probably infrequent. A minimum convex polygon fitted to the outermost capture points indicated a total occupied area of about 380 hectares on Oscar One, although this includes a mosaic of occupied and unoccupied habitat areas (Pavelka 1998-99). Additional data have been collected on Oscar One in 1997 and 1998 but have not yet been summarized by USFWS or released by the Base.

In June and August 1998, Montgomery and Dodd (1998) trapped in the Edson Range training area, immediately north of Oscar One, to determine presence or absence of PPM. The Edson Range is predominated by nonsandy soils, with fewer and smaller patches of fine sandy soils than occur on Oscar One. As a result, trap lines were set in small areas that appeared suitable for PPM, as well as many areas that appeared unsuitable based on soils and vegetation. A total of 20 individual PPM were captured (with one additional animal observed but not captured). Of the 20 captured, four were adults and 16 were young of the year; 11 were males and 9 were females. Capture locations were scattered from the southern edge of the Edson Range (adjacent to Oscar One) to Aliso Canyon, nearly 2.5 kilometers north of Oscar One, confirming a low-density PPM population over much of the range. Other training ranges surrounding Edson and Oscar One have previously been surveyed without discovering populations of PPM and generally also support a mosaic of marginal, apparently suitable, and apparently unsuitable habitat.

A minimum convex polygon fitted to known capture locations on both the Oscar One and Edson ranges (Pavelka 1998-99, Montgomery and Dodd 1998) suggests a total occupied area approaching

900 hectares. However, this polygon contains a mosaic of suitable and unsuitable habitat conditions, and on a finer, microhabitat scale, the total occupied habitat would be considerably less than 900 hectares. Continuing studies of PPM distribution and abundance in the Oscar One/Edson Range area should help refine estimates of population numbers and the acreage of occupied habitat (Pavelka 1998-99), and may better elucidate the value of unoccupied matrix habitat in such a mosaic situation.

The results on Edson Range suggest the following possible conditions: (1) PPM are persistent but low-density residents on the Edson Range, (2) PPM are occasional residents of Edson (e.g., during years of abundant food), (3) PPM are generally not residents of Edson but disperse into the area seasonally or periodically from "core" habitats on Oscar One, or (4) some combination of the above. Additional field studies are necessary to test these hypotheses.

Relationship of This Study to PPM Recovery Criteria

Before summarizing each research task, it is important to review the recovery criteria that the research is intended to further. Keeping these goals in mind will help focus the following discussions and hopefully will clarify our recommendations. The recovery criteria are abbreviated slightly here from USFWS (1998).

The USFWS may consider reclassifying the PPM from endangered to threatened status if and when:

1. Ten populations are independently viable and, stable or increasing, and their habitats are secure and fully and permanently protected. A population shall be considered viable if the appropriate analysis of measured population parameters indicates that it has a 95-percent or greater chance of surviving for 100 years.

2. Occupied habitat consists of at least 2,000 hectares (4,940 acres) that are secure, and fully and permanently protected.

3. All 10 populations are managed to maintain genetic diversity.

4. All 10 populations and essential habitat are managed to eliminate or minimize current and potential threats of extirpation.

USFWS may consider delisting the PPM if and when:

1. All actions listed above have been implemented.

2. Any necessary protection, restoration, and enhancement activities (on all sites determined essential to species recovery) are successfully completed.

3. Populations of PPM represent the full existing genetic variability and historical range of the subspecies and occur over the full range of historically occupied habitat parameters.

The four research tasks discussed herein are certainly relevant to these studies. However, we suggest some redirection of this study in the immediate future to more directly address information gaps relative to achieving these goals. These recommendations are contained in the final section of this report (Recommended Phase II Studies).

TASK 1
EVALUATE THE FEASIBILITY OF TRANSLOCATING PACIFIC POCKET MICE

The recovery strategy for the PPM consists of two components (USFWS 1998): (1) stabilize the existing or newly found populations by protecting occupied habitat and (2) establish additional populations, either through natural colonization events or by translocation and/or the release of captive-bred individuals. Existing information suggests that the possibilities for finding new populations, or for existing populations to naturally recolonize unoccupied habitats, are low. Consequently, and in light of the extreme rarity of the PPM, the feasibility of using translocations or reintroductions to facilitate recovery must be immediately evaluated.

METHODS

The available literature on translocations and reintroductions of animals was reviewed for insights pertinent to PPM. In addition, available information on the PPM was reviewed relative to 16 considerations for a translocation program that are listed in the recovery plan (USFWS 1998) based on Nielsen (1988):

1. the reason for translocation;
2. status of the wild population(s) to be translocated;
3. ecology, biology, and ethology of the subspecies;
4. current size and density of the wild population;
5. movements and distribution of the subspecies;
6. male:female ratio;
7. annual recruitment;
8. mortality rates and causes;
9. health and condition of the populations;
10. genetic variability and integrity;
11. status of remaining habitat;
12. depredation rates in target areas;
13. translocation strategy (e.g., timing, numbers and demographics of released animals);
14. capture, transportation, and release techniques;
15. number and location of release sites; and
16. post-release support of translocated animals.

For each of these considerations, the consultant team attempted (1) to determine whether existing information was sufficient to support a translocation recommendation, (2) to define more precisely what studies are both necessary and sufficient to fill critical data gaps, and (3) to prioritize and create schedules for the necessary and sufficient studies.

RESULTS AND DISCUSSION

Review of the available information on PPM relative to the recovery criteria for the species indicates that a translocation/reintroduction program would probably be necessary to achieve recovery in the long term, but may not be feasible or even desirable, at least in the short term. This apparent contradiction (translocation is necessary but not desirable) arises because (1) additional populations must be established to achieve recovery criteria, but (2) we know too little to conclude that a translocation program will not jeopardize the remaining populations or successfully established new ones. In short, a translocation program may do more harm than good, especially if rushed.

The following sections summarize the pertinent literature on animal translocations as a conservation strategy and how they relate to PPM translocation. These reviews reveal the following general information gaps and impediments to achieving PPM recovery criteria via translocations:

1. lack of basic biological information on the PPM necessary to design and monitor a translocation program;
2. potential lack of translocation receiver sites due to severe habitat losses and potential institutional or landowner resistance; and
3. unknown effects of translocation on the demographic and genetic needs of the donor populations.

Translocations and Reintroductions as a Conservation Strategy

Reintroductions and translocations are increasingly used as tools for the conservation and recovery of rare, threatened, and endangered species (Reading and Price 1999, Reading and Clark 1996, Yalden 1993, Short et al. 1992, Stanley-Price 1989, Booth 1988). However, these tools are generally expensive and have a high failure rate (Reading and Price 1999, Kleiman 1989, Griffith et al. 1989, Reading et al. 1996). Consequently, the IUCN/SSC Reintroduction Specialist Group and other conservationists have developed guidelines and recommendations intended to increase success rates (Reading and Price 1999, Reading and Clark 1996, Kleiman et al. 1993). Here we briefly review

relevant findings and recommendations from the translocation and reintroduction literature as they may pertain to PPM.

Definitions and Overview

Translocation involves moving animals from a donor (source) population to a receiver site that may or may not currently support the species. *Reintroduction* involves translocation to a receiver site from which a species has previously been extirpated (as opposed to translocations intended to bolster or expand existing populations, or to establish populations outside of the species' original range). *Captive breeding* of animals for reintroduction to the wild is an option to translocating animals directly from existing wild populations. It may be useful in limited cases where there are no other alternatives to saving a species from extinction (Miller et al. 1999), and perhaps where the reproductive and behavioral biology of the species allows for more rapid and cost-effective attainment of demographic and genetic goals than is possible with wild populations alone.

The vast majority of mammalian translocations and reintroductions have been of larger mammals and especially game mammals (Boyer and Brown 1988). Few translocations have been attempted for endangered rodents, with the notable exception of several subspecies of beach mice in the coastal southeastern U.S. (e.g., *Peromyscus polionotus trissyllepsis*; Holler and Mason 1988, Holler et al. 1989; *P. p. allophrys*, USFWS 1987; *P. p. ammobates* [proposed reintroduction], USFWS 1987).

Translocations of Heteromyid Rodents

We found no published studies designed to translocate or reintroduce populations of pocket mice. However, a number of translocations have been attempted on endangered kangaroo rat species. Many of these involve short-distance translocations to remove individuals from harm's way prior to development. Such salvage operations often are poorly planned, with insufficient followup monitoring to determine success. For example, Germano (1999) described several efforts to relocate populations of endangered Tipton kangaroo rats (*Dipodomys nitratoides nitratoides*) from areas to be developed. None of these translocation efforts were considered successful due to poor consideration of habitat suitability in receiver sites, lack of sufficient followup management and monitoring, poor weather conditions, high predator numbers, and lack of consensus among resource agency personnel regarding translocation areas and protocols.

O'Farrell (1999) reported on a recent salvage translocation of the endangered San Bernardino kangaroo rat (*D. merriami parvus*) from alluvial scrub habitats to be mined for sand and gravel to a reclaimed alluvial scrub habitat in a previously mined location. After three months, he found that six of 15 individuals were still present on the receiver site, and concluded that continued monitoring is necessary to truly verify success. O'Farrell (1999) and Montgomery (1996) have also performed experimental salvage translocations for the endangered Stephens' kangaroo rat (*D. stephensi*) with generally low persistence of translocated individuals.

One apparently successful reintroduction has been performed for a kangaroo rat species. Williams et al. (1993) translocated endangered giant kangaroo rats (*D. ingens*) to two unoccupied areas on the Carrizo Plain, San Luis Obispo County, California. One of the translocated colonies, on a fallow grain field, failed within one year, apparently due to heavy predation. However, the other colony, on historical habitat from which the species had been extirpated at least ten years earlier, grew rapidly in size and distribution over three years. This population reproduced at a higher rate than nontranslocated colonies elsewhere on the Carrizo Plain. Williams et al. (1993) concluded that reproductive performance may have been enhanced by genetic diversity in the translocated colony, whose founders were gathered from 16 different sites. More food (seeds) also may have been available to the translocated colony, because the area had few small mammals present before the reintroduction.

Success Criteria for Translocations and Reintroductions

For a translocation or reintroduction attempt to succeed, it is necessary to establish a stable population with natural social spacing patterns and genetic and demographic characteristics. In theory, a small founder population may flourish and establish a stable, self-sustaining population. However, in practice, successful translocation generally requires translocating large numbers of animals, often over an extended period of time. Many more animals may need to be translocated than are ultimately established in the new population because mortality rates and out-migration are likely to be high and reproductive rates low. Furthermore, a new population established from an initially small founder population is likely to have very low genetic variability and associated problems (the "founder effect" or "genetic bottleneck effect"; Carson 1983). These problems are especially worrisome if the founder population comes from captive stock. Overall, reintroduction is appropriate when there will be a positive effect on demography and genetics, when there is suitable habitat, and when the limiting factors to the wild population have been adequately controlled. Causes for the initial extirpation from the receiver site need to be eliminated if possible to prevent a recurrence following reintroduction (Reading 1998).

Miller et al. (1999) reviewed the literature and summarized variables that influence the success of carnivore translocations, most of which are equally germane to other mammals, including PPM. The following summary is based largely on Miller et al. (1999) and Reading and Price (1999), supplemented by other sources. Following each generalization, we have provided an initial interpretation relative to PPM translocations.

Genetic Considerations – Genetic diversity among release animals should be maximized, without jeopardizing genetic integrity of source populations, to reduce chances for founder effects and inbreeding depression, and increase chances for adaptability to the new environment. Reintroduced animals should come from similar genetic stock to avoid outbreeding or genetic swamping (Reading 1998).

Little information is currently available on genetic variation within PPM populations, and none is available between extant or historic PPM populations. Brylski and Patton (1997, unpubl. manuscript) examined phylogeographic structure among five subspecies of *P. longimembris* from southern California, based on sequence variation of an 810 bp fragment of mitochondrial DNA. All individuals (N = 7) of *P. l. pacificus* examined were from the Dana Point population. Among the five subspecies examined, Brylski and Patton found a strong isolation by distance relationship, suggesting an interplay of genetic drift and low gene flow in generating overall geographic structure. Three of the subspecies (including *pacificus*) contained unique sets of haplotypes not shared with the others. Within the limited context of their sampling effort, *pacificus* appeared to exhibit a considerable reduction in overall haplotype diversity compared with the other samples. This pattern held both between subspecies and between populations of subspecies, indicating that the other subspecies examined typically represented reasonably large effective population sizes. In contrast, the low haplotype diversity in *pacificus* may suggest "local bottlenecks in diversity due to habitat loss, metapopulation structure . . . , or simple historical accident" (Brylski and Patton 1997). The researchers cautioned, however, that *pacificus*, by virtue of its narrow natural distribution along the coastal strand, may never have existed at large population sizes, or with the degree of genetic exchange between local populations.

The authors concluded: "It would be valuable to obtain haplotype diversity estimates for this taxon from predevelopment samples now residing in museum collections." We would add, with the recent discovery of additional extant populations, these should also be analyzed. Such information would seem essential before pursuing a translocation program for PPM.

It should be noted that the extant PPM populations are all near the core of the species' range. Depending on predevelopment dispersal rates of the species, these extant populations might be hypothesized to be fairly genetically similar to one another. Losses of all populations at the northern and southern extremes of the species' range are therefore troubling. Inbreeding depression may be a more likely problem in the remainder (or translocated) populations than outbreeding depression or genetic swamping.

Source of Donor Animals – Wild-born animals are preferable to captive-born for translocations, due to lower cost and because the captive environment erodes genetic and learned bases for important morphological, physiological, and behavioral traits. If wild populations are used either to start a captive breeding program or for direct translocation to the wild, it is essential that the donor individuals represent "surplus" animals that are not essential to the demographic or genetic viability of the donor population. A situation where the source habitat is saturated, such that dispersing animals are unable to find suitable unoccupied habitat to settle in, is preferable. In this case, some individuals (particularly dispersal age animals likely to suffer high mortality or reduced reproduction in the source habitat) can be removed without increasing extinction probability in the source population.

Data are needed on reproductive output for the existing PPM populations to determine whether removal of "surplus" animals can be tolerated. Preliminary, indirect evidence would suggest that the Oscar One population may be sufficiently large, and may be producing surplus individuals which disperse into nearby, marginal habitat areas. For example, in 1995 several PPM were captured in herptile pit trap arrays by D. Holland (unpubl. data) on clay soils several hundred meters from suitable PPM habitat on Oscar One. Also, 16 of 20 PPM captured in marginal habitat areas (soils with lower sand content) on the nearby Edson Range were young of the year (Montgomery and Dodd 1998), suggesting that these areas may be receiving dispersers from the "core" population on Oscar One. Consequently, capture of dispersal age individuals in late summer, on the periphery of the Oscar One population, could be considered as a translocation source, but only after additional study.

Age-Sex Categories of Release Individuals – It is generally advisable to release animals in sex ratios similar to those exhibited in wild populations to ensure reproductive encounters. In many mammals, this entails releasing more females than males. Stable populations are generally established most quickly when juveniles of dispersal age are translocated, because they move the shortest distance from the release site and quickly establish home ranges (they may also represent "surplus" animals, as discussed above). Young animals may also display greater behavioral plasticity than adults and

are less important to maintaining the source population. Dispersal-age females generally move less and have a higher survival rate than male mammals.

Sex ratios for PPM appear to be about 1:1 or slightly male biased (Dodd et al. 1998a, 1998b; USFWS 1998). Dispersal age animals of both sexes may serve best to establish a translocation or captive-breeding population of PPM.

Demography – Populations of reintroduced animals must become large enough, quickly enough, to withstand fluctuations in the environment and the population size. Knowledge of a species' demographic parameters is essential to determining when a reintroduced population has become an established and viable population.

Little is known about demography of PPM in wild populations. More study is necessary to construct life tables. Such study should include multiseasonal and multiyear trapping of a marked population to establish a population history and provide essential life table parameters.

Number of Individuals and Timing of Releases – Numbers of animals released and the sequence and timing of releases are important to success of translocations. In general, translocation success increases with the number of individuals translocated, but with diminishing returns. With many species there is an Allee effect (a drop in reproductive output below a threshold population size) and hence below which extinction is likely. Depending on the habitat and the number of animals available, it is worthwhile to consider splitting the animals between multiple receiver sites, both to increase probability of success and to protect against catastrophic loss of all individuals. It follows that the greatest potential for success is when the candidate species is expanding and numbers are high, allowing for the greatest flexibility in release strategy (Griffith et al. 1989). Whether animals are translocated all at once, or over a long period of time needs consideration, as does the optimal season for release. These obviously depend on the biology of the species in question.

Insufficient data are available to determine the number of PPM that could be safely removed from existing populations or the optimal schedule for releases. Intuition suggests that late summer/early fall (dispersal season) may be the best time to translocate PPM, but weather patterns, abundance of seeds, and the availability of burrows in the receiver environment would seem to be critical to success. The mice would need to prepare adequately for winter hibernation in a novel environment. Consideration should also be given to translocation during periods of hibernation. These issues would be explored more in Task 4 (Translocation Protocol).

Hard versus Soft Releases – Hard releases involve releasing translocated animals directly from the donor site or captive population into an unconstrained receiver site (a "sink or swim" approach). Soft release involves a period of training, acclimation, or assistance to animals in the new environment. For example, translocated animals may be kept in a large, external enclosure for an acclimation period, or they can be provided with artificial shelters and food sources in the new environment. Soft releases may facilitate attachment to the site and formation of social bonds, and may reduce the tendency of individuals to "home" (attempt return to their former habitat). In carnivores, there is a correlation between distance moved after release and mortality, so a "soft" release is recommended (Miller et al. 1999). In contrast, a review of all endangered species translocation/relocation attempts from 1973 to 1986 found no direct association between success and the length of acclimation time at the receiver site (Griffith et al. 1989). In the successful translocation of the Perdido Key beach mouse, enclosures were believed successful in retaining mice in the immediate vicinity of the release site, despite that some mice escaped the enclosure (Holler and Mason 1988).

If translocation proves feasible, we believe soft releases, using enclosures designed to exclude predators, would be beneficial. The enclosures would at least provide researchers greater control over the animals' locations for observation and demographic monitoring, particularly in light of difficulties in designing a tracking method for PPM (see Task 3).

Behavior – Behavioral traits must be performed efficiently in a variety of situations, and some authors have suggested using behavior as a measure of reintroduction success (Miller et al. 1996, 1993; Kleiman 1989). Developing site fidelity and spatial learning in the new environment are critical to survival of translocated animals. Soft releases may facilitate these tendencies and reduce problems due to homing or premature dispersal out of the receiver site.

Several investigators (e.g., Bailey 1939, Hayden et al. 1966) have studied behavior of captive PPM. In general, heteromyid rodents develop most basic behaviors and survival skills (e.g., foraging, caching, grooming, sand bathing, social communication, burrowing, nest building, and mating) innately during the first few weeks of life; and *Perognathus longimembris* exhibits relatively rapid ontogeny without much parental involvement or teaching (Eisenberg 1993). However, learning of valuable site-specific information or spatial patterns, such as the distribution of food sources, burrows, or other habitat features, occurs throughout life in mammals (Spencer 1992). This suggests that a soft-release technique (e.g., using large enclosures in the receiver habitat), may increase survivorship in translocated mice. The enclosure would prevent premature homing and associated high mortality rates while the mice gain familiarity with the new area and build useful "cognitive

maps" (Spencer 1992, Jacobs and Spencer 1994). However, PPM are solitary and aggressive to conspecifics, except for brief male-female tolerance during estrous (Bailey 1939). Enclosures would therefore need to be sufficiently large to accommodate natural social spacing systems in the translocated population.

Health and Disease – The health and physical condition of translocated animals are considered crucial to ensuring the highest possible survivorship and reproduction in the new environment. Care must be taken not to introduce disease in subsequent releases, once a population has been founded.

Little or no information is available on the PPM to evaluate the relevance of diseases to translocation feasibility.

Habitat – Translocation into the core of a species geographic range is generally more successful than on the periphery (Griffith et al. 1989), presumably due to more suitable conditions. Obviously, the receiver site must contain a sufficient area of habitat to support a viable population, and the habitat must provide all life requisites for the species, such as appropriate forage, shelter sites, and soil conditions. Translocation of animals between isolated patches of habitat is not recommended as an alternative to restoring the historical connections between patches. More difficult to assess is the resilience and long- and short-term effects of disturbances, such as fire, drought, and catastrophic storms. If animals are reintroduced to areas from which the species was extirpated, the reasons for the original extirpation should be first determined and controlled, if possible.

The extant PPM populations are in the core of the species' historic range. A translocation program would need to evaluate whether priority receiver sites should likewise be in the core, or distributed to other portions of the historic range. Few suitable habitat areas (open scrub habitats on fine sandy soils within 4 kilometers of the Pacific coast) remain in protected status to serve as receiver sites. It is unknown why some historically occupied areas that appear to have suitable habitat (e.g., Tijuana River Valley) are not currently occupied, or if the reasons for extirpation remain.

Technical Considerations – Technical considerations, as listed by Miller et al. (1999), include the legal framework, research framework, fiscal resources, organizational structure, and logistical challenges to translocation. Translocations must be carefully monitored, legally defensible, embedded in an adequate research program, and adequately funded for the long term. A cooperative organizational structure, with entities sharing common goals, is critical.

These considerations are beyond the scope of this task. However, it should be noted that sites that may meet biological criteria as potential translocation receivers may occur on private or public properties where there may be institutional or legal resistance to translocation.

Captive Breeding for Reintroductions

Captive breeding is an option in translocation/reintroduction attempts when wild populations are too rare to supply donors, or when captive populations can be used to speed up the establishment of new wild populations and increase genetic diversity. For some species, the controlled conditions of captive breeding may result in a higher reproductive output and greater genetic variability then would be achieved from wild populations (e.g., taking advantage of double-clutching and captive rearing has assisted in the successful reintroduction of a number of endangered raptors). In other species, captive breeding may produce lower reproductive output than wild populations, and captive populations may therefore serve as population "sinks" (e.g., Sumatran rhino; Rabinowitz 1995, pandas; Johnson et al. 1996).

Captive-reared animals are generally less likely to survive and reproduce following relocation than wild caught animals (Griffith et al. 1989). The effects of selection in an artificial environment may dilute important survival skills that are environmentally cued or culturally transferred. For example, in carnivores, captive raised animals exhibited different behaviors and lower survival rates following releases than their wild-born counterparts (Miller et al. 1999). Captive-reared endangered Morro Bay kangaroo rats (*Dipodomys heermanni morroensis*) did not recognize identifying cues of natural predators, and had not learned predator avoidance behaviors (Roberts and Rall 1993). Released individuals will also be unfamiliar with the habitat, may behave inappropriately during intra-specific encounters, and be disadvantaged relative to wild animals on established territories (Kleiman 1989). To counter such deficiencies of captive breeding programs, active management and development of post-release education programs may increase success. For mice, these are likely to involve the use of release site enclosures to control social encounters and perhaps exclude predators until the animals are adjusted to the new environment (soft release).

For the above reasons, successful reintroductions from captive stock may need to release large numbers of individuals over an extended period before establishing a successful population. For example, Beck et al. (1993) reviewed 145 reintroduction projects using captive stock. Sixteen of these were considered successful, including five for mammals, seven for birds, and four for reptiles and amphibians. For these vertebrate classes, the successful reintroductions released an average of

726 individuals over 11.8 years, which was significantly more than the average for other projects (336 individuals over 4.7 years).

Feasibility of PPM Translocation and Reintroduction

The Recovery Plan (USFWS 1998) states that translocation should only be considered once (1) surveys indicate that the potential for undiscovered populations is very low and other conservation and management measures prove insufficient; (2) research reveals that animals may be safely translocated into target habitats; and (3) the donor population(s) can withstand the loss of individuals. Here we address these three points in order.

1) Nearly all suitable habitat and historically occupied habitat areas have been surveyed for PPM (USFWS 1998, Ogden 1997, Montgomery and Dodd 1998, Pavelka pers. comm.). Although it is still possible that a very few additional populations may be discovered in the future, it is certain that sufficient populations do not exist to meet the recovery criteria (10 independently viable populations) without intervention. On the other hand, other conservation and management measures have not yet been fully tested.

2) This report is only the first step in determining whether PPM can be safely translocated into target habitats. Additional research is certainly required to ascertain baseline biological and genetic data on the extant populations, identify potential target habitats for translocations, and test translocation procedures.

3) The small size of the extant populations makes it difficult to justify removal of donor animals unless it can be demonstrated that one or more of these populations are losing "surplus" individuals during dispersal. These surplus animals (e.g., dispersing young which would otherwise be lost to predation or unable to find suitable unoccupied habitat to establish a home range) could possibly be used to establish additional population(s), whether in another habitat area or in captivity.

The above three points largely overlap with and include many of the 16 considerations for translocation listed in the Recovery Plan (USFWS 1998, Nielsen 1988) as necessary to answer before advocating and designing a PPM translocation program. For most of these considerations, available information is insufficient to determine translocation feasibility at this time (Table 2). Of particular importance is the lack of specific information on PPM natural history (e.g., demographic parameters,

Table 2. Translocation Feasibility Considerations for PPM

	Consideration[1]	Sufficient Information?[2]	Notes and Comments
1	Reason for translocation	Yes	Recovery criteria probably cannot be met without translocation/ reintroduction program to achieve demographic and genetic goals.
2	Status of wild populations	Yes	Severely in danger of extinction. Most potential habitat has been surveyed: 4 known occupied locations, representing 3 or 4 isolated populations. All remaining populations small.
3	Biology of PPM	No	Insufficient information on habitat requirements, demographics, space-use and dispersal patterns, mating behaviors, etc. Sparse information available on related subspecies.
4	Size and density of wild populations	No	Rough estimates (individuals captured) available for 4 sites: Oscar 1/Edson Range = 131[3]; San Mateo South = 20; San Mateo North = 37; Dana Point = 21 to 36. No capture/recapture population estimates.
5	Movements and distribution	No/Yes	Little available information on movements of PPM or related subspecies. Geographic distribution fairly well established. Dispersal characteristics unknown.
6	Male:female ratio	Yes	Dana Point: 1.1:1 to 1.4:1; San Mateo North: 0.8:1.
7	annual recruitment	No	No information specific to subspecies; limited information on related subspecies.
8	Mortality rate and causes	No	No information on mortality rates. Some causes known or suspected based on conjecture and limited observation, but not quantified.
9	Health and condition of populations	No	Little information besides external observation of wild-caught specimens in hand. Most individuals appear healthy and free of external parasites.
10	Genetic variability and integrity	No	No information.
11	Status of remaining habitat	No	Although it is known that few potential habitat areas remain, no systematic review has been done to identify potential translocation receiver sites.
12	Depredation rates in target areas	No	Limited information on presence or abundance of predators in potential receiver sites. No quantitative studies. This study will evaluate introduced ant effects in some habitat areas.
13	Translocation strategy	No	To be determined by this study.
14	Capture technique and technology	Yes	Capture methods in donor sites are relatively simple to define.
15	Number and location of release sites	No	See number 11. Systematic review of potential receiver sites is needed to determine adequacy. Recovery criteria will be used to define number and relative distribution of desirable sites.
16	Post-release support of translocated animals	No	To be determined by this study.

(1) Items needing consideration to design a species translocation program (USFWS 1998, Nielsen 1988).

(2) Is existing information sufficient to determine whether translocation is feasible? A "yes" answer does not mean that more information is not needed to further recovery planning or improve translocation program.

(3) Includes 111 unique captures on Oscar One (USFWS 1996) plus 20 unique individuals on Edson Range (Montgomery and Dodd 1998 unpubl. data). Additional captures represent an unknown number of additional individuals because they were not marked to identify recaptures

space-use requirements, depredation rates) and on genetic variability and integrity. Also lacking is a systematic review of potential translocation receiver sites, including both their biological and their institutional suitability for this purpose.

Undertaking a translocation/reintroduction program would occur if and only if the recovery criteria for the PPM cannot be achieved without such a program. The first recovery criterion (10 independently viable populations) clearly cannot be met without a translocation or reintroduction program because at least the demographic criteria cannot be met without it. It seems highly unlikely that stabilizing or expanding existing PPM populations without establishing additional populations would be sufficient to overcome the "extinction vortex" (Gilpin and Soule 1986) for the species.

CONCLUSIONS AND RECOMMENDATIONS

In the immediate future, translocations are not recommended as feasible or desirable, although in the long-term it is probably impossible to achieve species recovery without translocations. We recommend that the research and policy agenda be immediately focused on the following tasks:

- Systematically identify and review the availability of potential translocation receiver sites based on current information on PPM habitat needs, existing Geographic Information System (GIS) databases, and a GIS gap analysis. Incorporate any identified potential receiver sites into conservation planning efforts ongoing throughout the range of the PPM. In particular, conservation plans forming under California's Natural Community Conservation Planning [NCCP] Act in coastal Los Angeles, Orange, and San Diego Counties, and the habitat management plan for Marine Corps Base Camp Pendleton, should include comprehensive analyses of PPM habitat potential within their planning areas. Existing or future habitat preserves should be analyzed for their potential to support translocated PPM populations. If such potential exists, these plans should incorporate policies accepting PPM translocations in preserve areas.

- Perform basic natural history studies on PPM after first perfecting methods on other, nonlisted subspecies of *P. longimembris* (e.g., *P. l. bangsi, P. l. internationalis, or P. l. longimembris*). Although the habitats of these subspecies differ from those of PPM (desert scrub on sandy soils versus coastal scrubs on sandy soils) the biology should be similar enough to add valuable insights on PPM.

- Continue monitoring extant populations of PPM with permanent trapping grids and using individual marking methods tested on a surrogate subspecies. Particular emphasis should be on trapping the Oscar One and Edson Range areas to get further insights on the use of dispersing animals there as a source population for translocations.

- Characterize genetic variability within and between populations of PPM, and within and between other subspecies of *P. longimembris*. For PPM, genetic characterization should include samples from all extant populations as well as all historic populations (using museum specimens).

Study approaches and schedules based on these recommendations are summarized in the final section of this report.

TASK 3
DETERMINE DISPERSAL CHARACTERISTICS OF PPM

Understanding dispersal characteristics of PPM would help determine (1) the degree of demographic (and perhaps genetic) isolation of existing PPM populations one from another; (2) the feasibility of translocating PPM to new, currently unoccupied habitat areas; and (3) alternative translocation protocols to maximize the success of translocations, if they prove feasible.

This section reviews existing information on movements, especially dispersal movements, in PPM and related species. It also reviews the available marking and tracking techniques that could potentially be applied to a field study of PPM dispersal characteristics. It then makes recommendations regarding which methods or combinations of methods should be tested using a surrogate subspecies of *P. longimembris* prior to using them on PPM.

However, the general conclusion of Phase I for this task is that focusing on intensive studies of PPM dispersal is not warranted at this time because the potential harm to existing populations outweighs the potential benefits of the limited data that are expected to result. Nevertheless, testing of marking and tracking methods on a nonlisted subspecies is recommended so that future studies on PPM may benefit. Furthermore, continued capture-recapture trapping at and near known population sites may provide some insights on dispersal, incidental to other valuable data that would be collected.

METHODS

The study team reviewed available information on (1) dispersal characteristics of PPM and related species, (2) methods of individually marking PPM, and (3) methods for recording movements or locations of marked or unmarked animals as part of a dispersal study. The team also tested a few promising techniques on laboratory mice and free-roaming house mice *(Mus musculus)* to screen their usefulness before proposing more systematic tests on native surrogate species.

Several general approaches can be used to sample dispersal events in small mammals:

1. Mark and recapture methods over large study grids or grid arrays.

2. Monitoring select (spatially restricted) locations over time to record visits by individuals coming from another spatially restricted location (e.g., using drift fences coupled with traps, PIT receivers, tracking media, or other recording devices).

3. Monitoring select individuals over time without spatial restrictions (e.g., by radio telemetry, harmonic radar, direct observation, or observation of tracks on a substrate such as snow or soil).

Each of these general approaches has advantages and limitations, as does each specific technique to mark, recapture, or record the locations or movements. Some techniques to uniquely mark individuals, such as PIT tags, may be applied to more than one of these general study approaches (e.g., capture-recapture studies or passive monitoring of selected sites or individuals). Other individual marking techniques (e.g., ear tagging) would only be beneficial for capture-recapture studies. The literature, interviews with experts, review of available technology, and limited testing on laboratory and house mice were used to summarize the advantages, risks, and general usefulness of each technique. Sources consulted include the following:

- Published and unpublished literature on PPM, other heteromyid rodents, and other mice, with emphasis on space use and dispersal patterns;

- Members of the scientific peer review committee (not listed individually here) (Figure 1);

- Other researchers with experience marking and tracking mammals (personal communications with T. Lampert, T. Shenk, W. Karesh, J. Brown, M. Pavelka, L. Jacobs, B. Miller, J. Diffendorfer, K. Miner, L. Hays, P. Behrends, E. Forys, G. Bourrassa, among others);

- Representatives of companies that produce radio telemetry equipment (Holohil, Advanced Telemetry Systems, AVM);

- Representatives of companies that produce PIT tags and associated equipment (BioMark, Trovan);

- Representatives of companies that produce suture materials potentially suitable for use in marking PPM (Johnson and Johnson, Davis and Geck);

- Veterinarians, including zoo vets, experienced with marking of animals and with surgical techniques and risks associated with various marking and tracking techniques (Friedman 1998, Young 1998, Hibi 1998); and

- Internet web sites pertinent to radio telemetry, animal tracking, animal marking, and related subjects.

Pilot Studies on Individual Marking Methods

Four adult male laboratory mice were acquired to test potential methods of marking and tracking mice before attempting them on PPM or a wild surrogate species. The mice are approximately 2.5 to 3 times the size of PPM (15 to 28 grams versus 6 to 9 grams). They are housed in a 12 x 24-inch aquarium with a wire mesh top, water bottle, exercise wheel, shredded paper and a cow skull for cover. Mice were initially identified by color (3 white and 1 brown) and markings made with red Sharpie markers on the fur.

Ogden biologists David King and Mike Fugagli performed some initial tests to determine the potential utility of leg bands (bird bands) to identify individual mice. Lab mice at a UC Davis research lab are routinely marked with metal leg bands (Baczkowski 1999). This technique was therefore considered as a possible alternative to ear tags and other material marking techniques that had been found unsatisfactory on PPM (Pavelka 1998-99; Dodd 1998).

As a preliminary assessment of this method, one small colored plastic bird band was attached to the left hind leg of each of the four lab mice. The size-0 bands were trimmed to a variety of sizes to determine proper fit, placed around the leg just above the tarsus, and sealed using acetone. Only two mice were successfully banded (the other two bands quickly slipped off due to inappropriate sizing). Banded mice initially reacted to the bands by investigating and gnawing at the bands. Eventually, both successfully banded mice resumed normal behaviors. After 48 hours, one of the banded mice was observed with slight redness and swelling of the banded leg, and the bands were removed from both mice and inspected. Both bands appeared to have been gnawed considerably, and would likely have been removed by the mice in coming days.

This short-term banding exercise demonstrated that leg banding, if pursued, should be done with proper fitting, metal bands. However, we have concerns regarding the long-term effects of leg banding on the behavior and fitness of wild mice. Furthermore, the bands were somewhat difficult to read, requiring that the hair be pushed away from covering the band with the animal in hand.

We did not believe the method held promise for use on PPM, so we terminated further testing.

Pilot Studies on Potential Tracking Methods

Ogden biologists David King and Mike Fugagli performed initial tests on the potential effectiveness and risks of using a fluorescent powder as a tracking medium to determine movement and space-use patterns. The powder is a plastic pigment manufactured by Day-Glo, Inc. It is a finely divided (4 to 5 micron) insoluble ground resin powder containing a dye. It is considered nontoxic and relatively inert, the only listed caution being that the fine powder may cause respiratory irritation if inhaled in large quantities. It is not an eye irritant. Two colors were used: signal green and Saturn yellow, both of which fluoresce brightly under ultraviolet light. They have a bright "day-glo" look under daylight but do not glow in the dark unless illuminated with ultraviolet wavelengths.

Powder was first applied to the four laboratory mice to determine powder adhesion, transfer to substrates under controlled conditions, and any behavioral effects. Several ounces of fluorescent powder were applied to the inside of a cow skull that served as their nest. The mice were initially observed for behavioral changes or ill effects of the powder and then released in a dark, carpeted room to test powder deposition. The room was empty except for the powdered nest and several boxes and bags containing brush as exploration objects. The mice explored the room for eight hours, after which the room was examined for powder traces using an ultraviolet lamp.

Mice were then observed for several weeks under laboratory conditions to detect how long powders adhered to them and whether there were any obvious health effects. One of the mice died of unknown causes approximately 20 days after first exposure to the powder. This individual was dissected and its lungs and other internal organs observed microscopically under ultraviolet illumination.

Powder was next applied to the burrows of wild house mice in a 1-hectare vacant lot vegetated with mustard *(Brassica* sp.), nonnative grasses, and sweet clover *(Melilotus* sp.) to determine effectiveness of the powders to delineate movements in the wild. The lot is in an industrial park and is surrounded by development and landscaped vegetation, with no possibility of supporting listed threatened or endangered species. About one ounce of powder was injected 6 to 10 centimeters into the burrow by squeezing it from a flexible plastic 100-millimeter separatory funnel. A total of eight burrows were marked, alternating between green and yellow powders. Burrows were redusted at about one-week intervals for four weeks. Fluorescing trails were observed at night using a portable

ultraviolet lamp. Some mice were then live-trapped to observe powder deposition and health for one day, and then released.

RESULTS AND DISCUSSION

Dispersal is a difficult phenomenon to observe and measure in any animal, but especially so in a tiny, nocturnal and cryptic species such as the PPM. No one technique currently appears suitable to justify an intensive field study of PPM dispersal, especially in light of the animal's endangered status, which rules out methods that risk harm to individuals or their habitat.

Dispersal Characteristics of Mice

Very little is known about PPM space use patterns in general, or dispersal in particular. The limited information available on PPM and related species is summarized below.

P. longimembris is solitary and exhibits strong intraspecific aggression. As with most heteromyids, all adults live alone in separate burrows and nest chambers (except mothers with juveniles). In captivity, studies have shown aggressive behavior in male/female, male/male, and female/ female encounters outside of estrous (Hayden et al. 1966). However, female/female spatial overlap (in home range) has been demonstrated to occur more frequently, suggesting a greater level of male aggressiveness (O'Farrell 1980). However, home range overlap does not necessarily connote intraspecific tolerance.

Most data on home range size in heteromyids are based on recaptures on trapping transects or grids, which generally underestimate actual home range sizes. In Joshua Tree National Monument, California, home ranges of *P. longimembris* were estimated at 0.12 hectare to 0.56 hectare (Chew and Butterworth 1964). In Nevada, home ranges of males ranged from 0.3 to 1.9 hectares, and home ranges of females ranged from 0.5 to 3.1 hectares (Maza et al. 1973). In Texas, the average size of home range of *P. merriami* males was 0.59 hectare, and for females 1.56 hectares (York 1949). Studies of Panamint pocket mice *(P. l. panamintinus)* in western Nevada showed males had smaller territories (0.72 hectare) than females (0.92 hectare) (Burge and Jorgensen 1973). O'Farrell (1978) determined that home range for both sexes varied from 0.28 hectare in early spring to 0.80 hectare in late fall. Generally, there is an inverse relationship between size of home range and population density, and there are shifts in home ranges and common excursions outside the home range (more frequently in males).

Burt and Grossenheider (1976) reported that little pocket mice range up to 305 meters (1,000 feet) from their burrows in a 24-hour period, but the basis for this conclusion is unknown. In the Owens Valley, California, Kenagy (1973) measured movements of less than 50 meters (165 feet).

Limited capture-recapture data on PPM are available to begin assessing movements based on maximum distances between capture locations for individual mice. These data do not, however, represent distances moved by dispersing PPM. Rather they represent minimum measures of home range lengths, or possibly lengths of extra-home range excursions.

The most extensive data available on PPM movements is from the Dana Point Headlands monitoring study (Dodd 1998 unpubl. data). Table 3 summarizes the maximum distances and total distances moved between capture locations for each PPM. The 19 PPMs were captured an average of 3.0 times each (median: 3; range: 1 to 6 captures). For the 16 individuals captured more than once, the maximum distance moved (between the farthest two capture locations) averaged 19.7 meters (range: 4.0 to 87.0 meters). Grouped by age, the mean maximum distance moved was 26.4 meters for adults and 18.9 meters for young of the year (subadults and juveniles). Ogden (1997) reported a recapture distance at the San Mateo south site of about 22 meters for one subadult female. Most other captures were at the first capture location (Spencer 1997).

No instances of long-distance dispersal by individual PPM have yet been observed. The preliminary trapping results of Montgomery (1998) and Dodd (1998) on the Edson Range, although not providing direct data on individual movements, are consistent with a hypothesis that young of the year may be dispersing relatively long distances (hundreds of meters) between habitat patches in an unconstrained system; however, further testing is required to verify this hypothesis.

Individual Marking Methods for PPM

This section reviews the pros and cons of each marking technique we examined and discusses their applicability to design of a dispersal study. In general, it appears that PIT tags would be the best method of individually marking PPM, although there remains some concern regarding the size of commercially available PIT tags (11.5 x 2 millimeters). Another novel technique, color-coded monofilament sutures, is tentatively considered a candidate for use in capture-recapture studies.

Table 3. Individual PPM Maximum Distance, Total Distance Moved, and Number of Times Captured at Dana Point

Animal	Max. Distance Moved (m)[1]	Total Distance Moved (m)[2]	Number of Times Captured
1	12	24	4
2	87	181	6
3	12	25	5
4	0	0	1
5	23	23	4
6	46	156	3
7	27	27	2
8	18	32	3
9	32	34	3
10	30	82	4
11	25	30	4
12	4	4	5
13	0	0	2
14	3	3	2
15	30	30	2
16	21	21	2
17	0	0	1
18	5	5	2
19	0	0	1
Means	19.7	35.6	3.0
By age	26.4 adults	41.8 adults	–
	18.9 young of year	43.0 young of year	–

[1] Maximum distance moved as measured by the furthest two capture locations
[2] Total distance moved as measured by all moves between successive capture locations

These two methods are discussed in more detail below. Other techniques investigated but found likely unacceptable are as follows:

- *Ear Tags:* Commercially available ear tags too large (7 millimeters) for PPM and have high loss rate (Pavelka 1998-99). USFWS and Shana Dodd have experimented with tiny surgical staple as ear tag on PPM (Michel tag), but found unacceptable rate of loss over one year, as well as some difficulty applying and reading tag in the field (Pavelka 1998-99, Dodd 1998).

- *Freeze Branding:* Considered too risky due to the need to shave hair and the inability of the PPM's small body mass to dissipate the freezing effects.

- *Tattooing:* Similar problems as with freeze branding; body mass too small to dissipate heat of tattoo iron. Problems with ink spread and tissue scarring reported on lab mice and deer mice (Pavelka 1998-99).

- *Hair Dyes (Including Indelible Inks, Acids, or Bleaches):* A satisfactory method for short term capture-recapture studies, but not for multiyear marking due to molt.

- *Toe Clipping (or Similar Mutilation Techniques):* Considered unacceptable by the USFWS for this endangered species.

- *Hair Clipping:* A satisfactory method for short term capture-recapture studies, but not for multiyear marking due to molt. Difficult to ensure unambiguous, unique individual identification.

- *Leg Banding:* May cause skin irritation or restrictions to movements. Mice will likely chew off most band materials or waste energy in the attempt. Limited testing on laboratory mice not promising.

PIT Tags – In general, it appears that PIT tags may be the best available method of individually marking PPM. The benefits of the PIT tags include small size and weight of the units, high reliability, and low loss rate. There are two drawbacks to the units: (1) there is some concern regarding the size of commercially available PIT tags (11.5 x 2 millimeters) relative to body length of the PPM (approximately 30 to 36 millimeters, excluding head); and (2) there have been some cases of tumorous growths occurring due to the implants, but this has only occurred in a few species (Young 1998). We therefore recommend testing the method on a surrogate species of *P. longimembris* before using it on PPM.

A PIT tag consists of a glass tube containing a magnetically activated transponder chip. The tags work through a series of magnetic field interactions which allow a scanner to read a unique identification code from the tag. Tags can be read over a distance of about 4 or 5 centimeters. PIT tags have the possibility of being used to passively record an animal's visit to specific locations as well as for use in capture-recapture studies (Jacobs 1998).

PIT tags have been used successfully to mark other small species of pocket mouse (e.g., *P. flavus*; Brown 1998). An eight-year study on the kangaroo rats *Dipodomyus heermanni, D. ingens,* and *D. nitratoides* tested many marking techniques and found PIT tags to be the preferred method (Williams

et al. 1997). Tattooing was found unacceptable due to misreading (3.9 percent) and mortality during handling (0.5 percent). Cheek pouch tags caused infection and injury. Ear tags had the highest rate of loss (>58 percent for >1 year), some reading errors (0.5 percent), and occasional infection. PIT Tags required the least amount of time to identify animals. They had low rate losses (1 to 7 percent) and the misreading error was negligible (0.005 percent). No infections or other pathology were noted. Mortality due to handling for applying and reading PIT tags was 0.04 percent, and occurred only with the smallest species of kangaroo rat, *D. nitratoides.*

PIT tags have become the standard marking technique for small mammals in zoos. San Diego Zoo veterinarian, Lee Young (1998) said that all their small animals are marked with PIT tags, including the 5-gram feathertail glider (*Acrobates pygmaeus*). This tiny marsupial shows no adverse effects to the implants, and the procedure has been performed on over 75 gliders. The tags are implanted in the scruff of the neck, and the wounds are sealed with surgical super glue. Dr. Young believes that the loose skin should be enough to allow the same procedure for PPM.

PIT tags were also recommended by Dr. Hibi of Amazon Pet Hospital (1998), who felt that there would be no loss in mobility due to tag insertion. If a smaller, less obtrusive tag were required, the cost to create a new die and new tags would cost over $1 million dollars (Trovan 1998) due to initial set up costs.

Sutures – The study team also investigated use of a novel method: color-coded surgical sutures or monofilament stitched through the skin and left slightly longer than PPM guard hairs. The sutures could be located on the rump above the tail, between the scapulae, or perhaps in the ears. General consensus of mammalogists and veterinarians we discussed this with (e.g., Hibi 1998) was that the loose skin between the scapulae was probably preferred.

The technique would be quick and relatively risk-free, but practice under the supervision of a veterinary surgeon would be required. Commercial, nonabsorbable suture material generally comes in five colors: green, blue, green-white braid, black, and steel, limiting possible coding combinations. Monofilament can also be used, which increases the available color options, but decreases the sterile condition. Field sterilization would be required with this or any suture material that didn't come prepackaged and sterile (Hibi 1998). The study team also investigated suture materials that could be dyed to create additional colors, but the companies contacted to date did not offer suitable materials (Cooleen 1998, Lamb 1998). Further research on dyable suture materials is required if this technique is pursued.

Potential Tracking Methods for PPM

The following techniques were investigated and found not to meet study requirements for PPM dispersal based on current technology and/or risks of harm to individuals or habitat:

- Telemetry units are still too large and unrealiable (duration and range) to risk trying to record rare dispersal events in this species at this time.

- Use of drift fences is all but ruled out by the recovery plan due to concerns of increased mortality (e.g., predation risks) that may result and the problem that fences change the movements they are meant to record.

- Harmonic radar is infeasible for use on a terrestrial, burrowing mammal, and due to prohibitive costs.

- Arrays of PIT recording stations are infeasible (and uneconomical) based on current technology, due to limited receiving range, expense of recorders, and impacts on the habitat (such as compaction or vegetation removal).

- Use of radioisotopes to mark and detect individuals or populations dispersing from a source population (Stenseth and Lidicker 1992) may pose health risks to marked individuals, and most isotopes can only be detected at very short distances (within about 1 meter or less).

- Use of direct observation techniques (e.g., night vision scopes or light emitting diodes [LEDs] on animals) also seems infeasible due to low likelihood of observing dispersal and possible changes in PPM behavior.

- Massive capture/recapture grids designed to measure dispersal may be too disruptive to populations or habitat relative to the chances of recording meaningful dispersal data; and trap grids generally under-represent space use requirements in small mammals. However, some use of more modest trapping grids is recommended, once an individual marking technique is perfected, to study basic biology of PPM.

- Use of fluorescent powders or similar tracking techniques may increase predation risks, and our pilot studies with house mice indicate a low likelihood of recording dispersal. However, this technique has merit for further testing on surrogates to study space use in PPM.

Although none of these techniques shows promise for a focused, intensive study of PPM dispersal, a few are discussed in more detail below, because they may, nevertheless, benefit study of other aspects of PPM biology. Some may also prove useful for dispersal studies in the future with further developments in technology, and especially after tests on surrogate species.

Fluorescent Powders: Results of Pilot Studies

The results of the pilot studies using lab mice and wild house mice indicate that this technique may be useful in helping delineate home ranges and may supplement other techniques for studying social spacing patterns, movements, use of burrows, and other aspects of PPM natural history.

Powder Adherence and Effects of Powder on Mice

The lab mice were initially heavily coated with powders, due to heavy application to their nest. White mice became green, and the brown mouse had a slight green hue. The amount of powder available was then greatly reduced, resulting in lesser adherence to the mice. Powders adhered most to the base of sparse hairs on feet, ears, and nose; to skin and fur of the body; and to waxy areas between scales on the tail.

The only behavioral change observed was an initial increase in grooming, which tapered off over time. Because of the heavy coating of powder and grooming with the tongue and mouth, scats became green and fluoresced under ultraviolet light. The urine was not green. Behavior and health were not obviously affected over the next two to three weeks. All mice increased in weight during this time. One mouse died of unknown causes about three weeks after initial exposure, while still lightly coated with powder, although it appeared healthy and active until death. The mouse was dissected and examined for green powder internally and externally with a dissection scope under ultraviolet light. The external deposits were as noted above: heaviest on the tail, feet, and nose area. Internally, the intestinal walls fluoresced green from the powder, and the scat was mostly all green. Adipose tissue in the pericardial sac, around the kidneys, and on the peritoneum fluoresced faintly, but the fatty tissues may naturally fluoresce. Examination of thick-sectioned lung tissue revealed some fluorescent particles, but whether the particles were inside or outside of tissues or caused the death could not be determined.

Powder Adherence to Substrate in Controlled Environment

Observation with ultraviolet light after eight hours of exploration by the mice showed numerous mouse tracks within about 1 meter of the nest as well as accumulations of powder in corners, along the baseboards, and other features of the test room. Tail marks were common along the walls. Powder was also evident throughout the brush where mice had climbed around. Enough fluorescent powder was dispersed in the room to justify outdoor trials using wild mice.

Results Using Powders in Wild Setting

Observations 24 hours after applying powder to house mouse burrows revealed trails of fluorescent powder leading 2 to 3 meters out from burrows. Over several nights, the trails became more clear and longer to about 5 meters. It appears that the house mice mostly ran along the same trails (one to three per burrow) within a 4- or 5-meter radius of the primary burrow and mostly to other nearby burrows. Forays off main trails into nearby vegetation clumps were also observed. Trails continued to develop over time, with no mixing of colors observed between burrow clusters, indicating that mice did not visit neighbors' burrows. Once the network of detectable trails was established from the initially marked burrows, other burrows showing evidence of use (powder deposition inside) were supplemented with powder. This increased the deposition on the existing trails, and expanded the detectable trail network slightly.

Both green and yellow powders were very detectable under ultraviolet light, even as single glowing particles. The powder seemed minimally affected by light rainstorms and wind. Smaller trails left by insects or snails were also identifiable.

Two male and one female house mice were captured after several weeks of testing. The female was pregnant, and one male scrotal. All three mice appeared in good heath and very active. One male was very lightly dusted with powder, detectable only on the feet and tail with ultraviolet light. Powders were barely discernible under sunlight. The other male and female had a moderate accumulation of powder, barely detectable on the body fur and somewhat brighter on the feet bottoms and tail. The most heavily dusted male used the most heavily powdered and recently recharged burrow complex. This was the only individual observed to have green-tinted scats. The other scats did not fluoresce, even under ultraviolet light.

Conclusions Regarding Use of Fluorescent Powders

The captive test mice did not show obvious ill health effects or major behavioral changes while heavily coated with powder. Whether the powder contributed to the death of one lab mouse could not be determined. The remaining mice appear healthy and unaffected. The much lower levels of exposure experienced by the wild mice are not expected to have ill effects.

The powder deposited nicely along established trails in the field. The network of trails at each burrow cluster reached almost to neighboring trail networks, indicating that most of the home range was being detected. The powder stood up well under varied weather conditions, and was readily detectable at night. The wild mice did not appear significantly affected by the powder, and the powder was not noticeable on them under normal lighting conditions. The amount of powder required to produce detectable trails was small. Addition of powder to outlying burrows of the same mouse made the trails more detectable, and expanded the detectable extent of the trail network slightly.

We believe application of small amounts of powder into burrow entrances deserves further testing in the field on a nonlisted subspecies of *P. longimembris*. Tests should determine whether the technique, perhaps in concert with other tracking techniques, can help delineate home ranges and social spacing characteristics of the species. Further research is also needed to determine whether the fluorescence can be detected by potential predators (e.g., hawks, owls, cats, foxes) and, hence, increase predation risks.

Radio Telemetry

Radio telemetry is generally the preferred method for studying natural, unconstrained movements of wild mammals. However, the PPM is so small that this technique is currently infeasible. Only in very recent years have advances in telemetry and battery technologies made it feasible to radio-track such tiny animals (6 to 8 grams at dispersal age), and there are limitations on radio-signal strength and battery duration. Because the PPM is a burrowing mammal, transmitters would likely need to be implanted subcutaneously or intraperitoneally (rather than worn externally), which further attenuates the limited transmission strength, and may alter behavior or affect health in unknown ways. Based on the size of transmitter package, subcutaneous implantation, burrowing behavior, and other factors, we expect receiving ranges of well under 100 meters, and battery lives under 2 weeks duration (Riecken and Raths 1996). Thus, we do not recommend telemetry on PPM at this time.

Holohil systems manufactures the smallest transmitter units currently available. The transmitters measure 8 x 7 x 5 millimeters, weigh 0.47 to 0.52 gram, depending on the battery, have a life expectancy of 10 days, and a maximum useable range of 500 meters. However, Riecken and Raths (1996), using a larger, 0.6- to 0.7-gram Holohil telemetry units on a beetle (*Carabus coriaceus*), found an operable range of only 100 meters. The smaller transmitter that would be proposed for use on PPM would have an even weaker signal. There are also discrepancies between laboratory and field tests on battery life. Riecken and Raths (1996) found that their transmitters allowed 14 to 18 days of tracking, although the maximum battery life is 28 days. Again, the smaller batteries used for PPM would have less duration.

Transmitters can be attached internally or externally. External attachment is easier and less traumatic, and generally uses a surgical glue on a shaved patch between the shoulder blades. In some cases the glue has been known to cause skin damage due to prolonged attachment (Schultz et al. 1998, Schultz 1998). Another option is to connect the unit to the animal using suture run through a minute polyvinyl chloride (PVC) tube attached to the transmitter. Subcutaneous insertion is more complicated and is generally used on larger animals. Schultz et al. (1998) experimentally implanted approximately 200 doves with radio transmitters, half subcutaneously and half in the abdominal cavity. Whip antennae were left protruding from the incisions and were found to pose little threat of infection to the doves; but the intra-abdominal group had much higher indications of infection. The abdominal transmitter was found to compact the organs in the abdominal cavity and may have affected fecundity. Similar results were found in a study comparing implants to controls in immature turkey poults (Hubbard et al. 1998).

The president of Holohil Systems (Anderka, pers. comm.) raised concerns that the size of transmitter unit may alter the behavior of PPM. The transmitter could interfere with the ability of the animal to enter its hole, the weight might impose a handicap on the functions of the mouse, and it may cause unknown effects on behavior. Some rodents carrying external units over long periods have attempted grooming them off.

Mark and Recapture Techniques

Mark and recapture techniques are not recommended specifically to study dispersal in PPM, because such an effort would be extremely labor intensive relative to the amount of dispersal data obtained. Furthermore, massive capture/recapture grids may be too disruptive to populations or habitat relative to the chances of recording meaningful dispersal data; and trap grids are notorious for not accurately representing space use in small mammals. (Individuals generally are captured at few trap locations

which under-represent their actual movements.) For dispersal studies, recaptures measure only minimum possible dispersal distances, rather than actual or potential distances.

Nevertheless, some systematic trapping of known PPM populations will be necessary to achieve the recovery criteria, and some dispersal data may be obtained incidental to these studies, especially if study grids are strategically placed. Long-term, systematic trapping studies should be initiated to mark individuals and track populations over time, once a reliable individual marking method is developed using a surrogate species.

CONCLUSIONS AND RECOMMENDATIONS

We know very little about dispersal in PPM or related subspecies. Furthermore, based on current technology, we fear that the risks of performing an intensive, focused dispersal study on PPM outweigh the potential benefits of doing so, and we do not recommend such a focused dispersal study at this time. However, we do recommend a field study of a nonlisted subspecies of *P. longimembris* to test promising techniques for studying dispersal and other aspects of P. *longimembris* biology that are pertinent to recovery planning for PPM. A proposed study approach for such a field study using surrogates is discussed in the final section of this document.

Despite the above conclusion, we may continue to gain some insights regarding PPM dispersal, both directly and indirectly, from analysis of ongoing trapping efforts at PPM population sites. The demographic and distribution results of presence/absence trapping at the Dana Point and Oscar One/Edson Range sites are already providing some indirect insights on PPM dispersal and should be continued. The results should be far more useful once PPM can be permanently and uniquely marked (with PIT tags or another suitable technique).

The extant PPM population sites offer opportunities to study dispersal under several different sets of conditions, which may lead to different insights:

- Dispersal from or between small, discrete, occupied areas of habitat in fragmented landscapes at the Dana Point Headlands and the San Mateo North and San Mateo South sites;

- Dispersal among suitable (sandy) habitat patches in a matrix of unsuitable (non-sandy) habitat at the Oscar One site, which is free of obvious dispersal barriers; and

- Dispersal between the relatively large areas of suitable habitat at Oscar One (a potential source area for PPM) and the apparently more marginal habitats on the adjacent Edson Range (a potential sink area).

Given that trapping continues or is reinitiated at these sites, we recommend procedures to maximize the potential to observe PPM dispersal. For example, expanding the Oscar One study grids to include portions of the Edson Range may record dispersal from a possible source area (Oscar One) to a possible sink area (Edson). This may support a finding that dispersers from Oscar One can serve as a source for future translocation or reintroduction efforts.

RECOMMENDED PHASE II STUDIES

RELATIONSHIP OF RESEARCH TO RECOVERY GOALS

The four tasks that the recovery research team have initiated are certainly relevant to the PPM recovery goals. However, we suggest some redirection of research efforts in the immediate future to more directly address the information gaps most pertinent to species recovery. Specific relationships between each of the four tasks and the species recovery criteria are summarized here, along with some suggested changes in approach for each task. The next section builds on these suggestions by proposing specific studies.

1. Task 1 (translocation feasibility) was designed to determine whether translocations or reintroductions of PPM are feasible. However, we do not know whether there are sufficient habitat areas remaining to receive a translocated population. A systematic review using GIS data layers, discussions with land-use authorities, and field measures of habitat suitability are recommended.

2. Task 2 (Argentine ant invasions) is directly relevant to measuring threats to the species and should be continued. We also suggest that it be expanded to measure additional threats, such as effects of predation by house cats and other vertebrates on PPM.

3. Task 3 (dispersal characteristics) is also relevant but should be imbedded in a more comprehensive field study of the species' natural history, and only after marking and tracking techniques are first perfected on a surrogate species to ensure that they will do no harm to remaining PPM populations.

4. Task 4 (translocation protocol) should be developed only if and as data become available to support such a procedure. This depends on the results of the other tasks above, as well as studies of genetic diversity and integrity of the remaining populations.

Considering the above discussion, the study team suggests redirecting research efforts for the immediate future. In light of the extreme rarity of the PPM, the study team has used the guiding philosophy: "First, do no harm." In other words, attempt to answer the critical questions for recovery planning without risking harm to the remaining PPM populations. Based on this approach, we recommend the following studies:

1. A systematic review of available habitats within the historic range of the PPM to identify sites that might support additional viable populations (perhaps via future translocations or reintroductions).

2. An intensive, multiyear field study of a permanently marked population of a nonlisted subspecies of *P. longimembris*. This study of a surrogate species should be designed with at least the following goals: (a) test techniques before applying them to the PPM; (b) obtain basic life history, demographic, and genetics information to design a population viability analysis and translocation protocols; and (c) test specific translocation methods and protocols that may be applied to PPM in the future. Some captive *P. longimembris* should also be used to test marking procedures.

3. Following closely after the surrogate studies, perform an intensive, multiyear field study of one or more permanently marked PPM populations. The study should be designed with at least the following goals: (a) measure demographic parameters and build life tables necessary for a population viability analysis on PPM; (b) obtain additional natural history and habitat data on PPM; (c) quantify current and potential threats to the populations (e.g., introduced predators), and design remedial measures; and (d) obtain DNA samples for genetic studies (see below).

4. A population genetics study on PPM to establish baseline measures of genetic diversity within and between extant populations (using live-captured specimens) and historic populations (using museum specimens), and to determine genetic goals for PPM recovery.

5. Continued monitoring at all extant sites of existing population size and demography using permanent study grids, integrated with and guided by the above studies.

Below we present draft study approaches for the review of translocation receiver sites, the intensive study on a surrogate subspecies, and the population genetics study. We also suggest modifications to ongoing PPM monitoring efforts administered by the USFWS.

REVIEW OF POTENTIAL TRANSLOCATION RECEIVER SITES

Objectives

This study would use existing digital information (GIS data layers) and field reconnaissance to systematically rate and prioritize potential translocation receiver sites throughout the historic range of the PPM. This information is critical to deciding whether translocations are feasible, and what biological, technical, or institutional issues must be addressed prior to attempting translocation.

Methods

The study would proceed in two phases: (1) a coarse-filter phase to identify potential translocation receiver sites using GIS and existing data and (2) a fine-filter phase involving field work to better characterize habitat suitability and to rank the potential sites identified during Phase 1.

In Phase 1, soils and vegetation types would be rated by the PPM research team for potential to support PPM, based on current knowledge and ongoing studies by the USFWS and others. This rating system would be conservative to avoid prematurely eliminating sites due to inadequate data or inappropriate mapping scales. For example, existing digital U.S. Department of Agriculture (USDA) soil maps are relatively coarse in scale and may omit small pockets of suitable soils within a matrix of other, less suitable soils (such as occurs on the Edson Range). A soil scientist would be involved in this effort to help the team identify those soil types that may support PPM or that may have unmapped inclusions of suitable soils. The GIS would then overlay the rated data layers to create coarse-scale habitat suitability maps for PPM. Such efforts have already been performed piecemeal for portions of the PPM's range, such as on Camp Pendleton (Ogden 1997), within the Multiple Habitat Conservation Planning (MHCP) area (Ogden and San Diego Association of Governments [SANDAG] 1997), and within southern Orange County (Pavelka 1998-99). This exercise would involve collating these independent assessments into a comprehensive data set and analysis, and subjecting the results to scientific peer review.

A preliminary gap analysis would also be performed during Phase 1 by overlaying land uses and land ownerships onto the coarse-scale habitat suitability map. Of particular interest would be land areas currently in open space, or identified as probable wildlife preserve areas by ongoing regional conservation planning efforts. Candidate areas for translocation receiver sites would be identified as those that are sufficiently large, with suitable PPM habitat characteristics, and having compatible land use and land management plans.

Phase 2 would involve field reconnaissance by experienced PPM biologists to verify and further rank the apparently suitable habitat areas. The soil testing methods currently being developed and used by the USFWS (Pavelka 1998-99) may be applied if they prove useful in predicting PPM habitat suitability. Improved, finer scale soils maps may be prepared on candidate sites, if appropriate. The field surveys would also characterize vegetation communities and degree of disturbance and threats to PPM (e.g., presence of house cats or Argentine ants) at each location. These field characterizations would serve to refine the coarse habitat suitability analysis to prioritize the most suitable habitat areas for translocations.

Any sites appearing highly suitable that have not already been adequately trapped for PPM would then be trapped with sufficient effort to verify presence or absence of the species. We suggest a minimum effort of 8 consecutive trapping nights with at least 200 traps per site. This trapping should also characterize the overall rodent community to determine if high levels of non-native or competing species may pose problems for PPM reintroductions.

Schedule

It is important that Phase 1 commence immediately, before the regional habitat conservation plans and associated habitat management plans are completed. These plans, which identify which areas of remaining habitat in southern California will be permanently protected as biological open space, and which will be subject to development, are fast becoming final. PPM translocation possibilities must be adequately addressed before these habitat conservation plans are implemented.

The habitat suitability modeling and gap analysis could be performed by spring 1999. Field reconnaissance should be completed in spring/summer 1999, and any necessary trapping surveys in summer 1999 (Phase 2). Identification and prioritization of candidate translocation receiver sites should occur by fall 1999.

FIELD STUDIES OF SURROGATE SUBSPECIES

Objectives

This study would use another, nonlisted subspecies *of P. longimembris* as a surrogate to the PPM, in order to test methods and obtain critical information without risk of harm to the endangered PPM. Specifically, the study would be designed with the following objectives:

1. Test the various marking and tracking techniques still under consideration for use on PPM. For example, PIT tags and color-coded surgical sutures could be tested on captive and free-roaming individuals to verify their utility and assess possible adverse effects. Possibly, telemetry units could be tested as well, in concert with trapping and fluorescent powders, for studying space use and dispersal patterns.

2. Collect blood samples, hair samples, and scat samples for use in genetics analyses and to select the technique that is most suitable and least invasive to the animals. These samples could be used by geneticists to refine methods on *P. longimembris* and develop additional genetic markers using the surrogate as an outgroup taxon for comparison.

3. Collect basic natural history and demographic information, which is likely to be similar between other subspecies and *pacificus*. Intensive study of a marked population would be used to refine parameter estimates for input into the population viability analyses called for in the recovery plan. By carefully extrapolating to PPM, we may be able to determine whether any of the existing PPM population sites (especially Oscar One) could serve as a translocation source population.

4. Experiment with specific recommended translocation methods, such as (a) design and use of enclosure fences at receiver sites, (b) design and use of artificial burrows and feeding stations at receiver sites, (c) determination of optimal timing for translocations, and (d) determination of optimal age/sex classes of translocated animals.

If properly designed, an intensive population study of a surrogate population could integrate many of the above research goals simultaneously. The most promising methods could then be tried on PPM, once we are confident that they would do more good than harm.

Potential Study Sites and Subspecies

The study team has identified a number of potential study sites for several subspecies of *P. longimembris*. The sites were identified based on known moderate to high populations of *P. longimembris*, relative ease of access, and other considerations. However, the land ownership and management status are not currently clear for all locations. The first task would be to perform a quick field reconnaissance and discussion with land use authorities to determine which site offers the optimum setting for intensive study.

P. l. bangsi

The following sites were surveyed for *P. l. bangsi* by Dodd (1996) for the Coachella Valley Multiple Species Conservation Plan (CVMSCP). They are all around the western and northern portions of the Coachella Valley, California, and most or all are candidate sites for habitat preservation. The land controlling agencies might welcome additional data on the species in these areas, since *P. l. bangsi* is a planning species for the CVMSCP.

Snowcreek/Windy Point – This site is in an undeveloped area in the vicinity of San Gorgonio Pass, near the village of Snow Creek. Dodd found a high density of *P. l. bangsi* in creosote scrub on loose, sandy soils. The animals were restricted primarily to gentle slopes. Steeper slopes forming the southern portion of the study area are unsuitable for the species. This may offer advantages for a dispersal study, since dispersal should be directionally biased away from the slopes, increasing the probability of recording dispersal movements.

West of Highway 62 – This site is near the northern end of the Coachella Valley. *P. l. bangsi* was found at moderate densities in desert scrub. Again, steep, rocky slopes along one side of the study area might restrict dispersal directions, to the potential benefit of a dispersal study.

Edom Hill/Willow Hole - This site is also in north Coachella Valley and had a moderate abundance of *P. l. bangsi*. The site was relatively homogeneous with no steep slopes, and the species is expected to occur over the majority of the site.

P. l. internationalis

San Felipe Wash, south of the town of Ranchita in the Anza Borrego desert, has a moderate to high density of *P. l. internationalis* (Dodd 1998). It should be relatively accessible for study.

P. l. longimembris

P. l. longimembris are thought to be abundant in creosote scrub near the town of Joshua Tree, outside of Joshua Tree National Monument. *Longimembris* should also be abundant within the monument, but there may be concerns regarding permanent study plots within monument boundaries. Monument staff should be approached regarding possibilities of studies within the Monument.

Methods

The precise methods to be used on the surrogate study are to be defined during further discussions with the USFWS and the TCA, with input and review from the scientific review panel. This section presents a brief overview of some approaches to be considered.

Once one or more surrogate study sites are selected, permanent study grids would be established based on the current optimal grid layout for PPM as determined by Dodd and Montgomery's grid spacing study at Oscar One (tentatively a 14-by-14 trap grid at 5-meter spacing). Assessment lines radiating out beyond the study grid would also be established based on the design of O'Farrell et al. (1977) for correcting density estimates on grids.

An attempt would be made to capture and permanently mark all resident animals on the study grid, with trapping at least three times during the active season (spring: prereproduction; summer: post-emergence of juveniles; and late summer/fall: dispersal). This would allow tracking of age cohorts over the seasons and construction of a basic life table for the species. The study team would first capture and mark the reproductive (adult) population during spring (April/early May) prior to the emergence of juvenile animals. This would ensure that there is no confusion between the age of animals born the current year and those born in previous years. This is important (1) to help determine if adults (animals born in previous years) disperse, (2) to determine whether habitats occupied by the resident, predispersal, adults differ from habitats settled by dispersing young, and (3) to be able to correctly age mice throughout the year.

Once sufficient animals are marked, field trials should begin to test various tracking techniques on the grid. Fluorescent powders would be applied to burrows to test whether this technique works on little pocket mice to study home range, movements, and social interactions. Telemetry units may also be tested, although this is not highly recommended at this time.

Possibly, large enclosures would also be established as experimental arenas to test various tracking methods and to test use of enclosures as a "soft release" measure for translocations. The enclosures would also be used to test effectiveness and design of artificial burrows and feeding stations at receiver sites, determine optimal timing for translocations, and determine optimal age/sex classes of translocated animals.

Schedule

During winter/spring 1999, reconnaissance visits and discussions with land use authorities should be initiated to select study site(s). If possible, study grids should be established during spring/summer 1999, and trapping should commence to begin marking animals and testing marking and tracking techniques.

Concurrent with the study site reconnaissance, the study team would work to refine the study questions, methods and schedules, with input from USFWS, TCA, and the peer review committee.

POPULATION GENETICS STUDY

Objectives

A study of genetic variability in PPM is necessary to determine the genetic integrity and variability both within and between the extant populations of PPM, and within and between all historic populations of PPM. This is critical to designing a translocation program, including (1) determining whether captive breeding is necessary to increase or maintain genetic integrity and (2) selecting translocation donor and receiver sites.

Methods

Tissue samples should be collected from museum specimens representing each of the historic populations of PPM and from each of the extant PPM populations. Hair follicles or other suitable tissues from museum specimens may be suitable for use with polymerase chain reaction (PCR) techniques. Fresh blood, hair, or scat samples from living animals are preferable for use on extant populations, and can be collected when animals are captured and marked. For example, a drop of blood can be collected on a paper filter strip when inserting PIT tags and dried. Hair can be plucked from the rump (complete with follicles) and dropped into alcohol or frozen in zip-lock bags. This technique has worked successfully on recent genetics studies of Stephens' kangaroo rats (Metcalf 1998). Extraction of DNA from tissues in scats may also be possible.

Protocols for extracting DNA from the tissue samples, and sequencing and amplification would presumably follow those developed by J. Patton and others, but are beyond the scope of this report. Likewise, analytical methods and statistics for determining patterns in haplotype variation,

apportionment, gene flow, and other pertinent measures are beyond the scope of this report, and should be developed by population geneticists in the next phase of research.

Schedule

Samples from museum specimens should be collected as soon as possible. Tissue samples from living specimens should be collected concurrent with trapping and marking studies on the surrogates and on PPM. Schedules and methods for genetics analyses should be developed as part of the next phase of research.

MODIFICATIONS TO PPM MONITORING PROTOCOLS

Continued monitoring of the known PPM population sites should consider the following modifications:

- Mark animals using whatever marking method is determined optimal based on the surrogate studies (e.g., PIT tags or color-coded surgical sutures). Prior to approval of a permanent marking technique, use a combination of hair clipping and indelible ink to uniquely mark individuals in the short term for capture-recapture studies.

- Add assessment lines (O'Farrell et al. 1977) to the sample grids to allow better estimates of population densities. Estimate population sizes using appropriate capture-recapture population estimators (e.g., using program CAPTURE or program MARK).

- Perform monitor trapping at least three times during the active season (prereproduction, post-reproduction/juvenile emergence, and late summer/dispersal seasons). Such a schedule is critical to tracking reproduction and mortality rates in cohorts, and to build life tables for the subspecies.

- Consider adding additional study grids in "marginal" habitat areas, especially in the vicinity of the Oscar One core population (e.g., on Edson Range). Differences in demography between animals caught in these marginal habitats and those caught in the core population should yield valuable insights on dispersal and perhaps source/sink dynamics on these areas. These results are crucial to determining feasibility of translocations and selection of donor animals. Furthermore, there is a small but finite chance of capturing individually marked PPM that disperse from one grid to another.

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APPENDIX A
BIOLOGY OF LITTLE POCKET MICE

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The following summary of the biology of little pocket mice (*Perognathus longimembris*) was prepared by Shana Dodd.

FOOD HABITS

Meserve (1976) studied a population of *P. l. pacificus* and found they had a strong preference for forb seeds and grasses and had low to no preference for shrubs. Bailey (1939) recorded seeds of the following plant species from the cheek pouches of collected specimens: "Lotus prostratus, two species of salt bush, heliotrope, mustard, Monoanthochloe, Franseria, a rush...." Von Bloeker (in Bailey 1939) recorded the seeds of *Heterotheca grandiflora*, *Chrysothamnus*, *Centaurea melitensis*, *Croton californicus*, *Plucheas sericea*, and *Hordeum murinum*. *P. l. pacificus* was observed to drink water regularly in captivity (Bailey 1939). *P. longimembris* in southern Nevada were found to have 82 percent seeds, 17 percent greens, and 1 percent insects (percent volume) for 38 stomachs examined (Bradley and Mauer 1973). This study also recorded the following specific food items in cheek pouches: seeds of grasses (*Oriysopsis hymenoides*, *Hilaria rigida*, and *Bromus rubens*), annual forbs (*Plantago insularis*, *Phacelia* spp., *Oenothera* spp., and *Erodium circutarium*), perennial shrubs (*Ephedra funera*, *Sphaeralcea ambigua*, and *Dalea fremontii*), and vegetative plant parts (*Phacelia* spp. and *Oenothera* spp.). Beatley (1969) suggested that dietary water (and vitamins), available in winter annual vegetation prior to or at the onset of the breeding season, is a requirement in the reproductive physiology of heteromyid species (note: *P. l. panimintinus* was included in this study).

BURROWS

Pocket mice are nocturnal and spend the day in burrows they construct in loose dirt and sandy areas. Kenagy (1973) found some individuals occupied as many as two or three separate home burrows in the summer and early fall. Burrow entrances are plugged during the day and comprise a system of tunnels and resting areas. Kenagy (1973) found that tunnels of *P. longimembris* were generally 2 centimeters in diameter and often nearer to the surface than those of larger species. Two nesting cavities were excavated and found to be 52 and 65 centimeters in depth, containing a loose bed of dry roots and leaves (Kenagy 1973).

DENSITY/HOME RANGE

P. longimembris is solitary and exhibits strong intraspecific (i.e., between individuals of the same species) aggression. As with other heteromyids, all adults live alone in separate burrows and nest chambers (except juveniles). In captivity, studies have shown aggressive behavior between male/female, male/male, and female/female when adults are put in close proximity out of the breeding season, more specifically outside of estrous cycles (Hayden et al. 1966). However, female-female spatial overlap (in home range) has been demonstrated to occur more frequently, suggesting a greater level of male aggressiveness (O'Farrell 1980), but home range overlap does not necessarily mean they tolerate each other. *P. longimembris* is also considered a habitat generalist and occurs interspecifically with other species, commonly with kangaroo rats (*Dipodomys* spp.).

Most data on home range size in heteromyids are based on recaptures on trapping transects or grids, which generally underestimate actual home range sizes. In Joshua Tree National Monument, California, home ranges of *P. longimembris* were estimated at 0.12 to 0.56 hectare (Chew and Butterworth 1964). In Nevada, home ranges of males ranged from 0.3 to 1.9 hectares, and home ranges of females ranged from 0.5 to 3.1 hectares (Maza et al. 1973). In Texas, the average size of home range of *P. merriami* males was 0.59 hectare, and females 1.56 hectares (York 1949). Studies of Panamint pocket mice *(P. l. panamintinus)* in western Nevada showed males had smaller territories (0.72 hectare) than females (0.92 hectare) (Burge and Jorgensen 1973). O'Farrell (1978) determined that home range for both sexes varied from 0.28 hectare in early spring to 0.80 hectare in late fall. Generally, there is an inverse relationship between size of home range and population density, and there are shifts in home ranges and common excursions outside the home range (more frequently in males). Home range size is not necessarily related to body size, as Maza et al. (1973) showed that *P. longimembris* have larger home ranges than *Chaetodipus formosus* (a larger animal).

P. longimembris has been observed to be the most abundant rodent in some areas, yet occurs in low numbers or is scarcely found in other areas. Hall (1946) estimated a population in Nevada to be as high as 400 individuals per acre. Chew and Butterworth (1964) recorded densities ranging from 0.85 to 1.74 individuals per hectares. In Texas, *P. merriami* population densities have been recorded from 2.68 to 10.20 individuals per hectares through the year (Chapman and Packard 1974).

LONGEVITY

Several researchers have shown *P. longimembris* to survive well under captive conditions. Bailey (1939) studied two *P. l. pacificus* in captivity that lived about four and six years. The longest

lifespan of *longimembris*, in captivity, was reported to be longer than eight years (Edmonds 1972). In nature, however, lifespans are markedly shorter. In a population of *P. longimembris* studied in Indian Cove (the northern edge of Joshua Tree National Monument), 30 percent of marked individuals survived from one spring to the next (Chew and Butterworth 1964). Beatley (1969) recaptured *P. l. panamintinus* up to four years apart in the wild.

REPRODUCTION

P. longimembris generally breeds from January to August, with a peak of activity from March to May. Hayden et al. (1966) studied breeding in the laboratory in a population of little pocket mice collected in Whitewater Canyon (probably *P. l. bangsi*). Hayden et al. (1966) found gestation to be about 22 to 23 days, with extremes of 21 and 31 days. They also reported that young are capable of reaching sexual maturity and breed the same year they are born, as early as 41 days for females. Several studies suggest reproduction in heteromyids to be dependent on the availability of annual vegetation.

ACTIVITY

Daily Pattern – Little pocket mice stay in burrows during the day and surface only at night to forage. *P. longimembris* are most active in the first two quarters of the night (two to five hours after sunset), except for a small, secondary increase just prior to sunrise, and are usually inactive during the early morning hours (O'Farrell 1974, Chew and Butterworth 1964, Jorgensen and Hayward 1965, Kenagy 1973). *P. longimembris* has been found to be active in all quarters of the moon, although evidence from field and laboratory studies indicate that bright moonlight reduces overall activity of nocturnal desert rodents (Price et al. 1984). Price et al. (1984) describe observations of differential use of areas under shrubs and open spaces during periods of differing moonlight, suggesting microhabitat preferences by desert rodents. Thus, quadrupedal pocket mice (such as *P. longimembris*) are associated with shrubs and trees because they have sensory structures and morphology that place them more at risk in open spaces. Brown and Lieberman (1973) describe *P. longimembris* typically foraging in and adjacent to clumps of vegetation. O'Farrell (1974) also found the moon to have a negative effect, but that smaller, more cryptic species (such as *Perognathus* and *Chaetodipus*) showed less pronounced an effect as larger more conspicuous species.

Annual Pattern – Little pocket mice are the smallest mammals (excluding bats) known to hibernate (Bartholomew and Cade 1957). They hibernate in winter and are active above ground in spring, summer, and fall, and have a circannual rhythm of approximately ten months (French 1977). Their

annual pattern depends largely on an ability to regulate body temperature. The range of deep body temperatures of active individuals is 32.6 to 39.3°C . Fluctuations in body temperature correspond to activity of the individual. Higher body temperatures are related to periods of eating or digging, while lower temperatures with inactivity or sleep. Bartholomew and Cade (1957) showed that hibernation (winter torpor)/aestivation (summer torpor) are the same physiological phenomena and could be induced (within 24 to 36 hours) by removal of food and exposure to lower environmental temperatures (9°C). While the animal is becoming torpid, the temperature of its body declines rapidly to within a degree or less of the ambient temperature, thereby conserving energy by greatly reducing it's metabolic rate by decreased heartbeat and breathing. Although not a requisite for becoming dormant, the little pocket mouse normally stores food during all seasons. In contrast to other hibernators that accumulate fat reserves for hibernation, little pocket mice feed on seed caches.

Periods of dormancy have neither a daily or strictly seasonal pattern. In captivity, this species exhibited dormant activity each day within their burrows. The ability to become dormant/torpid for only a few nights or for the winter seems to be an important survival technique to meet short-term as well as seasonal periods of environmental stress. The period of inactivity varies between populations (Kenagy 1973). Kenagy (1973) found that the activity of *P. longimembris* differed in three consecutive winters, ranging from 0 to 5 months of inactivity. In 1969-70, the year of greatest survival (82 percent) and the largest population (27), they were active all winter. The precipitation in the season prior to winter was three times normal and plants produced a prolific crop of seeds. During the following two years the survival of animals in the spring decreased following a year of poor seed production. This suggests that less fit individuals and young of the year may be forced into winter activity due to low food availability.

Emergence from hibernation is not entirely understood but has been suggested to correlate with availability of forb and grass seeds (Meserve 1976). Studies have shown that even though food is available on the surface, these animals spent several months continuously underground. French (1977) suggested the gradual transition between underground and surface active phases is caused by the vertical uniformity of soil temperatures in the spring which may cue the synchronization of the circannual rhythm with the seasons.

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APPENDIX B
PEER REVIEW COMMENTS
AND STUDY TEAM REPLIES

Appendix B

Responses to Comments
By Scientific Peer Reviewers
Pacific Pocket Mouse Studies Program
Phase I Report
and
Phase II Study Design

The Pacific pocket mouse study team greatly appreciates the helpful comments received on the Phase I report for PPM recovery planning studies. The comments have helped invigorate the discussions and strengthen our approaches for helping recover this species. Following is a summary interpretation of the comments (full comment letters are attached), with the responses of the study team. Pertinent recommendations will be carried forward during future phases of the recovery research.

Dr. James Patton

1. *Comment*: Long-term studies are required to evaluate habitat suitability; and recovery planning should not be hurried if it precludes obtaining multiple year data.

   Response: The parties involved in recovery planning fully agree that multi-year research is required to fully evaluate habitat suitability, that populations naturally fluctuate over time, and that multiple year studies are superior to shorter-term studies as a basis for recovery planning. However, the agencies involved are prepared to act swiftly, if necessary, should data suggest that extant populations are in imminent danger of extirpation or of irreversible demographic or genetic losses. Consequently, some professional judgments must be made quickly regarding habitat quality and other factors before it is too late. These initial judgments should be tested via longer-term studies, so long as opportunities for recovery are not precluded by delay due to scientific uncertainty.

2. *Comment*: Consider using additional capture methods, such as hand capture at night using artificial light, to supplement use of Sherman live traps.

   Response: Systematic trapping grids using Sherman live traps provide some advantages where systematic sampling and consistency are desired. However, hand captures or other alternative methods may have merit for increasing overall capture success or for

capturing "trap averse" individuals or groups. Hand captures may also present a lower risk of injury or death to animals, and are therefore worthy of further consideration. The study team will investigate this technique for its potential use in capturing PPM for marking, translocation, or other actions.

Dr. Nicholas Holler

Phase I Report

1. *Comment*: Attempting to assess viability and recovery using population viability models (PVA) will be extremely difficult and inaccurate for a small rodent, in part due to the difficulty of obtaining accurate parameter estimates and due to the great sensitivity of the models to variations in these estimates. Consider using new IUCN criteria for assessing recovery goals.

   Response: The study team agrees with the comment. The recovery criteria were taken directly from the U.S. Fish and Wildlife Service Recovery Plan for the species. Our investigations to date support the caution that it will be extremely difficult to obtain accurate parameter estimates without intensive and long-term studies, which may themselves adversely affect the remaining PPM populations. The team will therefore review the IUCN criteria and discuss their use as an alternative to the PVA approach taken in the Recovery Plan.

2. *Comment*: Continue being cautious relative to initiating a translocation program, but be prepared to implement one quickly in the event any of the remaining populations are extirpated. Consider selecting donor animals from across the donor population, and be prepared to begin with very small numbers of individuals. Intensive trapping to show that the donor population is producing "surplus" animals may pose a greater risk than removal of small numbers of animals from the donor population.

   Response: The team agrees with the suggested approach. We will reevaluate whether trapping is necessary to verify that surplus animals are available at the Oscar One/Edson Range population prior to initiating a translocation program. We agree that if animals are captured for translocation, it is probably best to select individuals from across the occupied habitat area, rather than removing animals disproportionately from portions of the area. In the event that one or more extant populations are in imminent risk of extirpation, the team is prepared to recommend a rapid translocation program, subject to legal land use constraints.

3 *Comment*: (a) It is better to select adult animals during the peak breeding season for translocation, rather than subadults during the dispersal season, to increase the probability of success. (b) Take care in applying principles of translocation developed for carnivores to a rodent species.

Response: (a) The study team will strongly consider this recommendation. The recommendation for using subadults during the dispersal season was based on a desire not to adversely affect viability of the donor population. However, provided that a only a small proportion of the breeding population is removed, we agree that translocating adults will more likely result in successful establishment of a new population, due to higher survivorship and initial population growth. We will continue to evaluate what proportion of the breeding population could be safely removed from the donor population for design of a translocation program. (b) We agree that care must be taken in translating principles between taxa. The intent wasn't so much to rigidly apply the principles to PPM, but rather to use them as heuristics to ensure that we considered the breadth of relevant issues for design of a translocation program. We were unable to find similar comprehensive summaries for rodent translocation efforts.

4. *Comment*: PIT tags or sutures are unlikely to be less traumatic than toe clipping as a marking technique. PIT tags seem large for use on this species.

Response: The team was asked to evaluate all possible marking techniques, with a preference for avoiding "mutilation marking," such as toe clipping. Preliminary results of Phase II laboratory and field tests on surrogate species strongly suggest that toe clipping is the least traumatic and most reliable method available. So far, PIT tags are proving feasible, despite their large size, but we remain concerned regarding their long-term health effects.

5. *Comment*: Good success was had using radio collars on 12- to 15-g beach mice.

Response: The study team remains cautious concerning whether radio collars (or alternative telemetry attachments) are advisable on the smaller (7- to 9-g) PPM, relative to the usefulness of the data that might thus be obtained.

6. *Comment*: Continue surveying for potential translocation receiver sites and testing methods on surrogate species, but be prepared to move ahead with emergency translocations if extinction seems a possibility. Having multiple populations is the greatest hedge against extinction.

Response: We agree.

7. *Comment*: Is there no estimate of PPM litter size, number of litters, etc.? Do they breed postpartum?

Response: There is little information on reproduction in PPM, but data are available on other subspecies of *P. longimembris*, which presumably are similar. Hayden et al. (1966. Laboratory breeding of the little pocket mouse, *Perognathus longimembris*. J. Mammal. 47:4123-423) recorded 57 litters resulting from 217 arranged matings in captive *P. longimembris* (presumably *bangsi)*. Most females exhibited polyestrus cycles of approximately 10 days duration. Fifty-two of 80 females produced litters in a single season; 50 females produced 1 litter each, and 5 produced 2 litters each. Litter size averaged 4, with a range of 1 to 6. Litters were born from late March through September with a peak in May and June. Two instances of post-partum estrus were recorded (at 2 days and 4 days post-partum), both in females that ate the first litter shortly after birth. Three other females produced second litters after they entered estrus approximately 5 to 6 weeks after producing first litters. In summary, multiple litters are probably rare in wild PPM.

Phase II Study Design

1. *Comment*: Concur with Task 5 (Translocation Receiver Site Study).

Response: No response necessary

2. *Comment*: Keep an open mind regarding toe clipping.

Response: We are, and early results of the laboratory and field marking studies suggest toe clipping is a preferred method.

3. *Comment*: Consider using a larger grid size (perhaps 100 x 100 m) and greater inter-trap spacing (5 or 10 m) for field studies.

Response: Experience with PPM suggests that larger grids are unlikely to fit fully within pockets of occupied habitat; and greater inter-trap spacing may miss some individuals. Systematic trapping of grids at varying spacing in the Oscar One training area suggested that tighter spacing (in this case, 3 m) captures a higher proportion of the population in a shorter time than larger spacing (7 m or 10 m). Our preliminary results at the Snow Creek surrogate field site also support smaller spacing (in this case, 5 m versus 7 meters) as more suitable for this species. Where they occur, *P. longimembris* occur in high enough densities to obtain reasonable sample sizes on relatively small grids. We are currently recommending 5-m spacing as an appropriate grid design.

Dr. Howard Shellhammer

1. *Comment*: (a) Creating ten viable populations as called for in the recovery plan is very unlikely. (b) Consider improving habitat at the Oscar One/Edson Range to increase viability and increase the population size to serve as a donor. (c) The other populations seem unlikely candidates for improvement or survival.

   Response: (a) We agree. (b) Yes, it is biologically feasible to attempt increasing the viability and size of the Oscar One/Edson Range population via habitat manipulation; however, this is an active military training area, and the military does not necessarily want to expand the population and thereby constrain military training outside the currently occupied area. The military is not averse to using the population as a donor for translocations. (c) We agree that the other smaller populations are at great risk of extirpation and unlikely candidates as donor populations. However, habitat manipulations may increase these populations and their long-term viability.

2. *Comment*: Mitochondrial DNA alone will not fully test genetic diversity; other molecular techniques should be applied as well.

   Response: We agree. Dr. James Patton also intends to apply microsatellite techniques (nuclear DNA) to better characterize genetic diversity within and between PPM populations.

3. *Comment*: (a) Consider knotting surgical sutures used for marking to increase information content. (b) Consider marking tails with permanent dye or ink.

   Response: (a) We considered a knotting system to improve the number of unique codes possible with the suture technique. However, we first tested whether using surgical sutures at all was a feasible technique, and have decided that it is too traumatic and too impermanent for further consideration. (b) We considered similar uses of dyes or inks, but felt that they would not create a permanent mark unless applied subcutaneously (e.g., by tattooing) due to molt and skin slough.

Dr. William Longland

1. *Comment*: Is it possible to achieve 10 viable populations given that most of the extant occupied sites are too small to support larger populations that might be considered viable?

Response: We agree it will be difficult to achieve this goal. Translocations or reintroductions to other, larger sites, will probably be necessary, along with active management to increase populations at extant sites.

2. *Comment*: Multi-animal enclosures for soft releases may result in high frequency of agonistic encounters, due to the aggressive nature of heteromyids. Otherwise, enclosures should be sufficiently large to allow for natural spacing patterns, which would be difficult to keep predator proof.

Response: We agree, and believe that enclosures should be sufficiently large to contain multiple animals in near natural spacing patterns (e.g., perhaps 1/16 ha, which is a 25-m square). It may not be necessary or possible to exclude all predators. If predation or agonistic encounters prove problematic, then small, single individual enclosures that can be made predator proof may be feasible. This subject requires further discussion before translocations are attempted

3. *Comment*: Captive breeding of heteromyids is difficult due to inter-individual aggression.

Response: We recognize that heteromyids are not easy to breed in captivity. However, Hayden et al. (1966) successfully bred *P. longimembris* by briefly pairing males with estrus females and removing them if fighting ensued. As pointed out by Dr. Longland, other researchers have had varying success breeding other heteromyid species. We will consult with these individuals (e g., P. Behrends, M Daly, M. Wilson, S. Yoerg) in design of a breeding program.

4. *Comment*: It might be more useful to test field techniques on another species of pocket mouse that shares a similar habitat with PPM (coastal sage scrub), rather than another subspecies of *P. longimembris* in another habitat type (e.g., desert scrub). Vegetation structure might be more important to testing marking techniques than other factors.

Response: We felt that differences in species biology, including body size, outweighed differences in vegetation structure in selecting a surrogate for testing PPM field techniques. The study team felt that species behavior (e.g., grooming behavior) and burrowing substrate may have more effect on mark retention than vegetation type. Also, body size is a critical factor in testing marking techniques, and other coastal sage scrub pocket mouse species are considerably larger than PPM (15-21 grams versus 7-9 grams). Finally, using another subspecies of *P. longimembris* provides a closer proxy to PPM for obtaining basic biological information on the species, in addition to testing field techniques

5 *Comment*: Consider habitat management to enhance population densities at extant PPM sites or to create new habitat areas by, for example, thinning shrub densities.

Response: The team is currently performing experimental shrub density thinning at the Dana Point Headlands PPM site, and Marine Corps Base Camp Pendleton is considering similar work at the two San Mateo sites. Results of these studies will help guide future habitat management decisions in hopes of increasing population sizes.

6 *Comment*: Fluorescent powders cannot be followed for long-distance tracking of heteromyids, require heavy application, and are persistent in the environment, making repeated use at one site impractical.

Response: These observations are consistent with our personal observations, and we are not currently prioritizing this technique to study space-use and dispersal in PPM.

7 *Comment*: Studies of Argentine ants seem less relevant to PPM recovery than the other proposed studies and may not be a good use of limited research funds. What evidence is there that ants are a threat to PPM?

Response: Argentine ants were identified as a potential threat to PPM in the recovery plan, based on recent research showing pervasive community effects of this invasive species in the fragmented ecosystems of southern coastal California (see, e.g., Suarez, Bolger, and Case 1998. Effects of fragmentation and invasion on native ant communities in coastal southern California. Ecology 79:2041-2056.). In addition to indirect effects on animal populations via changes in plant communities, Argentine ants have been shown to prey directly on subterranean reptiles and amphibians, and may also prey on small mammals (Case and Suarez, personal communications). However, Argentine ants are generally restricted to habitat edges where landscape irrigation or otherwise artificially mesic conditions are created by human development. Because PPM are restricted to well-drained soils, Argentine ants are not currently thought to be a major threat in PPM habitat. Consequently, current research funding is not being directed to this task, although the USFWS maintains that studying effects of Argentine ants should eventually be a component of the overall recovery effort for PPM.

8 *Comment*: It would be useful to consider whether the assemblage of rodent species at potential translocation sites is typical of the rodent community that coexists with PPM at extant sites. Other species may be indicators of good translocation receiver sites or may be strong competitors with PPM.

Response: We agree. Field efforts planned for Phase III (year 2000) will include trapping to characterize rodent communities at potential receiver sites in comparison with extant sites In general, extant PPM sites seem to have low rodent diversity, with PPM being the most frequently captured species where they occur.

9. *Comment*: Important considerations in getting heteromyids to accept artificial burrows include tunnel diameter and the number of entrances and chambers. It also helps to create natural surfaces for the animals, such as by gluing sand to artificial tubes.

Response: We appreciate this helpful information, and will seek more advice in designing artificial burrows if this technique is used in PPM recovery.

10. *Comment*: Hair clipping as a short-term marking technique causes a pelage color contrast that may make animals more conspicuous to predators.

Response: We agree. For short-term marking we prefer use of indelible markers under the chin.

UNIVERSITY OF CALIFORNIA, BERKELEY

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28 May 1999

Dr. Christina Schaefer
KEA Environmental
1420 Kettner Boulevard, Suite 620
San Diego, CA 92101

RECEIVED
BY:

Dear Christina:

In your letter of nearly two months past accompanying the Phase I Report for the Pacific Pocket Mouse Studies Program, you said that you would accept my comments at any time. I suspect you were not expecting to wait this long! My apologies. My time this spring has been virtually nonexistent, and now I leave on Monday for 5 weeks in Iran.

I have read the report through at least twice. In general, I find the program well conceived, the recommendations completely justified, and the overall tone appropriately measured. Serious and long-term populational studies are required before any recovery can be envisioned. All parties must be cognizant of this need, and there should be, therefore, the necessary efforts placed to obtain the requisite information for each of the four Tasks identified.

I have a number of minor points that I've written in various parts of the report, but I am not sure how valuable these would be at this point. My general cautionary comment is that one should be careful of leaping to conclusions (for example, that one habitat patch is optimal, another marginal) based on the very limited data available. In my experience trapping pocket mice over the past nearly four decades, they are sometimes quite common, other times not, in the same spot. There is a natural wax and wane in all populations, as local resources in one spot are consumed and then regenerated. To effectively evaluate the suitability of habitat, one needs to take a much longer term perspective than a single year's trapping data. In short, long-term population data are needed. This is obvious to all, I'm sure, but my cautionary point is that the agencies involved in recovery should not be in such a precipitous hurry so as to preclude the opportunity to obtain such multiple year data.

I do have one suggestion that is not mentioned in the report that might facilitate field studies to assess habitat use and even make estimates of population parameters. These, as with other small-bodied silky pocket mice, were frequently caught by hand by old-time naturalists using only a lantern for light. In many cases,

hand-captures were considerably more successful than simultaneous use of Sherman live traps. I used this method in my youth with great success, walking the desert floor with a Coleman lantern and a partner to help both spot and capture animals. Don't just rely on trap methods; there are others that can be employed with great effect by an experienced field investigator.

Again, my apologies both for the lateness of this response and for its sparseness. I can respond in more detail after I return to the US in early July, should that be of use.

Sincerely yours,

James L. Patton
Acting Director and Curator
Professor of Integrative Biology

Comments of Nicholas R. Holler
Pacific Pocket Mouse Studies Program
June 7, 1999

PHASE I REPORT (TASKS 1 AND 3):

I have reviewed subject report and am impressed with the care and thought put into development of this effort. The identified tasks are important and the overall approach seems sound. Having worked with an endangered mouse in similar habitat I am empathetic to the constraints under which you labor. I do have some thoughts which are presented below. These are offered for your consideration, and not as a criticism of your approach.

1. I predict that you will have great difficulty determining when you have achieved recovery criterion 1 as listed on page 9. PVA with a small rodent will at best be a gross estimate of survival probability due to highly fluctuating populations and the extreme difficulty, if not impossibility of obtaining some essential data. In working with *P. polionotus* we have found models to be very sensitive to neonatal and subadult survival. Obtaining reliable field data on these parameters is practically impossible. Without accurate estimates of these parameters, predictions of probability of persistence will be dependent and quite sensitive to the estimates which you provide. PVA may be helpful, but I'm not sure that you should show it as a criterion. It implies an ability at prediction that I do not believe you will be able to achieve. Using the new IUCN criteria might be a better approach.

2. I feel you are correct in being cautious relative to initiation of a translocation program (page 12), provided you do not feel that extinction is imminent. Given the population at Oscar One/Edson range, I would be inclined to move forward if a population at one of your currently occupied sites became extinct. We were faced with this situation with Perdido Key beach mice (*P. p. trissylepsis*) and translocated from a very small population. The population that we reestablished is now the only existing population of that subspecies. Had we not made the translocation we would have had an extinction. We were successful with initial translocations of only 3 pairs of mice. By selecting animals spread across the population, we minimized potential genetic impacts to the donor population. It may be quite a while before you are able to obtain data to reliably show that a population is losing "surplus" individuals during dispersal (page 21). In fact, intensively trapping to obtain that data might pose a greater risk than removal of small numbers of animals from a population such as that at Oscar One/Edson range. You acknowledge this on page 38, last paragraph.

3. I disagree with your suggestion that late summer or early fall may be the best time to translocate, and I would not select subadults for translocation. We preferentially moved beach mice in late fall/early winter during peak breeding. Our desire was to obtain reproduction from the translocated mice during the breeding season of translocation. (Beach mice show some reproduction all year, but there is a definite lull in summer). We believed that given the high mortality of mice, there would be better opportunity success if translocation were made with adults towards the beginning of the period of peak reproduction.

I also think that you should be careful in rigidly applying the principles of translocation from Miller et. al. (1999) which were developed to guide translocations of carnivores.

4. With respect to marking techniques (pages 31-32), I'm not convinced that use of pit tags or sutures will be less traumatic than toe-clipping. This seems more a political decision than one based on data or experience. The pit tag seems quite large, but your plan to test this and other techniques on surrogates is good.

5. We have had good success with radios attached by collars. Our adult mice weigh about 12-15 g. Mike Wooten could give you current information on this.

6. Your plan to survey for potential relocation sites seems quite good. Also, your plan to begin studies of a surrogate subspecies, followed by intensive study of the PPM. Again, I would move ahead with translocation attempts if extinction seemed a real possibility. With beach mice, I feel that our greatest hedge against extinction is having multiple poulations.

7. Relative to PPM Biology, is there no estimate of litter size, number of litters, etc.? Do they breed postpartum?

PHASE II:

Again, your overall plan looks good; I'm impressed with your effort to think things through.

1. Task 5. I concur.

2. Task 6. I concur. I note that you are using toe-clipping here. I suggest that you keep an open mind relative to its use in the field.

Task 7. I concur, but suggest consideration of the following (recognize that I have never trapped PPM and defer to your experience):

a. Grid size seems small. Would you consider a grid of 100 X 100 meters?

b. In conjunction with above, might you gain more information if you used spacings of 5 meters and 10 meters. A 10 meter spacing, if adequate for survey purposes would allow you to cover a good bit more ground with the same effort.

To: Wayne Spencer, Ogden Environmental
FAX 619-458-0943

From: Howard Shellhammer, Biol Sci., S.J.S.U.

Date: April 27, 1999

Subject: Comments on Peer Review Draft, Pacific Pocket Mouse Studies Program.

1. Sorry to be so slow. Lost my wife of 47 years and after a very difficult seven year illness four weeks ago and since then my brain has been mush. Did read the report yesterday and have but a few comments at this time. As my head clears and I can think better, I'll pass along my information to you.

2. My first impression is that it is highly unlikely to create the ten viable populations called for in the recovery plan. My guess is that you could only use the Oscar One/Edison Range population as the base population. Is it possible to improve the habitat in that particular area to increase the likelihood that it will survive and expand? Many of the other populations now extant seem unlikely candidates for improvement, or even survival over time.

3. Jim Patton is certainly the expert on population genetics but I do suggest you use more than one molecular technique to test the subspecies' genetic diversity. You telegraph mtDNA in your use of the term "haplotypes" but I doubt is that technique alone will give you what you are looking for.

4. A minor point but can the surgical suture material that projects from the body be knotted and hence increase its information contents. And could the sides of their tails be marked with dots of permanent dye or ink, again allowing several dots on each side and hence good information content (maybe not a decimal system but better than nothing, and that is almost what you are faced with). And yes, I know their tails can be easily pulled off but I do not think such a marking system would cause them much stress.

Spencer, Wayne, D.
From: Bill Longland [SMTP:longland@scs.unr.edu]
Sent: Wednesday, April 28, 1999 12:22 PM
To: Spencer, Wayne, D.
Subject: Pacific Pocket Mouse peer review

Dear Wayne:

Below are my comments concerning the PPM Studies Program, Phase 1 Report. The comments pretty much follow the order in which the relevant meterial occurs in the report, so the order has nothing to do with their relative importance. Hope you find these useful.

Regards,

Bill Longland

William S. Longland
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Longland's Comments on "Pacific Pocket Mouse Studies Program,

Phase 1 Report"

1. Reclassification/Delisting criteria (p. 9-10) -- Are there even 10 existing areas of appropriate habitat remaining that are large enough to support independently viable populations? It sounds apparent that most of the known sites with extant populations are too small to support significantly larger populations, yet even these existing populations must be significantly larger before they might be considered viable.

Task 1 -- Evaluate the feasibility of translocating PPM:

2. Soft releases (p. 18) -- Heteromyids are aggressive and there would likely be a high frequency of agonistic interactions in a multi-animal enclosure. Perhaps this problem could be reduced if sufficiently large enclosures were maintained to allow numerous animals to live inside with somewhat natural spacing patterns, but this would require a rather sizable enclosure, and it would probably be difficult to keep such a large enclosure predator-proof.

3 Captive breeding (p. 20) -- This makes it sound like captive breeding is fairly easily accomplished and that the main problems arise from releasing captive-bred animals. However, just breeding heteromyids in captivity is a very difficult task, as they generally fight when paired in captivity (aggression, even among male/female pairs, is mentioned in other parts of the report). Captive breeding programs for research or conservation purposes have been attempted with kangaroo rats by Martin Daly and Margo Wilson (McMaster University, Ontario, Canada), by Sonja Yoerg (UC Berkeley), and by Amy Barber (PhD student at Univ. of Nevada, Reno), and I think all of these researchers would agree that breeding k-rats (and probably other heteromyids) in captivity is anything but straightforward.

4 Perfecting field methods on surrogate subspecies of P. longimembris (bottom, p. 23) may be of limited value with subspecies that occur in a habitat that differs dramatically from PPM

habitat. P. l. bangsii, from Coachella Valley, may live in areas of "desert scrub on sandy soils", and this may sound similar to the habitat of PPM ("coastal scrub on sandy soils"), but these coastal and desert habitats are very different despite both occurring on sand. Shrub densities, for example, differ extremely, and this could easily affect the utility of some novel marking technique for individual identification of animals (e.g., monofilament or suture material might get tangled or pulled out more easily in the higher shrub and herbaceous understory densities typical of coastal habitats as compared with deserts); there are myriad other differences between these habitat types, as well, that might compromise the utility of transferring a field method from one habitat to another. Perhaps it would be more useful to test these field methods on another pocket mouse that lives in coastal sage scrub (e.g., C. fallax).

4(cont.)

One possibility not entertained in this part of the report is habitat tailoring and managing for suitable PPM habitat as a means to potentially enhance population densities of existing populations or to create new habitat areas. For example, it sounds as if reduction of shrub densities might make an area more desirable for PPM if it has sandy soils.

5

Task 3 -- Determine dispersal characteristics of PPM:

Fluorescent powders—Unless there is a heavy application, I've found they can't be followed for much more than 25-30 m before the trail fades out. We've been able to follow k-rat trails for up to about 80 m using bait stations dusted with heavy applications of powder (see Longland and Clements. 1995. Use of fluorescent pigments in studies of seed caching by rodents. J. Mammal. 76:1260-1266). Also, powders often persist in the environment for a long time, making repeated use at the same field site impractical (see Halfpenney. 1992. Environmental impacts of powdertracking using fluorescent pigments. J. Mammal. 73:680-682).

6.

Argentine ant studies (e.g., mentioned on p. 44) -- Does this really make the best use of limited PPM research funds? What evidence exists that they are a potential predator of or threat to PPM? Are they known to be a threat to other small mammal taxa or to other small ground-dwelling vertebrates (e.g., herps)? Perhaps my skepticism about this is just due to my naivete about these ants, but aren't there other insects that have invaded S. California that might be as likely to threaten PPM? Why not fire ants or killer bees? It just seems to be less directly relevant to the PPM recovery effort than the other proposed studies.

7.

Potential translocation sites (p. 43-44) -- It might be useful to consider whether the assemblage of rodent species at potential translocation sites is typical of the rodent community that coexists with PPM at extant PPM sites. For example, there may be other species (e.g., a k-rat—D. agilis or D. merriami?) that have similar substrate and habitat affinities, and therefore may provide a useful indicator that a potential translocation site could be appropriate for PPM. Or, you might want to consider whether there is another small pocket mouse species (a species similar enough to PPM that they may compete strongly—C. fallax?) already occupying a potential translocation site.

8.

Artificial burrow design tests in enclosed population (p. 47) --

I've done some playing around with designing artificial burrows for use in the field with k-rats, pocket mice (including P. longimembris), and kangaroo mice, and have had varying success at getting the animals to accept these surrogate burrows in field enclosures. Important points seem to be the opening size of the tunnel into the burrow (it shouldn't be much larger than the minimum necessary for the rodent species concerned), 2 entrances/exits (not just one), and multiple chambers or some complexity inside the burrow. Also, heteromyids don't like to walk across smooth, unnatural surfaces, so tubes used for burrow tunnels should be coated with sand (I apply Elmer's glue to the inside of the tubes, then coat it with sand).

9.

Hair clipping (as a short-term marking technique—p. 49) causes a contrast in pelage color that may make the animals more conspicuous to visual predators.

10.

Spencer, Wayne, D.

From: Bill Longland [SMTP:longland@scs.unr.edu]
Sent: Thursday, April 29, 1999 3:03 PM
To: Spencer, Wayne, D.
Cc: longland@scs.unr.edu
Subject: RE: Pacific Pocket Mouse peer review

Dear Wayne,

Let me try to answer the questions you posed in your response to my review (#s correspond to your numbered responses).

2. Yes, I agree that a few large multi-individual pens would probably be better than a bunch of small single-individual pens for potential soft releases. I guess the idea would be to allow some degree of social interactions to occur rather than an artificial situation of individual isolation, and to attempt to make pens large enough that at least a few individuals could get along in them, yet small enough that predator exclusion won't be a big problem.

4. You didn't ask a question about this, but I have a few thoughts about your response. I agree with the logic that using a proxy subspecies of P. longimembris has the advantage of providing some much-needed life history data about the species, even if the habitats of the surrogate subspecies differs a lot from that of PPM, and that may be sufficient justification for doing just that. However, I strongly suspect that above-ground habitat features will have a larger effect on utility of field methods (especially testing different marking techniques) than species identity. Of course, I'd also want to keep the species as similar as possible. So, I believe (and I fully admit that this is based largely on gut feelings and anecdotes from my field experiences in coastal sage scrub vs. desert habitats) that C. fallax would be a more instructive proxy for PPM than a desert-dwelling P. longimembris subspp. It's true that fallax is perhaps twice the body weight of PPM, but they live in similar habitats, probably have very similar burrow structure, etc.

8. Yeah, it's also been my impression that where you find high densities of P. longimembris (or any other pocket mouse spp. for that matter), you tend to find few individuals of other spp. I guess a simplistic interpretation is that these are the places that (for what ever reasons) are optimal pocket mouse habitat. Perhaps, then, it would be worthwhile to consider what other rodent (especially heteromyids?) spp. might co-occur in suboptimal habitats where PPM still exists—the Edson Range sounds like such a place.
9. I don't have any drawings or written descriptios of the burrows we've played with. Actually, to give credit where it's due, my colleague, Steve Vander Wall, has done most of the construction, but it's been our collective experiences and impressions of what the rodents are looking for in a burrow that has guided the variations we've tried on our basic design. The basic design is a large plastic bucket with a tight-fitting lid (I believe they're 5 gal.—the type you'd get large thing of paint or water-proofing sealant in). We drill a bunch of holes in the bucket to allow it to "breath" with the surrounding soil when it's buried. Then we put 3-4 different horizontally-oriented levels or floors into the bucket (each floor being made of ¼" plywood) with two holes in each floor to allow mice to easily move from one floor to the next—we glue small supports around the sides of the bucket to support each floor and make it so the floors can be lifted out of position easily. We use PVC tubes to make tunnels from the ground surface to the bucket, which is buried underground, and pivoting 45 degree PVC elbows attached through the side of the bucket to fit the tunnels into the bucket. Since the elbows and PVC tunnels can pivot, it's easy to adjust the precise angle and location of the tunnel opening, and to customize these for each burrow when burying them. We put one elbow/tunnel combination through to the top floor of each burrow and one to the bottom floor—then if a snake comes in one or the other entrance, the mouse can move either to the extreme top or bottom to escape. As I mentioned yesterday, the tunnels should have sand covering the insides to make a somewhat natural surface for the mice—I coat them with Elmers glue, then with sand, to keep it in place. For P. longimembris, I'd probably try PVC tubes for tunnels with a ¾" opening to start—I've watched P. longimembris go through the

squares of ½"-mesh hardware cloth. Call me if you want to discuss any more details, but that's the basic recipe.

10. I have no direct evidence that hair clipping affects predation rate, but I'd be surprised if it didn't make animals more conspicuous to nocturnal visual predators, like owls. I know you have to mark them somehow, and I agree that other methods probably also increase conspicuousness, but I'd think that an indelible marker would make them less conspicuous than hair clipping. At the same time, if you need to observe animals using night vision equipment, you probably won't be able to see marks made by ink markers very well. But, if you only need to see the marks at dawn or under artificial light, indelible ink should suffice just fine (you could even mark animals' bellies only, so that the mark wouldn't be visible to a predator), yet probably be less noticable to an owl (or fox?) than the contrast in color resulting from clipped hair. I'll never forget my first experience with marking Stephens' k-rats shortly before they were listed. After my first day of marking with eartags, I collected pellets from a nearby burrowing owl mound the second morning of trapping, and found the tags of the first stephensi I had marked inside an owl pellet—I think the eartags made the animal more conspicuous.

As for design of study grids, that depends on whether you feel like you need fairly precise estimates of absolute population density or whether a simple count of animals or index of relative abundance will suffice. I think it's fair to say that most mammalogists would recommend a trapping web (a series of transects radiating out from a central point) to get good estimates of poulation density. They allow adjustments of density estimates for the effective area trapped based on animal movement distances and differences in trap spacing between inner and outer parts of the web. I can't honestly say that I'm intimately familiar with this literature, but I think Mike Rosenzweig authored some of the first papers on the trapping web approach to density estimation. It sounds like the trapping design of O'Farrell's that you propose to use (grids with additional lines radiating out from the corners) is a variation on this web concept, but you might want to thoroughly review this literature before settling on a final design. I generally do not care about getting precise density estimates in my studies (only relative abundance of different spp. or of a single sp. at different times, etc.), so I just use standard grids instead of webs. As for grid designs, my only suggestions are simplistic ones that you've no doubt considered—appropriate trap spacing for the animals concerned (your proposed 5 m sounds reasonable); 2 traps per station, so you don't miss a PPM at a given spot if the trap there is already occupied by another sp. And my only suggestion for collecting life history information while trapping is the same I give to all my students who include any trapping in their studies—get every kind of data you can think of that might be even remotely relevant, yet not risk harm to an animal (species, sex, adult or juvenile, ID # or color, body mass, reproductive condition, new capture or recap., note any injuries or the presence of ticks or any noticable marks on the animal).

Regards,

Bill

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APPENDIX C
RECOMMENDED PHASE II SCOPE OF WORK

Appendix C

SCOPE OF WORK
PACIFIC POCKET MOUSE STUDIES PROGRAM

PHASE II

Phase I of the Pacific pocket mouse studies program concluded with a recommendation for several Phase II studies:

1. A systematic review of potential translocation receiver sites.

2. An intensive, multi-year study of a permanently marked population of a non-listed subspecies of *P. longimembris*. This surrogate study would be designed to test field techniques before applying them to PPM, to obtain basic biological information for design of a population viability model and PPM translocation protocols, and potentially to test alternative translocation methods,

3. An intensive, multi-year study of a permanently marked population of PPM, based on results of the surrogate studies.

4. A population genetics study on PPM to characterize genetic diversity and determine genetic goals for PPM recovery.

5. Continued monitoring of extant PPM populations, with methodological modifications based on the above studies.

This scope addresses those Phase II studies proposed for funding by the TCA during 1999. Specifically, TCA has proposed to fund a GIS analysis of potential translocation receiver sites and intensive studies of two surrogate subspecies (one in captivity, the other in the field). Other tasks considered above (field study of potential translocation receiver sites, genetics study, and continued monitoring) are being funded separately by USFWS and CDFG. The intensive field study of PPM must await results of these Phase II studies.

Review of Potential Translocation Receiver Sites

This study involves two phased tasks, the first of which (Task 5) is proposed for funding by the TCA, and the second of which will be funded by Section 6 money directed to Shana Dodd and Steve Montgomery through the SDSU Foundation. Task 5 is a coarse-filter GIS analysis to identify potential translocation receiver sites using available digital data. These results will be used to direct field researchers performing the field work using Section 6 money. The field efforts (not funded by TCA) will better characterize habitat suitability and will be used to rank the potential sites identified by Task 5.

Task 5. GIS Model to Identify Potential Receiver Sites

Soils and vegetation types will be rated by the PPM research team for potential to support PPM, based on current knowledge and ongoing studies by the USFWS and others. This rating system would be conservative to avoid prematurely eliminating sites due to inadequate data or inappropriate mapping scales. For example, existing digital USDA soil maps are relatively coarse in scale, and may omit small pockets of suitable soils within a matrix of other, less suitable soils (such as occurs on the Edson Range). UC Riverside soil scientist, Dr. Robert Graham, will assist this effort to help the team identify those soil types that may support PPM or that may have unmapped inclusions of suitable soils. The GIS would then overlay the rated data layers to create coarse-scale habitat suitability maps for PPM. Such efforts have already been performed piece-meal for portions of the PPM's range, such as on Camp Pendleton (by Ogden Environmental), within the Multiple Habitat Conservation Planning (MHCP) area (by Ogden and SANDAG), and within southern Orange County (Pavelka pers. comm.). This exercise would involve collating these independent assessments into a comprehensive data set and analysis, and subjecting the results to scientific peer review.

A preliminary gap analysis would also be performed by overlaying land uses and land ownerships onto the coarse-scale habitat suitability map. Of particular interest would be land areas currently in open space, or identified as probable wildlife preserve areas by ongoing regional conservation planning efforts. Candidate areas for translocation receiver sites would be identified as those that are sufficiently large, with suitable PPM habitat characteristics, and having compatible land use and land management plans. These areas would then be field checked by Steve Montgomery and Shana Dodd on their existing Section 6 contract with the CDFG.

Surrogate Subspecies Studies

Two separate but related study approaches are proposed to answer critical questions prior to initiating an intensive field study of PPM. The first (Task 6) is designed to test alternative marking methods on a captive population of a non-sensitive subspecies of little pocket mouse, *P. l. longimembris*. The second would involve capture-mark-recapture methods on a free-roaming population of another subspecies, *P. l. bangsi*, in a setting conducive to intensive experimental observation.

Task 6. Marking Study Using Captive *P. longimembris longimembris*

P. l. longimembris will be collected in the Mojave Desert for use in captive studies. *P. l. longimembris* was chosen as a logical surrogate for PPM due to close taxonomic and body size relations and its lack of sensitivity status.

Three to four marking techniques would be tested on the surrogate species in a laboratory setting. The animals would be divided into test groups (approximately 10 individuals for each marking techniques) and a control group. Therefore, about 50 to 60 *P. l. longimembris* would be collected from the field, individually housed, and cared for in a controlled laboratory setting. The laboratory could be the BioAssay Laboratory at Ogden Environmental and Energy Services in San Diego, California, approved animal holding facilities at San Diego State University, or another suitable site.

The animals would be fed mixed birdseed, occasional greens, and ad-lib water. Natural sand substrate (unwashed sand for dust bathing) and nesting material would be provided to simulate natural conditions.

The marking techniques applied in the lab will include (1) commercially available PIT tags, (2) color-coded monofilament sutures, (3) specially designed and manufactured ear tags, and (4) toe clipping. A veterinarian would demonstrate and teach Shana Dodd, Wayne Spencer, and Steve Montgomery the PIT tag and suture techniques (any additional researchers would also learn directly from the veterinarian, subject to prior approval by CDFG). After application of marks, the test and control groups would be observed for adverse health effects or behaviors frequently (at least every other day) for approximately one month, and periodically thereafter. Notes on animal condition will be taken regularly, and animals will be weighed at least weekly. Other measures of health and vitality that may be suggested by the veterinarian would also be considered.

The captive individuals would be kept indefinitely for future Phase III studies, including tracking of tag retention over the life span (approximately 4 to 6 years). The captive colony could also serve as a surrogate captive-breeding colony to test breeding protocols for application to PPM if a captive breeding program and reintroductions are deemed necessary by the wildlife agencies (Phase III).

Task 7. Field Study on *P. longimembris bangsi*

Objectives—This task has multiple objectives, and will be phased relative to funding, results of early phases, and potentially changing priorities for PPM research. This scope of work outlines the objectives and design for Task 7 during 1999, with the understanding that funding and design of additional research tasks using the surrogate species may depend on results of this task during 1999. The primary objectives for Task 7 are as follows:

6. Field test the various marking and tracking techniques proposed for potential use on PPM. This would follow closely after and complement the laboratory studies performed on *P. l. longimembris*. Field testing of tagging methods found promising during laboratory testing will help determine success of various methods under natural conditions. This is important, because such factors as social interactions, burrowing, and exposure to predators cannot be adequately simulated in the laboratory setting, but they may affect mark retention or affect animal health or mortality differently in marked animals.

7. Collect, on a surrogate subspecies, basic natural history and demographic information relevant to PPM and perfect techniques for collecting such data (e.g., different trapping grid designs) before trying them on PPM. With this surrogate information, a draft PPM population viability model could be prepared for later refinement, once the relevant parameters are available for PPM.

Additional useful information would be obtained incidental to these major goals, as allowed by funding and schedules. For example, information on movements and possibly dispersal may be obtained from replicate trapping grids on the surrogate study site. The team may also experiment with other techniques for collecting movements data, such as fluorescent powders applied to burrows, as time and budget allow.

Location—This study would be performed at the Snow Creek site selected by the study team during the March 29 field trip. The site is adjacent to the Snow Creek Ecological Reserve, administered by UC Riverside. It seems ideal for a potentially long-term and intensive field experiment, because it has an abundant population of *P. l. bangsi*, allows easy access, and lacks evidence of high trespass or disturbance incidence from humans (i.e., little evidence of off-road vehicular activity). The site also has a large expanse of high quality and relatively homogeneous habitat, but with a gradient from steeper, more open scrub habitat to flatter, denser scrub habitat. This setting allows the potential to set up replicate grid systems and to test effects of habitat factors or population densities on the measures of interest.

Methods—Due to funding and schedule limitations, efforts during 1999 will be limited, with primary goals of establishing and trapping grids at differing trap densities to (1) compare grid density results, (2) mark individuals, (3) begin collecting demographic data, and (4) collect tissue samples for genetics work. Captured animals will be marked with one or more of the techniques discussed above, guided by initial results of the captive studies.

Initially, two permanent trapping grids will be established in the field. Grids will be designed to test optimal trap spacing as well as to collect demographic, genetics, and natural history data on marked individuals. Each grid will be about 1/2 ha (70 x 70 m) in size with corners marked by rebar. Grids will be spaced at least 100 m apart to avoid frequent movements by individual mice between grids, but to allow for potential dispersal movements between grids. The two grids will be established in similar habitat (vegetation composition and density), along the same elevation contour. This design should minimize habitat variance between grids, while allowing for future expansion of the study with additional grids along the habitat gradient (across contours) if funding and study goals allow.

Trap density will differ between grids to help determine the optimal trap spacing relative to study goals. Defining "optimal" spacing depends directly on what is being optimized (i.e., what are the study goals?). This study is therefore designed to test optimal grid spacing relative to two different goals, both of which are important to PPM recovery research:

(1) <u>Maximize capture probabilities per individual mouse and the proportion of the total population captured per trapping period.</u> One ultimate purpose of study grids, either for the surrogate or for the PPM, is to obtain accurate demographic data on a marked population of individuals, including all sex and age classes. Because a significant proportion of the population must therefore be marked and recaptured, optimal trap spacing can be defined as that which maximizes individual capture probabilities and the proportion of the total population captured during each trapping period. This goal will therefore probably require high trap densities and relatively long trapping durations.

(2) <u>Maximize catch per unit trapping effort, and thereby minimize census costs per capture</u>. Although higher trap densities capture more animals, they do so at diminishing returns (Skalski and Robson 1992). Therefore, the optimal use of limited funding to census pocket mouse populations will generally require relatively lower trap densities than for goal number one, and may require shorter trap periods.

To determine optimal grid densities for these two goals, one study grid will be assigned a trap density of 100 trap stations (at 7-m spacing) and the other 196 trap stations (at 5-m spacing). All trap stations will be set with two traps each. Having two traps per station allows for higher trap success on the target species (*P. longimembris bangsi*) given that non-target species (e.g., *Dipodomys merriami*) enter a trap at a station before the target species has an opportunity. These grids will be trapped once in 1999 for up to eight nights. All captured individuals will be marked using one or more suitable marking methods, based in part on results of the laboratory study.

Cumulative captures will be tracked for total individuals and for newly captured (not previously marked) individuals to determine the asymptote in capture rates and probabilities of individual capture for each grid density. Results will also be tested using the methods of Skalski and Robson (1992), or other suitable statistical methods, to determine captures per unit effort and to estimate proportion of total population captured.

The grids will be retrapped in the year 2000 (Phase III) using the same grid densities, but switching grids. This ensures that differences between grids do not systematically influence capture probabilities (Skalski and Robson 1992). If study priorities and budget allow, additional grids (and densities) could be added in the year 2000 to better quantify capture success.

Task 8. Meetings

Principal Investigator Wayne Spencer and Project Manager Christina Schaefer will attend up to seven meetings with the TCA and other team members.

Task 9. Phase II Report

Results of Tasks 5 through 7 will be summarized in a brief progress report for review by the Scientific Peer Committee. The report will also recommend Phase III studies (beginning in the year 2000) based on Phase I and II results.

appendix c.wpd

United States General Accounting Office

GAO

Report to Congressional Requesters

May 2004

DOD OPERATIONAL RANGES

More Reliable Cleanup Cost Estimates and a Proactive Approach to Identifying Contamination Are Needed

G A O

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GAO-04-601

May 2004

GAO
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Highlights

Highlights of GAO-04-601, a report to congressional requesters

DOD OPERATIONAL RANGES

More Reliable Cleanup Cost Estimates and a Proactive Approach to Identifying Contamination Are Needed

Why GAO Did This Study

For decades, the Department of Defense (DOD) has tested and fired munitions on more than 24 million acres of operational ranges. Munition constituents such as lead, trinitrotoluene (TNT), and perchlorate may cause various health effects, including cancer. Concerned about the potential cost to clean up munitions, Congress required DOD to estimate the cost to clean up its operational ranges.

You asked GAO to determine (1) how DOD identified the location and last use of operational ranges and the basis for DOD's cost estimates for cleaning up those ranges; and (2) DOD's policy to address contaminants linked to the use of munitions on operational ranges and, where contaminants such as perchlorate have been detected, what corrective actions the military services have taken.

What GAO Recommends

GAO recommends that DOD (1) revise its cost estimates for the cleanup of operational ranges using its most complete range inventory and a consistent estimating methodology, and (2) provide specific funding for sampling at sites where perchlorate contamination is likely, in accordance with DOD's policy requiring sampling.

In commenting on this report, DOD disagreed with GAO's findings and recommendations. GAO believes its findings are sound and its recommendations are appropriate.

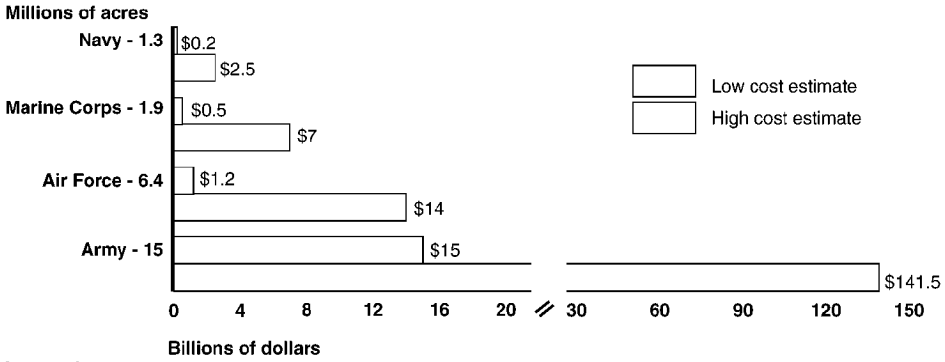
www.gao.gov/cgi-bin/getrpt?GAO-04-601.

To view the full product, including the scope and methodology, click on the link above. For more information, contact Anu MIttal at (202) 512-3841 or MittalA@gao.gov.

What GAO Found

DOD identified the location and status of its operational ranges based on inventory data developed by the individual military services. However, the reliability of DOD's inventory is questionable because the services did not use a common framework to collect and analyze data on the number of existing operational ranges. Because DOD's cost estimates to clean up its operational ranges were based on individual service calculations that combined inventory data with unvalidated DOD cost assumptions, various service assumptions, and computer-generated cost rates, these cost estimates are also questionable. Specifically, GAO found that each service compiled inventory data using various methodologies over different time periods and developed cost estimates using a mix of differing assumptions and estimates, along with actual data. As a result, the services' estimates to clean up an acre of highly contaminated land vary from about $800 for the Air Force to about $7,600 for the Army. The figure below shows high and low cost estimates and range acreage used to estimate costs, by service.

High and Low Cleanup Cost Estimates and Total Range Acreage by Service



Source: DOD.

DOD does not have a comprehensive policy requiring sampling or cleanup on operational ranges for the more than 200 chemicals associated with military munitions. However, when required by the Safe Drinking Water Act or other environmental laws, DOD has sampled and cleaned up munitions and munitions constituents. With regard to perchlorate, DOD has issued sampling policies but cannot assure funding is provided for such sampling. In some cases, DOD has sampled for perchlorate when required under the Safe Drinking Water Act's Unregulated Contaminant Monitoring Regulation and for other contaminants when directed by state environmental agencies. However, DOD generally has not independently taken actions specifically directed at cleaning up munitions contaminants, such as perchlorate, on operational ranges when they have been detected.

Contents

Letter

	1
Results in Brief	3
Background	6
DOD's Inventory and Cost Estimates for Operational Range Cleanup May Not Provide Congress with a Reliable Picture of Potential Liabilities	15
DOD Does Not Have a Comprehensive Policy on Contaminants Associated with Military Munitions and Has Not Specifically Cleaned Up Known Perchlorate Contamination	24
Conclusions	31
Recommendations for Executive Action	31
Agency Comments and Our Evaluation	32

Appendixes

Appendix I:	**Safety, Environmental, and Human Health Risks**	36
Appendix II:	**Scope and Methodology**	38
Appendix III:	**Installations That Were Cleaning Up Perchlorate as a Result of Demonstration Projects**	40
	Edwards Air Force Base	40
	Naval Surface Warfare Center, Indian Head	40
Appendix IV:	**Installations That Identified Perchlorate as a Result of Munitions Research, Manufacturing, Testing, and Disposal Activities**	42
	Edwards Air Force Base	42
	Holloman Air Force Base	42
	Naval Surface Warfare Center, Indian Head	42
	Redstone Arsenal	43
	White Sands Missile Range	43
	Naval Air Weapons Station, China Lake	44
Appendix V:	**Comments from the Department of Defense**	45
Appendix VI:	**GAO Contacts and Staff Acknowledgments**	48
	GAO Contacts	48
	Staff Acknowledgments	48

Tables

Table 1:	Dates Service Inventories Were Conducted	16
Table 2:	Active and Inactive Operational Ranges and Acreage as Reported by DOD in April 2003	18

Table 3: Low and High Cost Estimates to Clean Up Unexploded Ordnance, Discarded Military Munitions, and Munitions Constituents 23
Table 4: High Cost Estimates to Clean Up an Acre with a High Density of Contamination, by Service 23
Table 5: Summary of Perchlorate Sampling Conducted at Installations Visited by GAO 27
Table 6: Potential Effects of the Munitions Constituents Closely Associated with Military Munitions 37
Table 7: Installations Visited during Our Review 39

Figures

Figure 1: Discarded Munitions on an Operational Range That Were Later Uncovered by Erosion 7
Figure 2: Discarded Military Munitions Discovered on a Closed Range 8
Figure 3: Munitions Debris, Including Ordnance, Collected during Range Clearance 9
Figure 4: High and Low Density Operational Range Acreage Used to Estimate Cleanup Costs, by Service 22

Abbreviations

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOD	Department of Defense
EPA	Environmental Protection Agency
NPDES	National Pollution Discharge Elimination System
RCRA	Resource Conservation and Recovery Act
TNT	Trinitrotoluene

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United States General Accounting Office
Washington, D.C. 20548

May 28, 2004

The Honorable John D. Dingell
Ranking Minority Member
Committee on Energy and Commerce
House of Representatives

The Honorable Hilda L. Solis
Ranking Minority Member
Subcommittee on Environment and Hazardous Materials
Committee on Energy and Commerce
House of Representatives

For decades, the Department of Defense (DOD) has tested and fired munitions on millions of acres of operational ranges. These munitions contain various constituents such as lead, trinitrotoluene (TNT), and ammonium perchlorate salt (perchlorate) that are, in some instances, known or suspected of causing health effects such as damage to the central and peripheral nervous systems, cancer, and interfering with thyroid function. Concerns about the potential cost to clean up munitions prompted Congress to require that DOD develop an estimate for what it would cost to clean up its operational ranges. The National Defense Authorization Act for Fiscal Year 2002 required DOD to provide (1) a comprehensive assessment of unexploded ordnance, discarded military munitions, and munitions constituents at current and former DOD facilities; and (2) an estimate of the aggregate projected cost of remediation (cleanup) at operational ranges,[1] stated as a range of costs, including a low and high estimate. As of April 2003, DOD identified 10,444 operational ranges located in the United States and its territories, with Army operational ranges accounting for 94 percent of the total. DOD estimated it would cost between $16 billion and $165 billion to clean up unexploded ordnance, discarded military munitions, and munitions constituents on these operational ranges.

There is a growing concern about the potential health effects associated with the environmental contamination caused by constituents used in the munitions and specifically the possible contamination of drinking water with perchlorate—the primary ingredient of solid rocket propellant that is also used in varying quantities in many types of munitions, explosives, and

[1]DOD was also required to provide a separate estimate for all other defense sites.

incendiary devices, such as mortars, grenades, and flares. The Environmental Protection Agency (EPA) estimates that about 90 percent of the perchlorate manufactured in the United States is for solid rocket fuel used for military purposes and by the National Aeronautics and Space Administration. According to EPA, studies have shown that perchlorate can interfere with thyroid function and negatively affect fetal and infant brain development and growth. Since 1990, the state of California has detected perchlorate in wells and other drinking water sources near sites that once supported munitions manufacturing, storage, and testing. EPA reports that perchlorate has been detected in 34 states and attributes a significant portion of the contamination to defense manufacturing and test sites.

In monitoring and cleaning up munitions and munitions constituents on operational ranges, DOD must comply with applicable provisions of various federal environmental laws, including the Safe Drinking Water Act, as amended; the Resource Conservation and Recovery Act of 1976, as amended (RCRA); and the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA). EPA does not have specific regulatory standards under the Safe Drinking Water Act for the roughly 200 chemicals associated with military munitions use,[2] but requires sampling for some of these contaminants, including perchlorate. According to DOD, at least 20 of these constituents, including perchlorate, are of great concern due to their widespread use and potential environmental impact. For example, EPA and some states are considering whether to establish a specific drinking water standard for perchlorate levels and have, in some cases, established advisory levels. Appendix I contains a listing of munitions constituents of greatest concern and their potential health effects.

You asked us to determine (1) how DOD identified the location and last active use of all operational ranges and the basis for DOD's cost estimates for cleaning up those ranges; and (2) DOD's policy to address contaminants linked to the use of munitions on operational ranges and, where munitions-related contaminants have been detected, what corrective actions the services have taken. Specifically, you asked us to focus on DOD's actions with regard to perchlorate.

[2]DOD's *Fiscal Year 2002 Defense Environmental Restoration Program Annual Report to Congress.*

To determine how DOD identified the location and last active use of all operational ranges, we reviewed the services' inventory data and interviewed DOD and service officials to obtain information on how the inventories were conducted and the reliability of the data collected. We assessed the reliability of the services' data (1) by reviewing existing information about the data and processes that produced them and (2) by interviewing DOD officials knowledgeable about the data. We determined that data on the number of operational ranges and acreage were sufficiently reliable to include in our report. Although we found the reliability of data on operational range characteristics to be questionable, we present the data in the report for informational purposes. To determine the basis for DOD's cost estimates for cleaning up the operational ranges, we reviewed the services' estimated costs, supporting analyses, and calculations, and interviewed service and DOD officials on the scope and methodology used to develop cost estimates. To identify DOD's policy on sampling for constituents linked to the use of munitions on operational ranges, we reviewed DOD's and the services' policies related to sampling and cleanup of potential contaminants and specifically their policies on perchlorate. Finally, to report on what corrective actions the services have taken with regard to munitions constituents, particularly perchlorate, we visited seven DOD installations where perchlorate had been detected and discussed what efforts have taken place or were planned to respond generally to munitions-related contaminants and specifically to perchlorate.[3] Our observations about these installations are not generalizable to all military installations. We conducted our work between June 2003 and March 2004 in accordance with generally accepted government auditing standards. More detail on the scope and methodology of our review is presented in appendix II.

Results in Brief

DOD identified the location and status of its operational ranges based on inventory data developed by the individual services. However,

[3]The installations we visited were Holloman Air Force Base, in New Mexico; Edwards Air Force Base, in California; Army Redstone Arsenal, in Alabama; Army Aberdeen Proving Ground, in Maryland; Army White Sands Missile Range, in New Mexico; Naval Surface Warfare Center, Indian Head, in Maryland; and Naval Air Weapons Station, China Lake, in California. We selected installations based on available data, but were unable to determine the total number of installations reporting perchlorate contamination. DOD and EPA had only recently begun to collect data on perchlorate and data lists were not always current or complete, and were often redundant in that the same installations appeared on more than one list of installations reporting contamination.

inconsistencies in how DOD collected and analyzed data on operational ranges raise questions about the reliability of DOD's inventory. For example, the services used different methods to gather data, conducted inventories at different periods of time and for different reasons, and did not always validate their results. DOD's cost estimates to clean up operational ranges also are questionable because the estimates were based on this inventory data, as well as on a mix of cost assumptions that were not validated—where DOD did not establish a reasonable and defensible basis for the assumptions used—and computer-generated cost rates that varied across the services. For example, we found that in addition to DOD-provided assumptions, the services were allowed to use their own assumptions to estimate cleanup costs. Their differing approaches to estimating the percentage of acreage likely to be contaminated produced varying, and likely questionable, estimates of the costs to clean up operational ranges. In 2004, DOD completed another inventory of its operational ranges that was based on a more consistent data collection framework. However, because the 2004 inventory was conducted for a different purpose and scope, the 2003 and 2004 inventories are not comparable and there are differences between them. The differences between the two inventories make it difficult to determine if the range data used to estimate the cost of cleaning up operational ranges were accurate.

DOD does not have a comprehensive policy requiring sampling or cleanup of the more than 200 chemical contaminants associated with military munitions on operational ranges. None of these munitions constituents are currently regulated with a drinking water standard under the Safe Drinking Water Act, although some of them, including perchlorate, are covered under the act's Unregulated Contaminant Monitoring Regulation.[4] Certain chemicals associated with military munitions may, however, be subject to other environmental laws, including RCRA and CERCLA. With a few exceptions, EPA generally has not used its authority under these laws to require DOD to conduct a cleanup of its operational ranges, although some states have required installations to monitor and sample for contaminants, including perchlorate. For example, EPA and several states have asked DOD to test for perchlorate in areas such as old dump sites because of concern about potential contamination of groundwater. In this context, DOD issued a policy in November 2002 allowing the services to test for perchlorate if there was a reasonable basis to suspect both the presence of

[4]DOD has other policies requiring the services to assess potential hazards from munitions constituents migrating from operational ranges to off-range areas.

perchlorate and the possibility for human exposure. In September 2003, DOD revised its policy to direct sampling for perchlorate contamination at previously unexamined sites, including operational ranges, where a perchlorate release is suspected and a pathway to human exposure is likely, but the policy did not identify specific funding for this sampling. None of the seven installations with reported perchlorate contamination that we visited were currently sampling operational ranges for perchlorate under DOD's guidance, although they had conducted some sampling when required by states. While six of the installations we visited had reported high levels of perchlorate, none of these were cleaning up perchlorate contamination because, installation officials said, DOD policy did not require that they do so. Further, at six of the locations we visited, we determined that research, manufacturing, testing, and disposal of perchlorate were the primary activities that had caused contamination, and not the use of ordnance during training exercises.

In order to assist Congress, EPA, and state regulators in assessing and planning for the cleanup of contamination from the use of munitions at operational ranges, we are recommending that DOD (1) use its most complete operational range inventory to revise its cost estimates for the cleanup of operational ranges and use a more consistent methodology for estimating costs, and (2) provide specific funding for sampling at sites where perchlorate contamination is likely, in accordance with DOD's policy requiring sampling.

In commenting on a draft of this report, DOD disagreed with our findings and recommendations. DOD disagreed with our conclusion that it did not have a comprehensive policy requiring sampling or cleanup of munitions constituents on operational ranges and cited specific policies requiring the services to respond to the release of munitions constituents. However, the policies cited by DOD pertain only to the migration of munitions constituents off-range, and environmental reporting, and do not address the sampling or cleanup of munitions constituents found on operational ranges that are the subject of this report. DOD disagreed with our recommendation that it needed to develop new cost estimates for cleaning up operational ranges, stating that it is developing a system for providing data and assessing its ranges for potential munitions constituent migration to off-range areas. However, the requirement in the National Defense Authorization Act for fiscal year 2002 was to report estimated costs to clean up operational ranges, not the costs to respond to or clean up constituent migration off-range. DOD also questioned whether decision makers would find useful an estimated cost to clean up operational ranges.

We disagree with DOD's view of the usefulness of the information to Congress, because on two occasions, including in DOD's authorization act, Congress has directed DOD to provide such information. DOD also disagreed with our recommendation to provide specific funding for perchlorate sampling. According to DOD, its current policy designates funding for perchlorate sampling as a high priority environmental project. However, we believe that due to limited funds and because perchlorate sampling must compete with other high priority environmental priorities, it may not be funded. Consequently, while DOD policy designates a funding mechanism for perchlorate, it cannot assure that perchlorate sampling will be funded. DOD also provided technical comments and clarifications that we incorporated into the report, as appropriate. DOD's comments appear in appendix V.

Background

DOD policy defined an operational range as an area used to conduct research, develop and test military munitions, or train military personnel. Operational ranges were considered active when regularly used for range activities, and inactive when not currently used but still under military control and available for use as a range.[5] Once a range is closed, DOD is required to identify, assess, and clean up or take other appropriate action in response to contamination by military munitions.[6] As such, DOD's current inventory of operational ranges represents a potential liability for future cleanup. Figures 1, 2, and 3 show examples of the types of ordnance and explosives that can be found on operational ranges.

[5]DOD no longer distinguishes between active and inactive ranges. The current statutory definition of an operational range is "a range that is under the jurisdiction, custody, or control of the Secretary of Defense and (A) that is used for range activities, or (B) although not currently being used for range activities, that is still considered by the Secretary to be a range and has not been put to a new use that is incompatible with range activities." Pub. L. No. 108-136, § 1042(e)(3) (Nov. 24, 2003).

[6]DOD distinguishes range cleanup from range clearance. Range clearance is routine, conducted for the continued use of active ranges, and performed primarily for safety reasons, whereas range cleanup involves interim removal, remedial activities, and a final remedy, but only for closed ranges.

Figure 1: Discarded Munitions on an Operational Range That Were Later Uncovered by Erosion

Source: U.S. Army.

Figure 2: Discarded Military Munitions Discovered on a Closed Range

Source: U.S. Army.

Figure 3: Munitions Debris, Including Ordnance, Collected during Range Clearance

Source: U.S. Army.

Section 313(a)(1) of the National Defense Authorization Act for Fiscal Year 2002[7] required DOD to provide Congress with a comprehensive assessment of unexploded ordnance, discarded military munitions, and munitions constituents at current and former DOD facilities.[8] The law required the assessment to include an estimate of the aggregate projected cost of

[7]Pub. L. No. 107-107 (Dec. 28, 2001).

[8]This report deals with operational ranges on active installations. In December 2003, we issued a report on closed installations or those in the process of closing. As of September 2002, DOD had closed 542 ranges on open installations and 74 ranges on installations closed under the Base Realignment and Closure process, and is required to clean up munitions contamination on these ranges, if present. See U.S. General Accounting Office, *Military Munitions: DOD Needs to Develop a Comprehensive Approach for Cleaning Up Contaminated Sites*, GAO-04-147 (Washington, D.C.: Dec. 19, 2003).

remediation (or cleanup) at operational ranges, to be presented as a range of costs including a low and high estimate, and delivered to Congress in 2003 in DOD's report on the Defense Environmental Restoration Program. In April 2003, DOD reported its estimate for the total cost to address the potential liability associated with unexploded ordnance, discarded military munitions, and munitions constituents at operational ranges to be between $16 billion and $165 billion.

Collecting Inventory Data and Estimating Cleanup Costs

To provide Congress with estimated costs to clean up operational ranges, DOD used inventory data available at the time of its April 2003 report, which counted 10,444 operational ranges located in the United States and its territories. At the direction of Congress, only operational ranges in the United States and its territories were to be considered for the purpose of estimating cleanup costs. According to DOD, these cost estimates were supported by individual service estimates, which in turn were supported by summary information on the number of operational ranges and acreage assumed to contain a high density of unexploded ordnance and munitions constituents—such as target areas, detonation sites, and demolition areas—and the percentage of acreage assumed to contain a low density of contamination from unexploded ordnance and munitions constituents, such as buffers, training areas, and maneuver areas.

The services continued to inventory operational ranges under section 366 of the National Defense Authorization Act for Fiscal Year 2003,[9] which required DOD to inventory operational ranges to address training range sustainment and encroachment concerns and submit the inventory to Congress as part of the President's fiscal year 2005 budget request early in calendar year 2004. The scope of this inventory effort addressed operational range training and testing capacities and capabilities, and specific constraints on the use of operational ranges, but did not specifically include data on the cleanup of unexploded ordnance, discarded military munitions, or munitions constituents.

[9]Pub. L. No. 107-314 (Dec. 2, 2002).

We previously reported that the two key data needed to develop operational range cleanup costs were (1) an accurate and complete operational range inventory and (2) a consistent methodology for estimating costs.[10] Reliable cost estimates can be critical information for DOD and Congress when considering the potential benefits of closing operational ranges or entire installations versus the potentially very high cost of cleaning up such sites. However, such estimates must be based on accurate data that, in the case of operational ranges, begins with a complete and accurate operational range inventory. The costs for cleaning up ranges can be extensive. For example, DOD estimates it will cost $22.6 million to clean up Fort McClellan in Alabama, recommended for closure under DOD's base realignment and closure program in 1995, and $247 million to clean up Fort Ord in California, closed in 1994. DOD officials explained that wide variations in cost can be attributed to a number of factors, such as future land use, technical complexities, and the high level of difficulty to locate, recover, and destroy ordnance located beneath the ground surface.

Environmental Laws and Regulations Affecting DOD Installations and Operational Ranges

DOD's operations at military installations and operational ranges in the United States are subject to laws and regulations governing a variety of environmental concerns, from water quality to the treatment and disposal of hazardous wastes. These laws include the Safe Drinking Water Act, the Clean Water Act, RCRA, the Federal Facility Compliance Act, and CERCLA. DOD is also generally required to comply with state and local environmental statutory and regulatory requirements on its installations and operational ranges. DOD has proposed that Congress specifically exempt it from requirements to clean up unexploded ordnance, munitions, and munitions constituents on operational ranges under RCRA and CERCLA.

The Safe Drinking Water Act authorizes EPA to issue national primary drinking water regulations setting maximum contaminant level standards for drinking water that must be met by public water systems.[11] EPA may authorize states to carry out primary enforcement authority for

[10]U.S. General Accounting Office, *Environmental Liabilities: DOD Training Range Cleanup Cost Estimates Are Likely Understated*, GAO-01-479 (Washington, D.C.: Apr. 11, 2001).

[11]A public water system is subject to the Safe Drinking Water Act if the system has at least 15 service connections or regularly serves at least 25 individuals.

implementing the Safe Drinking Water Act if, among other things, the state adopts drinking water regulations that are no less stringent than the national primary drinking water regulations. EPA has set standards for approximately 90 contaminants in drinking water, including microorganisms, organic chemicals, inorganic chemicals, disinfectants, disinfection byproducts, and radioactive substances.[12] None of the more than 200 chemical contaminants associated with munitions use are currently regulated under the Safe Drinking Water Act.

The 1996 amendments to the Safe Drinking Water Act required EPA to establish criteria for a monitoring program for unregulated contaminants (where a maximum contamination level has not been established) and to publish a list of contaminants—chosen from those not currently monitored by public water systems—to be monitored. EPA's regulation, referred to as the Unregulated Contaminant Monitoring Regulation, was issued in 1999 and supplemented in 2000 and 2001.[13] The purposes of the regulation are to determine whether a contaminant occurs at a frequency and in concentrations that warrant further analysis and research on its potential effects and to possibly establish future drinking water regulations. The first step in the current program required public water systems serving more than 10,000 customers (and a sample of 800 small public water systems serving fewer than 10,000) to monitor drinking water for perchlorate and 11 other unregulated contaminants over a consecutive 12-month period at any point between 2001 and 2003, and report the results to the EPA. Under this regulation, some DOD installations were required to monitor drinking water for perchlorate and other munitions-related contaminants and to report the results.

[12]None of the approximately 90 contaminants regulated by EPA under the Safe Drinking Water Act are associated with the use of military munitions. Some regulated contaminants, such as arsenic, may result from the use of military munitions, but EPA does not regulate arsenic resulting from such use. It does, however, regulate arsenic found in drinking water resulting from the erosion of natural deposits, runoff from agriculture sites, and certain production wastes.

[13]40 C.F.R. § 141.40.

The Clean Water Act authorizes EPA to regulate the discharge of pollutants into waters in the United States. EPA may authorize states to carry out a state program in lieu of the federal program if the state program is at least equivalent to the federal program and provides for adequate enforcement. Under the Clean Water Act's National Pollution Discharge Elimination System (NPDES) program, facilities discharging pollutants into waters of the United States are required to obtain an NPDES permit from EPA or authorized states. NPDES permits include specific limits on the quantity of pollutants that may be discharged and require monitoring of those discharges to ensure compliance. EPA's list of the toxic pollutants subject to regulation under the Clean Water Act includes nitrobenzene, a chemical that is on DOD's list of 20 constituents of greatest concern.[14]

RCRA requires owners and operators of facilities that treat, store, and dispose of hazardous waste, including federal agencies, to obtain a permit specifying how their facilities will safely manage the waste. Under RCRA's corrective action provisions, facilities seeking or holding RCRA permits can be required to clean up their hazardous waste contamination. The corrective actions can be specified in the facility's operating permit, in a separate corrective action permit, or through an enforcement order. EPA also has authority under RCRA to order a cleanup of hazardous waste when there is an imminent and substantial endangerment to public health or the environment. EPA may authorize states to administer their own programs in lieu of the federal program, as long as these programs are equivalent to and consistent with the federal program and provide for adequate enforcement. EPA's regulations define hazardous wastes to include those that are specifically listed in the regulations as well as those that are "characteristic wastes." Characteristic hazardous wastes are defined as wastes that are ignitable, corrosive, reactive, or toxic. A federal district court in California recently ruled, in part, that perchlorate is a hazardous waste under RCRA because it is ignitable.[15]

[14]40 C.F.R. § 401.15.

[15]*Castaic Lake Water Agency v. Whittaker Corp*, 272 F. Supp. 2d 1053 (C.D. Cal. 2003). The conclusion that perchlorate is a hazardous waste was the first step in the court's analysis of whether perchlorate is a hazardous substance under CERCLA. (The definition of hazardous substances under CERCLA includes hazardous waste under RCRA.)

Under section 107 of the Federal Facility Compliance Act of 1992,[16] EPA was required, in consultation with DOD and the states, to issue a rule identifying when military munitions become hazardous waste under RCRA, and to provide for protective storage and transportation of that waste. Under the rule issued by EPA, military munitions are subject to RCRA when, among other things, (1) unexploded munitions or their constituents are buried or otherwise disposed of, or (2) when used or fired munitions are taken off-range.[17]

CERCLA governs the cleanup of releases or threatened releases of hazardous substances, pollutants, or contaminants. CERCLA's definition of a hazardous substance includes substances regulated under various other environmental laws, including RCRA, the Clean Air Act, the Clean Water Act, and the Toxic Substances Control Act. Under section 120 of CERCLA, the federal government is subject to and must comply with CERCLA's requirements to the same extent as any nongovernmental entity. DOD's cleanup under CERCLA section 120 is interrelated with its environmental restoration program under section 211 of the Superfund Amendments and Reauthorization Act of 1986.[18]

Contaminants Associated with Military Munitions

According to DOD, there are more than 200 chemicals associated with military munitions, and of these, 20 are of great concern due to their widespread use and potential environmental impact. TNT, Propanetriol trinitrate (nitroglycerin), Royal Demolition Explosive, and perchlorate are among the 20. Perchlorate is the primary oxidizer in propellants, present in varying amounts in explosives, and is highly soluble. According to EPA, an estimated 90 percent of the perchlorate produced in the United States is manufactured for use by the military and the National Aeronautics and Space Administration. Typical production quantities average several million pounds per year. Nonmilitary uses for perchlorate include fireworks, flares, fertilizer, and automobile airbags. As of 2004, EPA reported that 34 states confirmed perchlorate contamination in ground and

[16]Section 107 of the Federal Facility Compliance Act amended RCRA by adding a new section 3004(y), codified at 42 U.S.C. § 6924(y).

[17]40 C.F.R § 266.202.

[18]Under the Defense Environmental Restoration Program established under section 211, DOD is required to identify, investigate, and clean up environmental contamination and other hazards at active and closing installations, as well as at formerly used defense sites.

surface water, and in states where EPA determined the source of the contamination, it attributed a significant portion to defense manufacturing and test sites.

EPA has not established a federal drinking water standard for perchlorate. However, in 1999, EPA established a provisional reference dose for perchlorate in drinking water of between 4 and 18 parts per billion. A reference dose is an estimate of the daily exposure to a human that would not pose a significant risk of harmful effects. In October 2003, the National Academy of Sciences (Academy) began a study of the best scientific model to use for determining a drinking water standard or reference dose for perchlorate, if any. According to EPA, the Academy's study will take about one year to complete. Based on recommendations from the Academy, EPA will decide whether to regulate the contaminant and will have up to 2 years after making an affirmative determination to propose a national primary drinking water regulation for perchlorate.[19] An EPA official told us that updating drinking water standards can take 2 to 3 years and predicted that a perchlorate standard will likely not be available until 2006 or 2008.

In the meantime, some states that detected perchlorate in various media, such as groundwater, have established state guidance or advisory levels for the contaminant. As of February 2004, seven states have established interim perchlorate advisory levels. Of those states, Maryland and Massachusetts have the lowest perchlorate advisory level of 1 part per billion. On March 12, 2004, California revised its advisory action level for perchlorate from 4 parts per billion to 6 parts per billion.

DOD's Inventory and Cost Estimates for Operational Range Cleanup May Not Provide Congress with a Reliable Picture of Potential Liabilities

DOD's estimate that it would cost between $16 billion and $165 billion to clean up unexploded ordnance, discarded military munitions, and munitions constituents on operational ranges is questionable. To determine the costs of operational range clean up, DOD had to first inventory its operational ranges and obtain data such as the type of range and munitions used. However, the military services used inventory data that were collected for different purposes over different periods of time and verified with varying degrees of analytical rigor. Next, the costs of operational range cleanup were calculated using a mix of unvalidated assumptions provided by DOD and assumptions provided by the individual services, as

[19] 42 U.S.C. § 300g-1(b)(1)(E).

well as actual service data, where available. Consequently, DOD's overall cost estimates were based on assumptions, estimates, and actual data that differed across the services and that raise questions about the reliability of DOD's estimated costs to clean up operational ranges.

Operational Range Inventory Process Lacked a Common Framework and Analytical Rigor

Each service inventoried its operational ranges and collected data on range acreage and munitions used, using various methodologies over different periods of time. (See table 1 for the starting and ending dates of the service's inventories.) Services also conducted inventories for different reasons, such as to respond to pending legislation on ranges, public concern about military use of ranges, or simply to gather data to calculate cleanup cost estimates. The rigor of the analysis and the degree of the validity of the inventory results varied by service. The inconsistencies in how DOD collected and analyzed data on operational ranges raise questions about the reliability of DOD's inventory.

Table 1: Dates Service Inventories Were Conducted

Military Service	Inventory started	Inventory ended
Air Force	August 2001	December 2002
Army	July 2000	December 2002
Marine Corps	October 2001	November 2002
Navy	December 1999	January 2000

Source: GAO analysis of military service data.

The Air Force inventory of operational ranges in the United States and its territories was based on a survey sent to field command levels to estimate costs to clean up operational ranges. Service officials said survey data was validated during on-site field inspections or, in some cases, brief desk reviews to assure surveys were complete and free of obvious errors. As of December 2002, the Air Force counted 222 active ranges, 23 inactive ranges, and 23 ranges that were not categorized as either active or inactive. Together, Air Force operational ranges covered 6,423,161 acres.

The Army's inventory of operational ranges was conducted concurrently with an inventory of nonoperational ranges and was based on field surveys. According to Army officials, the Army initiated an inventory of its ranges primarily in response to anticipated legislation on the use of ranges,[20] which required a comprehensive inventory of DOD ranges as well as a collection of descriptive data about each range, such as the acreage and types of munitions used on the range. The Army's inventory was also conducted in response to DOD directives issued in August 1999 that required the services to establish and maintain an inventory of operational ranges and data on munitions and ordnance.[21] To inventory ranges, the Army used contract support staff who requested data from field commands and installations, and then sought to validate the data through on-site visits. Army officials said the Army's inventory of operational ranges was completed in December 2002, and encompassed 9,427 active ranges, 377 inactive ranges, and 4 ranges not designated active or inactive. In total, Army operational ranges covered 14,991,072 acres in the United States and its territories.

Similar to the Army, the Marine Corps conducted an inventory of its operational ranges primarily in response to anticipated legislation on the use of ranges and DOD directives that required the services to establish and maintain an inventory of operational ranges and data on munitions and ordnance. The Marine Corps developed its inventory from an archive data search and surveys sent to installations. Headquarters' officials reviewed the surveys to assure that submitted data agreed with data in the archive search. As of December 2002, the Marine Corps counted 216 operational ranges totaling 1,980,119 acres in the United States and its territories. According to headquarters' officials, the Marine Corps did not distinguish between active and inactive ranges but designated all ranges as operational.

[20]On September 26, 1997, DOD published a proposed range rule on closed, transferred, and transferring ranges containing military munitions. The proposed rule identified a process for evaluating response action on closed, transferred, and transferring ranges and required a comprehensive inventory of DOD ranges, including a collection of descriptive data for each range. However, the proposed rule applied to nonoperational ranges only. On November 13, 2000, DOD withdrew the proposed range rule from the rule-making process because DOD, EPA, and federal land managers could not reach consensus on several key issues, including how explosive safety would be handled under the rule, concurrence on remedial actions, and who would decide the remedy.

[21]DOD Directives 4715.11 and 4715.12.

The Navy's inventory of operational ranges in the United States and its territories was conducted at the request of the Navy's Environmental Readiness Division. The Navy's inventory was prepared in response to the anticipated inventory requirements of DOD's proposed range rule and because of increased public and regulatory scrutiny of military ranges, Navy officials said. The inventory was conducted through surveys sent to the installations. As of December 2002, Navy operational ranges totaled 121 active ranges and 31 inactive ranges on 1,284,374 acres.

As of April 2003, when DOD reported its estimated cost to clean up operational ranges, DOD's inventory included 10,444 operational ranges totaling 24.6 million acres in the United States and its territories. (See table 2 for a breakout of operational ranges by service and status and total acres.)

Table 2: Active and Inactive Operational Ranges and Acreage as Reported by DOD in April 2003

	Operational Ranges				
	Active	Inactive	Not categorized	Total	Total acreage (in millions)
Air Force	222	23	23	268	6.4
Army[a]	9,427	377	4	9,808	15.0
Marine Corps	0	0	216	216	1.9
Navy	121	31	0	152	1.3
DOD total	**9,770**	**431**	**243**	**10,444**	**24.6**

Source: GAO analysis of military service data.

[a]According to Army officials, the Army's inventory of operational ranges was finalized in the summer of 2003 and revised to 9,427 active and 377 inactive ranges totaling about 15 million acres in the United States and its territories.

DOD continued to inventory its operational ranges. The National Defense Authorization Act for Fiscal Year 2003 required DOD to develop a plan to address training range issues, such as range sustainment and encroachment and, as part of this plan, to develop a range inventory system that included all available operational training ranges. In January 2003, DOD provided the services with an inventory framework and data definitions to ensure reporting consistency and required the services to complete detailed inventories of all of their operational ranges. DOD

revised its existing inventory of operational ranges to meet this new requirement. Because the revised inventory was conducted for different purposes, using a scope and set of assumptions that were different from the inventory data used to estimate cleanup costs, it identified a different number of operational ranges. For example, the inventory for developing the cost estimates used actual operational range acreage, whereas the revised inventory used actual and potential operational range acreage. Further, the revised inventory is divided into range complexes and individual ranges, and includes operational ranges outside the United States and its territories not included in the inventory DOD used to estimate cleanup costs.

In February 2004, DOD released the results of its training range plan and revised inventory. The revised inventory listed 353 range complexes and 172 individual ranges on 26 million acres worldwide. These numbers differ from the inventory data DOD used to estimate cleanup costs, which counted 10,444 operational ranges on 24.6 million acres in the United States and its territories primarily because of the aggregation of individual ranges into complexes and the inclusion of ranges outside the United States and its territories. For example, under the prior inventory, Fallon Naval Air Station, in Nevada, reported it had 150,365 acres of rangeland, but under the new inventory, Fallon reported it had just 103,300 acres of actual and potential rangeland. Also under the prior inventory, the Marine Corps reported that Camp Lejeune, in North Carolina, had 95,872 acres of rangeland, while under the new inventory, Camp Lejeune reported it had 152,000 acres of actual and potential rangeland (even though the entire installation encompasses just 153,000 acres). The Marine Corps also reported that Camp Pendleton, in California, had 39,084 acres of rangeland under the old inventory, but under the new inventory, Camp Pendleton reported it had 114,000 acres of actual and potential rangeland, almost a threefold increase.

While the 2003 and 2004 inventories are not readily comparable because of the varying scope and definitions used to develop the revised inventory, the difference between the two highlights the difficulty in understanding the basis for, and the results of, DOD's cost estimates. Finally, we believe the differences in the two inventories may further complicate efforts of Congress to identify the potential liabilities that may exist if operational ranges or installations are closed and require cleanup.

Cost Estimates Were Calculated Using a Mix of Differing Assumptions, Estimates, and Actual Data

In 2002, DOD provided guidance to the services on how to estimate costs for cleaning up operational ranges. This guidance specified the scope for estimating costs but allowed for variation across the services. According to DOD officials, because the requirement to estimate cleanup costs was a one-time congressional requirement, DOD directed the services to limit their data gathering efforts by using certain costing assumptions and a computer-costing model in combination with already existing data. Examples of the scope and some of the assumptions DOD used to estimate costs include the following:

- The scope of the inventory was limited to operational ranges within the United States and its territories because DOD believed that was what Congress intended.

- The scope excluded certain operational ranges, such as water ranges, because DOD did not have a model for estimating costs associated with such ranges and did not have any significant historical experience on which to base an estimate. DOD also did not develop cost estimates for several types of airspace, such as warning areas and restricted areas.

- DOD directed the services to use both a computer-costing model that automatically assigned certain values for the cleanup costs of unexploded ordnance and discarded military munitions and an electronic worksheet to estimate costs to clean up munitions constituents.

- DOD provided cost assumptions to the services based on operational range acreage and other variables. For example, the services were directed to divide range acreage into areas assumed to have a high density of contamination and a low density of contamination and, on that basis, calculate individual cleanup costs.

- DOD also provided specific assumptions to calculate costs for various cleanup activities. For example, to estimate the cost to remove unexploded ordnance from a highly contaminated range area, the services were told to assume they would need to remove ordnance from 50 percent of that area to calculate the high cost estimate and 5 percent of that area to calculate the low cost estimate.

DOD said its assumptions were based on discussions with the services and developed through consensus. DOD could not provide any documentation that the assumptions they asked the services to use were validated—a

confirmation of the reasonableness and justification for assumptions used—and a senior DOD official told us that, in fact, the assumptions were not validated.

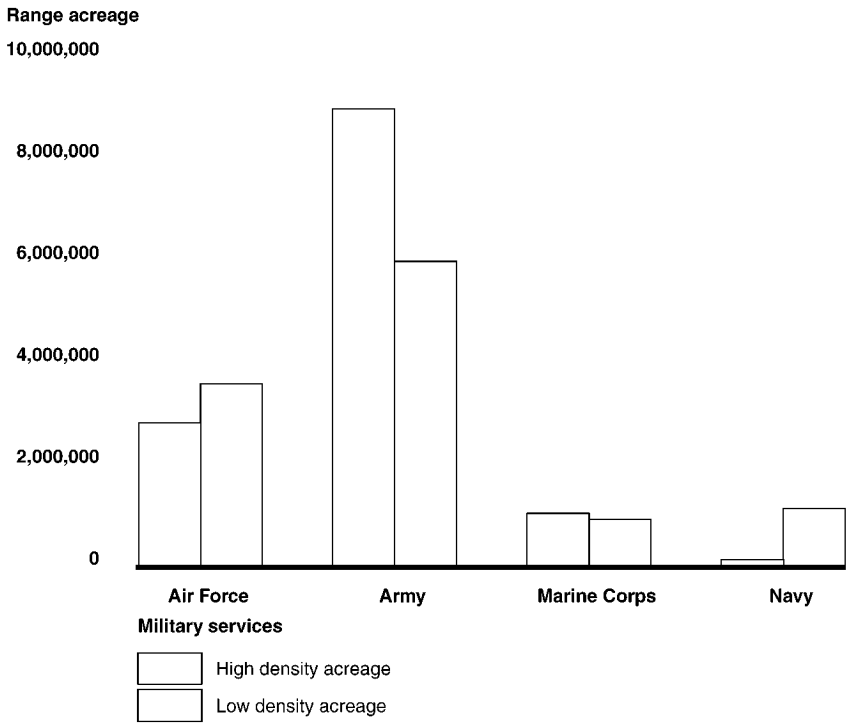
Furthermore, DOD instructions to the services allowed them to use additional assumptions or site-specific data so that cost estimates were calculated based on a mix of actual data and assumptions. Based on our review of DOD's 2003 report to Congress, and discussions with service officials on their methodologies to estimate costs, we found DOD did not fully explain the mix of assumptions and data used and how this mix affected the cost estimates, so that the usefulness of DOD's overall cleanup cost estimates to Congress is questionable.

The inconsistencies in how the services developed their cost estimates are evident in areas such as how the services calculated high-density acreage (that is, the area of a range containing a high density of ordnance) and the costs for cleaning up these acres. For example, although DOD guidance directed the services to estimate what proportion or percentage of operational range acreage contained a high density of unexploded ordnance and munitions constituents, and specified how various types of ranges were to be treated for cost estimating purposes, each service performed this calculation differently. If site-specific data was unavailable, the Marine Corps used varying percentages based on the characteristics of similar ranges to determine those that were highly contaminated. Our analysis showed that for about two-thirds of its operational ranges, the Marine Corps assumed 10 percent of its nonsmall arms or multipurpose range acreage was highly contaminated. However, based on a review of the Marine Corps' total cleanup cost estimates for operational ranges, GAO determined that the Marine Corps calculated its costs assuming that an average 53 percent of range acreage has highly contaminated. In contrast, the Air Force and the Army used estimated data to determine that 44 percent and 60 percent of their acreage was highly contaminated, respectively.[22] Further, the Air Force did not designate a percentage of each operational range with a high density of contamination and a low density of contamination, but rather defined each operational range as either 100 percent high density or 100 percent low density. The Navy used actual data to determine that 11 percent of its operational range acreage was highly

[22]Army officials told us the Army assumed 60 percent of operational range acreage was highly contaminated, but our analysis of Army data (see table 4) shows the Army actually assumed that 58 percent of acreage was highly contaminated.

contaminated. (Figure 4 shows the high and low density acreage by service used to estimate cleanup costs.)

Figure 4: High and Low Density Operational Range Acreage Used to Estimate Cleanup Costs, by Service



Source: GAO analysis of military service data.

Based on the data provided by the services, the model calculated four totals for each operational range: a low and high estimated cost to clean up the portion of the range assumed to have a low level of contamination, and a low and high estimated cost to clean up the portion of the range assumed to be highly contaminated. Low estimates for low and high contamination areas were combined to calculate a total low estimate, and high estimates for low and high contamination areas were combined to calculate a total high estimate. (See table 3 for low and high estimates by service.)

Table 3: Low and High Cost Estimates to Clean Up Unexploded Ordnance, Discarded Military Munitions, and Munitions Constituents

Billions of dollars

	Low estimate	High estimate
Air Force	1.2	14.0
Army	14.5	141.5
Navy	0.2	2.5
Marine Corps	0.5	6.7
DOD[a]	16.0	165.0

Sources: The Fiscal Year 2002 Defense Environmental Restoration Program report and military service data.

[a]Estimates do not add due to rounding.

In general, using the model and standardized assumptions should have produced estimates with some variation across the services because of differing missions, operational practices, and types of munitions used. However, as reflected in table 4, a tenfold difference in the average cost to clean up an acre of highly contaminated rangeland calls into question the mix of different assumptions and data used by the services to estimate costs. For example, the Air Force's average cost to clean up an acre with a high density of contamination was $755, whereas the Army's estimate was $7,577. As a result, the services cost estimates are not comparable. (Table 4 shows the total and average cost per acre estimates by service.)

Table 4: High Cost Estimates to Clean Up an Acre with a High Density of Contamination, by Service

Service	Acreage	High cost estimate (dollars)	Average high cost per acre (dollars)
Air Force	2,835,579	2,140,072,819	755
Army	8,691,311	65,855,410,348	7,577
Marine Corps	1,023,623	3,719,488,388	3,634
Navy	134,459	920,669,000	6,847

Source: GAO analysis of military service data.

DOD Does Not Have a Comprehensive Policy on Contaminants Associated with Military Munitions and Has Not Specifically Cleaned Up Known Perchlorate Contamination

DOD does not have a comprehensive policy requiring sampling or cleanup of the more than 200 chemical contaminants associated with military munitions on operational ranges. However, DOD installations have sampled for and cleaned up munitions-based constituents when directed by state regulatory authorities. With regard to perchlorate, DOD has issued sampling policies but does not provide specific funding for such sampling. Nevertheless, we found some installations have sampled and monitored for perchlorate to meet the requirements of environmental laws and regulations, such as RCRA and the Unregulated Contaminant Monitoring Regulation. During visits to six installations that reported high levels of perchlorate, we found that none were cleaning up perchlorate contamination. At six of the seven installations we visited, perchlorate contamination was largely the result of researching, manufacturing, testing, and disposing of munitions, and not the use of munitions during training.

Previous DOD Policy Did Not Require Cleanup or Sampling for Contaminants Associated with Military Munitions

According to EPA, of the more than 200 chemicals associated with military munitions, which include 20 that DOD considers to be of greatest concern due to their widespread use and potential environmental impact, none are specifically regulated under the Safe Drinking Water Act. Further, except in some specific instances, EPA does not generally use its authority under other environmental laws, such as RCRA and CERCLA, to require DOD to conduct cleanups on operational ranges.[23] An EPA official told us that although EPA is concerned with constituents associated with military munitions such as perchlorate and Royal Demolition Explosive, and the migration of plumes (pollutants that drain or flow through soil and water) from military ranges to groundwater, the agency generally does not interfere with DOD's operation of its operational ranges. Recently, DOD proposed that Congress specifically exempt it from requirements to clean up unexploded ordnance, munitions, and munitions constituents that remain on operational ranges under RCRA and CERCLA.

[23]In some instances, EPA has used its authority under these acts to require cleanup of munitions constituents on operational ranges. For example, at Fort Richardson, Alaska, EPA required the Army to clean up contamination caused by munitions containing white phosphorus.

DOD policy does not generally require the services to clean up or sample for munitions contaminants because, according to DOD officials, these contaminants are deposited on operational ranges in the course of the normal and intended use of these munitions. Yet, DOD may be required by EPA or states to sample and clean up its munitions contaminants under various environmental laws and regulations on operational ranges. For example, under the Clean Water Act, facilities that discharge pollutants into surface water are required to obtain a NPDES permit from EPA or an authorized state agency. Several states have required some DOD installations to monitor for various contaminants associated with military munitions as part of the NPDES permit process. For example, the Regional Water Quality Control Board in San Diego and the Hampton Roads Sanitation District in Hampton Roads, Virginia, required Navy facilities to monitor their water discharges for various constituents that are on EPA's list of toxic pollutants under the Clean Water Act.[24] Under the Unregulated Contaminant Monitoring Regulation, EPA required some installations to sample for and report on 12 unregulated contaminants in drinking water during any 12-month period between 2001 and 2003. The list of contaminants included four munitions-related contaminants—perchlorate, 2,4 and 2,6 dinitrotoluene, and nitrobenzene. In April 2004, DOD reported that 36 installations had sampled for the presence of unregulated contaminants in drinking water, including perchlorate, under this regulation. Of these, 33 installations reported no perchlorate was detected or detection results were below the reporting limit of 4 parts per billion. Only three Air Force installations detected perchlorate above the reporting limit, ranging from just over 4 parts per billion to 46 parts per billion.

Revised DOD Policy Directs Sampling for Perchlorate under Certain Conditions but Little Sampling Has Been Done

In November 2002, DOD issued its first policy on perchlorate assessment that stated the services may sample and assess for perchlorate if there was a reasonable basis to suspect both a potential presence of perchlorate and a likely pathway that could lead to human exposure. The policy stated that the services could fund assessments using the operations and maintenance environmental compliance account, but specified that sampling should be considered a lower priority (Class II) environmental project and, as we

[24]See 40 C.F.R. § 401.15. The three constituents—2,4 and 2,6 dinitrotoluene (used to produce explosives and ammunition and known to cause cancer) and nitrobenzene (may be used in defense manufacturing and linked to blood disorders)—are on DOD's list of munitions constituents of greatest concern.

found in a prior effort, was unlikely to be funded.[25] Finally, the policy directed those installations that sampled for and found perchlorate to report to DOD on the location and amount of perchlorate found. On September 29, 2003, DOD issued a revised policy on perchlorate sampling that directed the services to (1) consolidate data on perchlorate detections, including data developed in response to environmental laws such as the Clean Water Act and Safe Drinking Water Act, and (2) sample any previously unexamined sites, including ranges, where a perchlorate release is suspected because of prior DOD activities and where human exposure is likely. The policy stated that the services should fund sampling using the same environmental compliance account specified in the previous policy, but elevated sampling to a higher (Class I) funding priority and thus made it more likely to be funded. However, when DOD issued its policy, funding had already been allocated to Class I requirements for fiscal year 2004. In future years, unless specific or additional funding is added, perchlorate sampling will have to compete with other high priority environmental requirements and may not be funded.

In implementing the revised policy, the services added a third criterion requiring that installations coordinate with, or obtain written approval from, headquarters and the chain of command before sampling for perchlorate. However, if sampling is specifically required by an environmental law or state agency, the service policies do not require installations to request approval or notify headquarters before sampling. During visits we made to selected installations with reported perchlorate contamination between October 2003 and January 2004, we found installations were not sampling under the revised policy to determine the presence of perchlorate on operational ranges. More broadly, as of

[25]To assure compliance with the requirements of environmental laws, DOD has an environmental quality program that is largely funded by DOD's appropriation for operation and maintenance activities. This account also funds a wide range of installation activities such as military training, base operations, and property management. As such, DOD's environmental quality program must compete with these other activities for funding. As GAO reported in June 2003, DOD's environmental quality program has a ranking system for funding environmental activities where activities ranked Class 0 or I must be funded in the current program year because of a law or regulation, whereas funding for activities ranked Class II or III may be deferred because there is no legislative requirement in the current budget year. We found DOD did not always have sufficient funds to pay for environmental priorities and sometimes did not follow the program's ranking system and instead funded lower priority activities while not funding some higher priorities. See U.S. General Accounting Office, *Environmental Compliance: Better DOD Guidance Needed to Ensure That the Most Important Activities Are Funded*, GAO-03-639 (Washington, D.C.: June 17, 2003).

February 2004, Marine Corps and Navy officials said that no installations had requested permission to sample under this policy. According to the Air Force, three installations asked for permission to sample for perchlorate because EPA had asked that they sample. Air Force headquarters approved two of the requests but denied the third because, according to Air Force headquarters, there was not a reason to suspect the presence of perchlorate. Four Army installations have asked for approval to sample for perchlorate, and Army headquarters approved all four as of March 2004, an Army headquarters official said. Overall, this suggests that little sampling is being done under DOD's revised perchlorate policy.

Although none of the installations had begun sampling under DOD's revised policy, during our visits we found a few installations had sampled and monitored for perchlorate to meet the requirements of certain environmental laws and regulations. Table 5 summarizes the perchlorate sampling that has been conducted at installations we visited as reported by DOD as of April 2004.

Table 5: Summary of Perchlorate Sampling Conducted at Installations Visited by GAO

Installation	Number of samples collected	Number of positive detections	Range of concentrations detected (in parts per billion)	Source of perchlorate contamination
Edwards Air Force Base	413	309	Up to 2,100,000 in soil and up to 30,700 in groundwater	Propulsion research and rocket test stand; maintenance; landfill
Holloman Air Force Base	2	1	7,600	Research, development, testing and evaluation
Aberdeen Proving Ground	1,193	540	Less than 1 and up to 12,000	Training with pyrotechnics and smoke; use of propellants, ordnance, smoke and chemical agents
Redstone Arsenal	Not reported	Not reported	Up to 37,000	Rocket testing
White Sands Missile Range[a]	Not reported	Not reported	Not reported	Not reported
Naval Air Weapons Station, China Lake	12	12	Up to 720	Research, development and testing; disposal; possible natural occurrence
Naval Surface Warfare Center, Indian Head	708	278	Up to 480,000	Disposal, open burning, unknown source

Source: DOD perchlorate sampling data as of April 2004.

[a]Although it was not reported by DOD as of April 2004, we found during our visit to White Sands Missile Range that officials sampled for perchlorate as part of an RCRA application.

During our visits, we found the following installations had sampled for and monitored perchlorate to meet the requirements of RCRA or the Safe Drinking Water Act:

- In 1999, as part of an application under RCRA to close an open burning and detonation facility used to destroy excess and obsolete ammunition, the state of New Mexico required White Sands Missile Range, in New Mexico, to sample for contaminants, including perchlorate. The former open burning and detonation facility is located on an operational range. Groundwater sampling detected high levels of perchlorate—up to 25,000 parts per billion.[26] The Army installed 56 monitoring wells on the range to map the plume. Each well is sampled quarterly. After four years of quarterly sampling and monitoring, Army officials said the plume is stable and contained, which means it is isolated underground and not expected to move. Further, officials said there is no indication that perchlorate has migrated outside the identified plume. Under its RCRA closure permit with the state of New Mexico, the Army must continue monitoring the groundwater for up to 20 years.

- Three of the seven installations we visited tested for perchlorate under the Safe Drinking Water Act's Unregulated Contaminant Monitoring Regulation program. Edwards Air Force Base, in California, sampled twice in 2002 and reported that none of the 12 chemicals listed on the EPA list of unregulated contaminants, including perchlorate, were detected in any of the groundwater samples collected from drinking water wells. (Under the regulation, EPA required surface water systems to be sampled quarterly and groundwater systems to be sampled semiannually for one consecutive 12-month period.) Redstone Arsenal, in Alabama, sampled quarterly for a 12-month period beginning June 2001. Two water intake sites were sampled (a drinking water source and a drinking water and industrial water source), both along the Tennessee River. Redstone Arsenal reported that perchlorate was not detected above the EPA sampling level of 4 parts per billion. Nearby Huntsville, Alabama, also sampled for perchlorate and detected no contamination, a Redstone Arsenal official said. Finally, although the requirements of the Unregulated Contaminant Monitoring Regulation did not apply to

[26]Initially, Army officials said they believed the perchlorate contamination resulted from the burning of rocket motors in pits at the open burning and detonation facility. More recently, however, Army officials speculated that the plume in the hazardous test area is from another unknown source because it is uphill from the open burning and detonation facility.

the Naval Air Weapons Station, China Lake, in California, because its water supply system was too small, installation officials volunteered to sample for perchlorate and other unregulated contaminants. Accordingly, in October 2003, officials at China Lake sampled 10 drinking water wells for perchlorate and other contaminants, but perchlorate was not detected.

DOD Has Not Directed the Services to Clean Up Known Perchlorate Contamination

According to information provided by DOD and officials at the installations we visited, the services were generally not cleaning up known perchlorate contamination. DOD officials explained that perchlorate is not a regulated contaminant and, therefore, there is no requirement to clean up perchlorate contamination.[27] (Current DOD policy is that DOD will clean up perchlorate if there is imminent and substantial endangerment to the public.) The exceptions we found were two installations that had cleaned up perchlorate under demonstration projects designed to demonstrate perchlorate cleanup technologies. At the installations we visited, perchlorate contamination was generally the result of research, manufacturing, testing, and disposal of munitions (such as rocket motors) that contained high levels of perchlorate. In one case, the perchlorate resulted from training with smoke munitions containing perchlorate.

Although six of the seven sites we visited reported high levels of perchlorate contamination, none of these installations were conducting cleanup actions specifically directed at perchlorate. However, at two installations we visited—Edwards Air Force Base and the Naval Surface Warfare Center, Indian Head—officials said they conducted demonstration projects to develop perchlorate treatment and cleanup technologies in anticipation of future cleanup requirements. (See app. III for details on these demonstration projects.)

At six of the seven installations we visited that had operational ranges and detectable levels of perchlorate, we found the perchlorate contamination was generally not due to training on operational ranges. Rather, we found that prior and ongoing research, manufacturing, testing, and disposal of

[27]Although there is not a standard for perchlorate under the Safe Drinking Water Act, in at least one instance EPA required the Army to clean up munitions constituents in groundwater, such as perchlorate. EPA required the Massachusetts Military Reservation to clean up munitions constituents under its Safe Drinking Water Act authority, which allows it to take action when there is an imminent and substantial endangerment to the health of persons. 42 U.S.C. § 300i(a).

rocket motors were primarily responsible for perchlorate contamination. (See app. IV for details of perchlorate contamination caused by such factors.) Only Aberdeen Proving Ground, in Maryland, reported that some perchlorate contamination was due to the use of perchlorate during training exercises on operational ranges. Further, Aberdeen was the only installation we visited where perchlorate had contaminated a neighboring municipal water supply. At Aberdeen, perchlorate concentrations of up to 5 parts per billion have been detected in drinking water supply wells and 24 parts per billion have been detected in groundwater.

Between June and August 2002, Aberdeen Proving Ground sampled drinking water wells owned by the city of Aberdeen located in and along the northern border between the city and the installation, and detected perchlorate contamination in four wells ranging from 1.2 to 5 parts per billion. According to Aberdeen officials, the installation sampled for perchlorate because it was required to do so by the state of Maryland. Groundwater samples taken near the well field showed a large perchlorate plume with contamination levels up to 24 parts per billion. Aberdeen Proving Ground officials attributed the perchlorate contamination to intensive testing and training with smoke grenades and other obscurants. Until about mid-2002, during training exercises in the vicinity of the city of Aberdeen drinking water wells, Aberdeen Proving Ground trained troops using smoke grenades that contained perchlorate. After perchlorate was found in city drinking water, Aberdeen Proving Ground stopped all training with smoke grenades containing perchlorate. However, officials at Aberdeen Proving Ground are not cleaning up the perchlorate detected in city wells. Instead, both the city of Aberdeen and the installation sample finished water and production wells on an alternating monthly schedule: Finished water is sampled weekly, four production wells are sampled twice a month, and the remaining eight production wells are sampled monthly. Recent sampling has detected contamination below the EPA interim assessment guidance of 4 parts per billion, but in some cases, well samples have been above the Maryland Department of the Environment public health advisory for perchlorate, which is 1 part per billion for drinking water. In the event a sample is found to be above the Maryland state advisory limit, the city of Aberdeen blends well water without perchlorate with well water containing perchlorate to lower the concentration level to below 1 part per billion. The Army stated that it would not clean up the perchlorate contamination at Aberdeen until an EPA maximum contaminant level for perchlorate in drinking water is established.

Conclusions

Because of DOD's approach to how it inventoried its operational ranges for munitions and how it estimated the costs to clean up those ranges, both the inventory and the cost estimates are questionable. Further, DOD did not fully disclose to Congress the basis and limitations of its estimates, including identifying estimates based on direct observations and those based on assumptions, and the affect of assumptions on DOD's cost estimates. Instead, DOD provided only general information to Congress on the assumptions and cost model used without specific details on how costs were developed or the effect of assumptions used on the resulting cost estimates. Consequently, we believe it is difficult for Congress to evaluate the cost estimates DOD provided and that it may be unwise to rely on them for assessing the potential liability associated with contamination on operational ranges. Reliable cost estimates can be a critical piece of information for DOD and Congress when considering the potential costs versus benefits of closing operational ranges or entire installations. However, such estimates must be based on accurate data that, in terms of ranges, begins with a complete and accurate operational range inventory.

DOD installations have conducted little or no sampling for perchlorate under DOD's perchlorate policy, and DOD has not provided specific funding to the services to conduct the sampling that is required by its policy. Available information indicates that testing for perchlorate on installations has been limited and is specifically needed at facilities that are or were involved in research, manufacturing, testing, and disposal of munitions. DOD's decision not to provide specific funding to the services for sampling hampers the ability of DOD, as well as EPA and the states, to collect better data on the extent and nature of possible perchlorate contamination on military installations. Such information could be important to regulators when determining if there is a potential public health risk from perchlorate and deciding what, if any, actions might be warranted. Further, the lack of such information impedes DOD and congressional efforts for planning and budgeting future cleanup that may be required if federal or state standards regulating perchlorate are adopted.

Recommendations for Executive Action

In order to the assist Congress, EPA, and state regulators in assessing and planning for the cleanup of contamination associated with military munitions at operational ranges, we are making the following two recommendations:

- To improve congressional oversight of DOD and its operational ranges, including providing Congress with more realistic estimates of the potential liability associated with cleaning up contamination related to the use of military munitions, we recommend that DOD, using a more consistent estimating methodology, use its most complete operational range inventory to revise its cost estimates for the cleanup of operational ranges. The revised estimates should include an explanation of the basis and scope on which the inventory was conducted, and how the cost estimates were calculated. The estimates should be accompanied by a detailed description of how costs were developed, such as where estimates and assumptions were used, the basis of and rationale for any assumptions used, and an explanation as to how such assumptions affected cost figures.

- To develop information needed by Congress, EPA, and the states, such as the location and amount of perchlorate contamination, when deciding what, if any, actions are warranted to address such contamination, we recommend that DOD, acting under its revised perchlorate sampling policy, provide specific funding for comprehensive sampling at sites where no prior sampling has been conducted, yet perchlorate contamination is likely and human exposure is possible based on the sites' prior or current use. To help identify possible sites of perchlorate contamination, we recommend DOD consolidate and review sampling data previously collected by installations under environmental laws governing the release or disposal of various hazardous substances.

Agency Comments and Our Evaluation

In its May 6, 2004, letter, DOD disagreed with our findings and recommendations. DOD also provided technical comments and clarifications that we incorporated in the report, as appropriate.

DOD disagreed with our conclusion that it did not have a comprehensive policy requiring sampling or cleanup of munitions constituents on operational ranges, and that it generally has not taken actions to clean up contaminants. In its letter, DOD cited specific policies in place requiring the services to address the release of munitions constituents. However, the guidance DOD cited pertains only to the migration of munitions constituents off-range and the reporting of environmental liabilities, but does not address the sampling or cleanup of munitions constituents found on operational ranges that are the subject of this report. Further, DOD's letter states that it is responding to munitions constituents at 23 installations and ranges. We acknowledge that DOD is sampling for, and in some cases, cleaning up munitions constituents when directed to do so by EPA or a state environmental agency under various environmental laws. In reviewing the data provided by DOD, however, we found that only 2 of the installations they cited had operational ranges and both of those were being cleaned up because of EPA direction or a court order. At the 12 other installations with active ranges, half of them had sampled or were sampling for munitions constituents as a result of EPA or state environmental agency requests, RCRA requirements, or cleanup associated with Superfund hazardous waste sites. None of these installations, however, were cleaning up the munitions constituents found as a result of sampling.

DOD disagreed with our assessment that its inventory data and cost estimates were questionable and said it was not necessary to revise its cost estimates because inventory data used to develop the estimates were "accurate within reason." In its comments, DOD stated that it was not required to use validated costing assumptions, or a consistent estimating methodology, because the fiscal year 2002 National Defense Authorization Act provided that the standard for the report of liabilities did not apply to DOD's cost estimates. Although the act allowed DOD to develop cost estimates that did not meet the same standards as required for the report of liabilities in DOD's annual financial statement, we believe that DOD had a responsibility to provide Congress with useful information by making a reasonable attempt to prepare accurate and complete estimates, including assuring that its assumptions were valid. However, as our report sets out, the inconsistencies in how DOD collected and analyzed data on operational ranges raise questions about the reliability of DOD's inventory. Specifically, DOD did not provide Congress with a detailed description of how the costs were prepared and an explanation of where site-specific data were used in place of assumptions, why specific and different assumptions were used by the services, and how assumptions affected the overall cost estimates. Without DOD's supporting data and analysis, it is difficult for Congress to

evaluate the accuracy or validity of the cost estimates DOD provided and it may be unwise to rely on them for assessing the potential liability associated with contamination on operational ranges.

DOD disagreed with our recommendation that it needed to develop new cost estimates for cleaning up operational ranges, stating that it is developing a system for providing auditable data that meets the standards for the report of liabilities and is actively assessing its ranges for potential munitions constituent migration to off-range areas. However, the requirement in the National Defense Authorization Act for fiscal year 2002 was to report estimated costs to clean up operational ranges, not the costs to respond to or clean up constituent migration off-range. In its letter to GAO, DOD also questioned whether decision makers would find useful an estimated cost to clean up operational ranges and asserted that it is not required to develop cleanup estimates for operational ranges until such costs become probable and estimable by accounting standards. We disagree with DOD's view of the information and its usefulness to Congress. Congress on two occasions asked DOD to provide just such information. Specifically, the 2002 Defense Authorization Act required that DOD report this information. In addition, the Senate Committee on Armed Services, in its report accompanying the National Defense Authorization Act for fiscal year 2000 (S. Rep. No. 106-50), directed DOD to provide to the congressional defense committees a report with a complete estimate of current and projected costs to clean up munitions constituents. In our opinion, the authorization act's requirement and the committee's direction provide ample evidence that congressional decision makers would find such information useful.

DOD also disagreed with our recommendation that DOD provide specific funding for sampling for perchlorate. As our report points out, DOD's current policy on perchlorate sampling designates funding for sampling as a Class I high priority environmental project. This means that perchlorate sampling is a priority for funding, along with all other high priority environmental projects. As a result, perchlorate sampling must compete with other high priority environmental priorities for funding and, due to limited funds, may not be funded. The result is that while DOD policy has designated a funding mechanism for perchlorate, DOD's policy cannot assure that perchlorate sampling will be funded. Simply stated, if DOD wants to assure that installations conduct perchlorate sampling where appropriate, then it will need to provide specific funding for this sampling.

As agreed with your office, unless you publicly announce the contents of this report earlier, we plan no further distribution until 30 days from the report date. At that time, we will send copies of this report to the appropriate congressional committees, the Secretary of Defense, and other interested parties. We will also make copies available to others upon request. In addition, the report will be available at no charge on the GAO Web site at http://www.gao.gov.

If you or your staffs have any questions, please call me at (202) 512-3841, or Edward Zadjura at (202) 512-3841. Key contributors to this report are listed in appendix V.

Anu K. Mittal
Director, Natural Resources
and Environment

Safety, Environmental, and Human Health Risks

Military munitions can pose risks to public safety, human health, and the environment. Unexploded ordnance poses a risk of physical injury to those who encounter it. Military munitions may also pose a health and environmental risk especially on ranges located in ecologically sensitive wetlands and floodplains because their use and disposal may release constituents that may contaminate soil, groundwater, and surface water. More than 200 chemical munitions constituents are associated with ordnance and its use. When exposed to some of these constituents, humans potentially face long-term health problems, such as cancer and damage to the heart, liver, and kidneys.

Munitions Constituents of Greatest Concern

Of the more than 200 chemical munitions constituents associated with ordnance and its use, DOD considers 20 to be of greatest concern because of their widespread use and potential environmental impact. The 20 munitions constituents, taken from DOD's *Fiscal Year 2002 Defense Environmental Restoration Program Annual Report to Congress*, are

- Trinitrotoluene (TNT),
- 1,3-Dintrobenzene,
- Nitrobenzene,
- 2,4-Dinitrotoluene,
- 2-Amino-4,6-Dinitrotoluene,
- 2-Nitrotoluene,
- 2,6-Dinitrotoluene,
- 4-Amino-2,6-Dinitrotoluene,
- 3-Nitrotoluene,
- Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX),
- 2,4-Diamino-6-nitrotoluene,
- 4-Nitrotoluene,

- Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX),
- 2,6-Diamino-4-nitrotoluene,
- Methylnitrite,
- Perchlorate,
- 1,2,3-Propanetriol trinitrate (Nitroglycerine),
- Pentaerythritoltetranitrate (PETN),
- 1,3,5-Trinitrobenzene, and
- N,2,4,6-Tetranitro-N-methylaniline (Tetryl) (White Phosphorus).

While many of these compounds have been an environmental concern to DOD for more than 20 years, the current understanding of the causes, distribution, and potential effect of constituent releases into the environment remains limited. The nature of the potential effect, and whether it poses an unacceptable risk to human health and the environment, depends upon the dose, duration, and pathway of exposure, as well as the sensitivity of the exposed populations. The link between constituents and their potential health effects is not always clear and continues to be studied. Table 6 describes some of the potential health effects of five of the munitions constituents of greatest concern.

Table 6: Potential Effects of the Munitions Constituents Closely Associated with Military Munitions

Contaminant	Potential toxicity/effects
Trinitrotoluene (TNT)	Possible human carcinogen. Targets liver, skin, irritations, cataracts.
Royal Demolition Explosive (RDX)	Possible human carcinogen, prostate problems, nervous system problems, nausea, and vomiting. Laboratory exposure to animals indicates potential organ damage.
High Melting Explosive (HMX)	Animal studies suggest potential liver and central nervous system damage.
Perchlorate	Exposure causes itching, tearing, and pain; ingestion may cause gastroenteritis with abdominal pain, nausea, vomiting, and diarrhea; systemic effects may follow and may include ringing of ears, dizziness, elevated blood pressure, blurred vision, and tremors. Chronic effects may include metabolic disorders of the thyroid.
White Phosphorus	Reproductive effects. Skin burns, irritation of throat and lungs, vomiting, stomach cramps, drowsiness. Liver, heart, or kidney damage. Death.

Source: Environmental Protection Agency.

Scope and Methodology

You asked us to determine (1) how DOD identified the location and last active use of all operational ranges and the basis for DOD's cost estimates for cleaning up those ranges; and (2) DOD's policy on sampling for contaminants linked to the use of ordnance on operational ranges and, where munitions-related contaminants have been detected, what corrective actions the services have taken. Specifically, you asked us to focus on DOD's actions with regard to perchlorate.

To determine how DOD identified the location and last active use of all operational ranges, we reviewed the services' inventory data and interviewed service headquarters officials to determine how the inventories were conducted and the reliability of the data collected. We assessed the reliability of the services' data (1) by reviewing existing information about the data and the processes that produced them and (2) by interviewing DOD officials knowledgeable about the data. We determined that data on the number of operational ranges and acreage were sufficiently reliable to include in our report; however, we determined that data on range characteristics were unreliable. Although we found the data on range characteristics to be unreliable, we present the data for informational purposes. To determine the basis for DOD's cost estimates for cleaning up operational ranges, we reviewed the services' estimated costs, supporting analyses, and calculations, and interviewed service and DOD officials on the scope and methodology used to develop cost estimates.

To identify DOD's policy on sampling for constituents linked to the use of ordnance on operational ranges, we reviewed DOD's and the service's policies related to the sampling and cleanup of potential contaminants and specifically their policies on perchlorate. We also interviewed officials at both headquarters and several installations on the implementation of DOD and service policies. To report on what actions the services have taken with regard to munitions constituents and perchlorate, we visited seven DOD installations where perchlorate had been detected and discussed what efforts have taken place, or were planned, to respond generally to munitions-related contaminants and specifically for perchlorate. We selected installations based on available data but were unable to determine the total number of installations reporting perchlorate contamination. We selected installations where generally high levels of perchlorate had been detected or, in one case, where perchlorate had contaminated a local municipal water supply. We also based our selection on the desire to include at least two installations from each military department and installations from different states or geographic locations in order to

provide a mix of services and state agencies. (See table 7 for a listing of the installations we visited.)

During our visits, where possible, we observed the areas of contamination as well as any cleanup demonstration projects under way. To identify what levels of contamination had been detected at DOD installations, we first obtained various summary schedules and lists of active and closed DOD and non-DOD sites with suspected or detected perchlorate contamination from both EPA and DOD. Because DOD has only recently begun to collect data on perchlorate, none of the listings we obtained included all installations. Further, most lists did not generally contain current data and were incomplete. Additionally, much of the data was redundant, with the same installations appearing on more than one list. Prior to selecting an installation to visit, therefore, we contacted service officials to verify that perchlorate contamination had, in fact, been detected. Our observations about perchlorate contamination and response actions at these installations are not generalizable to all military installations.

Table 7: Installations Visited during Our Review

Installation	Military department	State	Perchlorate contamination levels initially detected or reported
Edwards Air Force Base	Air Force	California	Up to 160,000 parts per billion in groundwater (detected in 1997)
Holloman Air Force Base	Air Force	New Mexico	About 16,000 parts per billion in surface water (detected in 1999)
Aberdeen Proving Ground	Army	Maryland	5 parts per billion in drinking water and 24 parts per billion in groundwater (reported in 1998)
Redstone Arsenal	Army	Alabama	About 19,000 parts per billion in groundwater (as of 2000)
White Sands Missile Range	Army	New Mexico	21,000 parts per billion in groundwater (reported in 1998)
Naval Air Weapons Station, China Lake	Navy	California	560 parts per billion in groundwater (detected in 2001)
Naval Surface Warfare Center, Indian Head	Navy	Maryland	More than 1,000 parts per billion in surface water (reported in 1998)

Source: GAO.

Installations That Were Cleaning Up Perchlorate as a Result of Demonstration Projects

Although we found no installations were cleaning up perchlorate, two installations we visited were conducting or had conducted demonstration projects of new technologies to clean up perchlorate, in anticipation of future cleanup requirements.

Edwards Air Force Base

In May 2003, Edwards Air Force Base, in California, began a demonstration project to remove perchlorate from groundwater. Edwards officials said the installation funded the project because the Air Force is DOD's lead agency for perchlorate-related efforts and expected to help develop perchlorate treatment technologies. Edwards first detected perchlorate on the installation in 1997, while testing for other contaminants, and has detected perchlorate at 10 sites on the installation. Perchlorate contamination of 160,000 parts per billion was detected at one site where the source of the contamination is attributed to the use of perchlorate by various research facilities beginning about 1945. On this site the Air Force constructed a well field and project treatment facility. The demonstration project uses resin beads, which act like a magnet to pull perchlorate out of the water. Four wells extract groundwater that is discharged into a storage tank and then pumped through treatment equipment containing the resin. Treated groundwater is returned to the aquifer through five injection wells. Plans are to operate the project through July 2005. Currently, Edwards officials report that perchlorate continues to be removed to nondetectable levels, or less than 1 part per billion.

Naval Surface Warfare Center, Indian Head

In 2002, the Naval Surface Warfare Center, Indian Head, in Maryland, funded a field demonstration project using naturally occurring microorganisms, or bacteria, that break down or consume perchlorate. Navy officials first became concerned about perchlorate in 1998 when they learned of widespread perchlorate contamination at DOD sites in California. At that time, the installation regularly drained perchlorate-contaminated water into ditches and two bordering rivers. In 2001, Navy officials sampled and detected a shallow and well-defined plume of perchlorate contamination located in an area where the Navy once cleaned small rocket motors using a high-pressure wash. Perchlorate levels detected in the area ranged from 8,000 to 430,000 parts per billion. On this site in early 2002, the Navy installed two extraction wells, two injection wells, and nine groundwater monitoring wells. Groundwater was removed from the site, mixed with a lactate and a carbonate/bicarbonate liquid mixture, and then reinjected into the aquifer. After 20 weeks, perchlorate

levels were reduced by more than 95 percent in eight of the nine monitoring wells. According to Navy officials, the mixture acted as an oxidizer to stimulate microorganisms that consumed the perchlorate. Officials said they plan to reuse the equipment to field test the technology at another site in an attempt to clean soil contaminated with perchlorate.

Installations That Identified Perchlorate as a Result of Munitions Research, Manufacturing, Testing, and Disposal Activities

We visited installations that had operational ranges and detectable levels of perchlorate but found the perchlorate contamination was generally not due to training, but rather due to prior and ongoing research, testing, manufacturing, and disposal of rocket motors and propellant waste on operational ranges and other parts of the installations.

Edwards Air Force Base

Perchlorate contamination was detected at 10 sites on Edwards Air Force Base beginning in 1997. Officials attributed all detected perchlorate contamination to rocket propellant manufacturing, research, development, and testing, and not to the use of munitions during training. The maximum perchlorate contamination level detected was 160,000 parts per billion in groundwater at one site. Officials said no live bombs had been exploded on Edwards Air Force Base ranges since 1952, and some ranges where bombs were exploded have been closed. Perchlorate is not used as part of current range activities, and Edwards Air Force Base does not test for contaminants on operational ranges, installation officials said.

Holloman Air Force Base

In March 1999, after a rainstorm, the U.S. Geological Survey sampled for perchlorate in a normally dry riverbed at Holloman Air Force Base, in New Mexico, and detected contamination of 16,000 parts per billion. During periods of rain, the river flows from the installation to the neighboring White Sands National Monument. The contamination was found on the installation near a former munitions operations site and rocket sled. Air Force officials said it was unlikely that the contamination was due to training. They attributed the perchlorate contamination to munitions research and testing in the 1960s and 1970s. Officials at White Sands National Monument attributed the perchlorate contamination to spent rocket motors stacked near the river and a high-speed rocket sled used to test the effects of acceleration. DOD and New Mexico's state environmental agency sampled the riverbed and surrounding area again in 1999 and 2000 but did not find the high concentration of perchlorate previously detected. Air Force officials said they believed the 16,000 parts per billion detected in 1999 was an anomaly.

Naval Surface Warfare Center, Indian Head

At the time of our visit, officials at the Naval Surface Warfare Center, Indian Head, in Maryland, reported they detected perchlorate contamination at five sites on the installation, of which three were landfills, one was a metal parts disposal site, and one was a metal parts degreasing tank site. Indian

Head detected maximum perchlorate concentrations between 88 and 450,000 parts per billion in the soil at two of the three landfills. At the third landfill, a perchlorate concentration of 2,000 parts per billion was detected in the groundwater. However, none of the contamination detected was attributed to the use of perchlorate during training exercises on operational ranges.

Redstone Arsenal

As of March 2004, Redstone Arsenal, in Alabama, detected perchlorate contamination in the groundwater at 2 sites and in surface water and soil at 11 other sites. Redstone Arsenal officials attributed contamination to various past production, maintenance, and disposal activities at a number of sites, including at open burning areas used to incinerate waste rocket motor propellant, burning trenches used to incinerate solid material contaminated with rocket propellant, a rocket engine plant, motor degreasing and trimming areas, and a propellant waste storage area. Perchlorate contamination of about 20 parts per billion was also detected in ground and surface water outside the installation. The highest concentration levels detected in groundwater on Redstone installations have ranged from 106,000 to 160,000 parts per billion and the highest concentration levels detected in surface water have ranged from 377 to 1,700 parts per billion. Although Redstone Arsenal has conducted training on the installation, none of the contamination detected has been attributed to the use of perchlorate during training exercises.

White Sands Missile Range

White Sands Missile Range, in New Mexico, detected perchlorate contamination at two sites beginning in 1999. At one site, sampling detected perchlorate concentrations up to 25,000 parts per billion. Officials said they were unsure of the precise cause of the contamination but said they initially believed it was due to an open burning and detonation facility used in the 1950s to incinerate rocket motors. However, officials also said that the contamination plume was uphill from where the open burning and detonation site is believed to have been, so that the contamination may be generally due to previous testing of hazardous materials in the area. Perchlorate was also found at the former site of a high-energy laser system test facility. Perchlorate contamination detected has been as high as 118 and 295 parts per billion in some wells. Officials said the contamination might be due to open ground burning of expended test items, or residue from actual tests, conducted prior to 1995. Officials said they planned to conduct more sampling to precisely identify the source of the perchlorate

but did not attribute any of the perchlorate detected to training exercises on operational ranges.

Naval Air Weapons Station, China Lake

At the time of our visit in October 2003, the Naval Air Weapons Station, China Lake, in California, had detected perchlorate at five sites on the installation. Perchlorate contamination was predominantly found in drainage and waste disposal areas, most likely the result of research on propellants and explosives, and residue from the manufacture of propellants. Installation officials said that since the 1960s, thousands of pounds of perchlorate-based propellant have been stored and tested on China Lake. In July 2003, installation officials sampled and detected perchlorate concentrations of 778 and 921 parts per billion at two wells and at a drainage site. However, none of the contamination detected is attributed to the use of munitions during training exercises on operational ranges.

Comments from the Department of Defense

OFFICE OF THE UNDER SECRETARY OF DEFENSE

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ACQUISITION,
TECHNOLOGY
AND LOGISTICS

MAY - 6 2004

Ms. Anu Mittal
Director, Natural Resources and Environment
U.S. General Accounting Office
441 G Street N.W.
Washington, DC 20548

Dear Ms. Mittal:

This letter is the Department of Defense (DoD) response to the GAO report, "DOD OPERATIONAL RANGES: More Reliable Cost Estimates and a Proactive Approach to Identifying Contamination Are Needed," May 2004 (GAO-04-601).

The Department nonconcurs with GAO recommendations that the Department (1) revise its cost estimates for the cleanup of operational ranges and (2) provide specific funding for sampling at sites where perchlorate contamination is likely. Enclosed are specific comments on each of these recommendations.

The Department also nonconcurs with the GAO findings that (1) the reliability of DoD's inventory is questionable, (2) DoD's cost estimates are questionable, (3) DoD does not have a comprehensive policy requiring sampling, (4) neither DoD nor the Services provide specific funding to installations to sample for or cleanup contaminants linked to munitions use, and (5) no corrective actions have been taken by DoD specifically directed at cleaning up contaminants, such as perchlorate. Enclosed are specific comments on each of these findings.

Although some of GAO's points merit discussion, the Report presents an invalid characterization of the Department's environmental efforts at operational ranges. The Department believes that government decision makers deserve a more accurate and objective analysis of the Department's Sustainable Range policies and actions.

The Report incorrectly asserts that DoD does not have a comprehensive policy requiring sampling or cleanup of munitions constituents. A careful examination of the Department's policies and actions demonstrate that it has comprehensive policies in place to address munitions constituents associated with operational ranges. The Report mentions none of the key policies. For example:

- Since 1999, DoDI 4715.11 has required the Services to conduct an appropriate response using existing statutory authorities (e.g., DERP, CERCLA) to any release of munitions constituents that are migrating from an operational range to off-range areas. An update to be published soon will further require assessments of the hydrology and hydrogeology of operational ranges and how the ranges are being or have been used.

- The Defense Planning Guidance (DPG) for Fiscal Years 2004-2009 established a requirement for the Services to "... assess potential hazards from off-range migration of munitions constituents and begin remediation by FY2008." The Services have begun implementing programs to conduct operational range assessments, and are expecting to begin any necessary responses by the FY08 date.
- DoD Directive 3200.15 "Sustainment of Ranges and Operating Areas (OPAREAs)" requires reporting of environmental liabilities for operational ranges where the Department of Defense is obligated to conduct environmental remediation, in accordance with DoD 7000.14-R (the DoD Financial Management Regulations).

The Report states that, "DoD policy does not require the Services to clean up or sample for munitions contaminants." In fact, the Department has had policy in place on response actions for some time. In addition to the failure to discuss current policies, GAO does not address new or expanding policies that the Department presently has under development.

The Report also asserts that, "To date, no corrective actions have been taken specifically directed at cleaning up contaminants when they have been detected." Again, this observation is not factual. DoD is responding to munitions constituents at twenty-three installations and ranges, as is illustrated in the enclosures. The Report fails to recognize DoD's efforts at these sites.

Finally, the Report asserts that DoD's operational range inventory and its estimates of cleanup costs are "questionable." However, the Report provides no supporting analysis for this conclusion and is misleading in that it does not factually address:

- The adequacy of inventory data to support cost estimating.
- The specific Congressional direction to DoD about development of the aggregate high-low cost estimates.
- The reasonableness of the assumptions in the detailed estimating guidance the Department developed.
- Differences in the way the Services use and manage operational ranges and the impact of these differences in cost estimates among the Services.

In addition, the Report incorrectly assumes that decision makers would find a cost to clean up an operational range useful. The decision to close an operational range will not be determined by cleanup cost. It will be determined by whether the range is needed for operational requirements. An estimate of the cost to clean up a range will be developed after the range is no longer operational. There is no requirement for DoD to produce cleanup estimates for operational ranges.

The report also misrepresents the current state of affairs because it fails to report the facts surrounding EPA's treatment of perchlorate regulation. The report insinuates that DoD has some affirmative responsibility to sample for perchlorate under the Safe Drinking Water Act beyond Unregulated Contaminate Monitoring Rule requirements, which is not the case.

This response and the enclosed materials are provided to help GAO better understand and recognize DoD's policies and actions. Enclosure 1 provides the Department's specific responses to GAO's Report Findings and Recommendations. Enclosure 2 offers the Department's detailed, line-by-line analysis of the elements of GAO's report. Enclosures 3 and 4 provide examples of the Services' operational range assessment programs that assess potential hazards from off-range migration of munitions constituents. Enclosures 5, 6, and 7, which the U.S. Environmental Protection Agency provided to Congressman Dingell in response to an inquiry, provide some details on munitions constituents. Specifically:

- Enclosure 5 provides information on DoD installations where sampling for perchlorate and other munitions constituents is ongoing
- Enclosure 6 provides information on occurrences of perchlorate or other constituents of military munitions in public or private drinking water wells where a DoD facility is a possible or likely source of the occurrence.
- Enclosure 7 provides information on DoD installations where EPA has reason to believe that a constituent of military munitions, including perchlorate, TNT, RDX, HMX, or White Phosphorus has been detected or discovered, and the status of the response action.

Taken together, the analytical and logical deficiencies in this Report render the findings and recommendations invalid. The Department recommends that the Report be withdrawn and a new analysis be undertaken.

Sincerely,

Alex A. Beehler
Assistant Deputy Under Secretary of Defense
(Environment, Safety, and Occupational Health)

Enclosures:
As stated.

GAO Contacts and Staff Acknowledgments

GAO Contacts

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Staff Acknowledgments

In addition to those named above, Christine Frye, Roderick Moore, David Noguera, and Doreen Feldman made key contributions to this report. John Delicath and Amy Webbink also contributed to this report.

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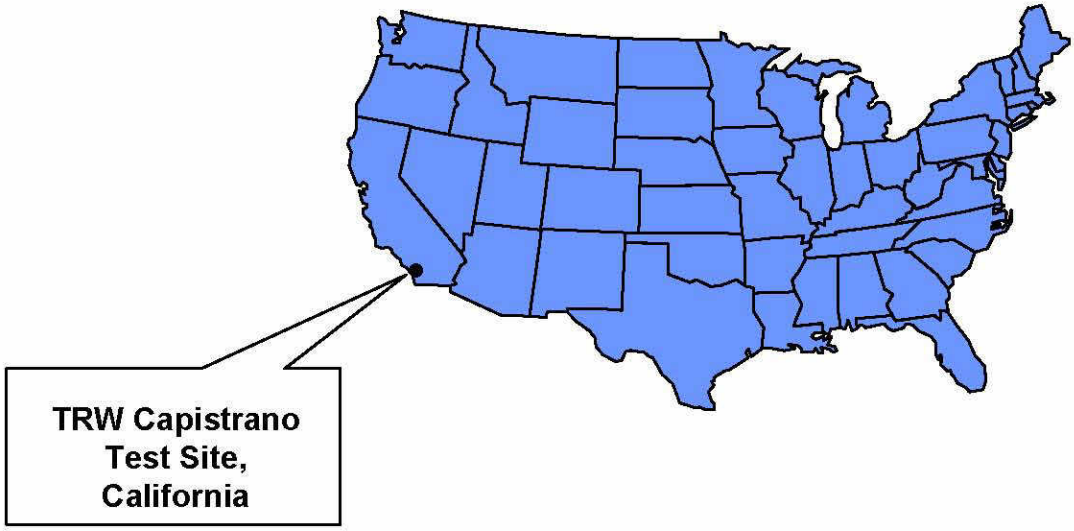
ENVIRONMENTAL BASELINE SURVEY FOR THREE SITES AT TRW CAPISTRANO TEST SITE, CALIFORNIA



November 1999

Prepared by
Headquarters Space and Missile Systems Center
Los Angeles Air Force Base, California

Environmental Baseline Survey
for
Three Sites at
TRW Capistrano Test Site, California

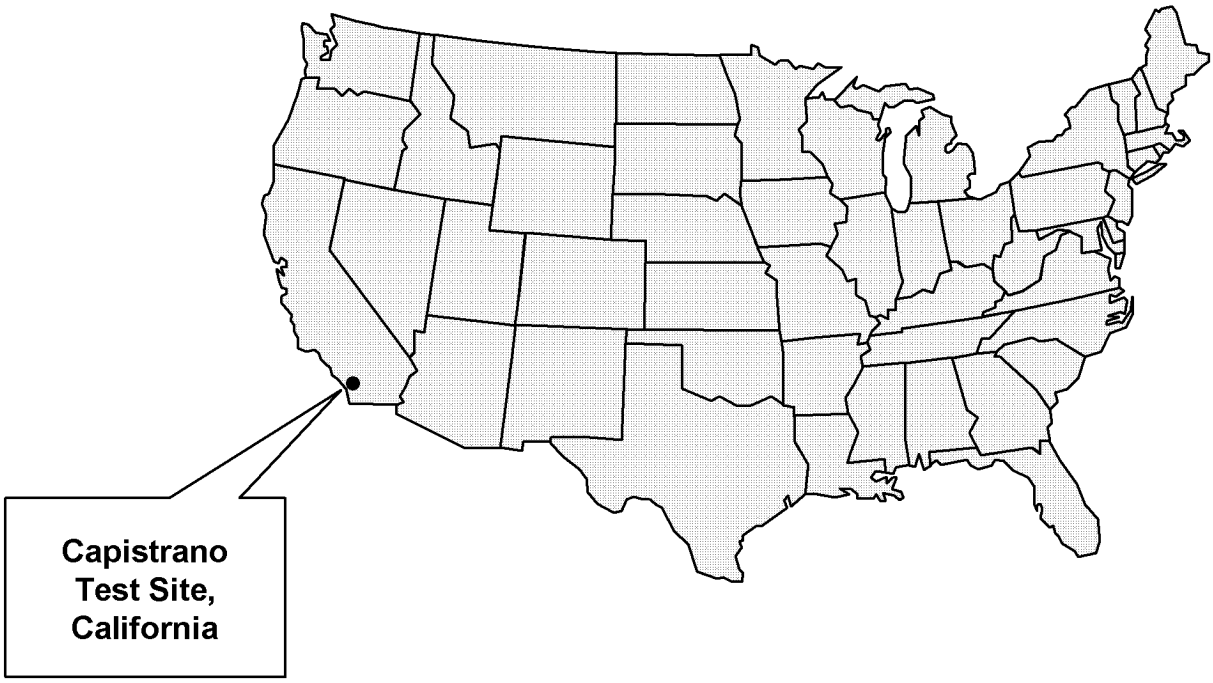
Prepared for:

Department of the Air Force
Headquarters Space and Missile Systems Center
Los Angeles Air Force Base, California

Contract F41624-95-D-9018
Delivery Order 049, CDRL A003

November 1999

Printed on Recycled Paper



EXECUTIVE SUMMARY

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Assets of the Space-Based Laser (SBL) program at Capistrano Test Site (CTS), California, are being transferred from the Ballistic Missile Defense Organization (BMDO) to the United States Air Force (USAF). These assets are situated at three adjacent sites named the High Energy Propellant Test Stand (HEPTS), the Vertical Engine Test Stand (VETS), and the High Altitude Test Stand (HATS). The CTS is operated by TRW Corporation (TRW) under a long-term lease from the San Juan Company, which owns the Mission Viejo Ranch. The leased land is part of the Mission Viejo Ranch.

This Phase I environmental baseline survey (EBS) is based on information obtained through a records search, interviews, and a visual site inspection (VSI) of the subject and adjacent properties. The records search included a review of all available Air Force and TRW records. These records include environmental restoration and compliance reports, audits, surveys, inspection reports, and a review of real estate documents for the subject property. Additionally, aerial photographs were analyzed, interviews were held with both civilian and military personnel, and a VSI of the sites and adjacent properties was conducted. This EBS includes an assessment of the environmental condition of the subject property as well as the properties immediately adjacent to or relatively near that could pose environmental concern or affect the subject property.

Based on the categorization criteria presented in Section 1, the property is classified Category 1 and would be considered eligible for transfer of ownership.

This EBS was prepared in accordance with Air Force Instruction 32-7066, *Environmental Baseline Surveys in Real Estate Transactions*, April 25, 1994, and guidelines contained in the American Society for Testing and Materials (ASTM) standard: *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process*, ASTM Designation 1527-97. Categorization was performed in accordance with the HQ USAF/ILEV memorandum on Interim Use of Environmental Baseline Survey Property Categorization Codes dated 9 February 1999.

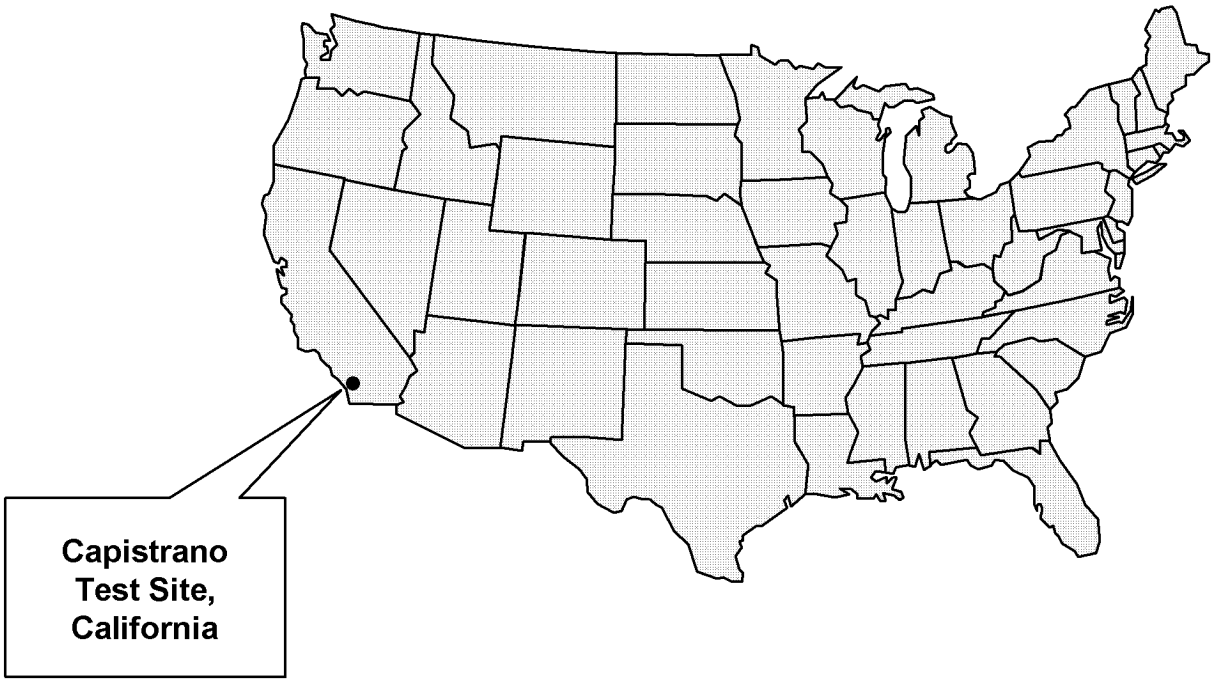


TABLE OF CONTENTS

CONTENTS

Page

SECTION 1 Purpose of the Environmental Baseline Survey 1-1
1.1 Introduction 1-1
1.2 Boundaries of the Subject Property and Survey Area 1-3

SECTION 2 Survey Methodology 2-1
2.1 Approach and Rationale 2-1
2.1.1 Description of Documents Reviewed 2-1
2.1.2 Property Inspection 2-3
2.1.3 Personal Interviews 2-3
2.1.4 Sampling 2-3

SECTION 3 Findings for Subject Property 3-1
3.1 History and Current Use 3-1
3.1.1 General Information 3-1
3.1.2 Historical Use 3-1
3.1.3 Current Use 3-1
3.2 Environmental Setting 3-2
3.2.1 Land Use 3-2
3.2.2 Soils and Topography 3-2
3.2.3 Drinking Water and Groundwater 3-2
3.2.4 Ecology 3-3
3.3 Hazardous Substances 3-3
3.3.1 Hazardous Materials and Petroleum Products 3-3
3.3.2 Hazardous and Petroleum Waste 3-4
3.4 Installation Restoration Program Contamination 3-5
3.5 Storage Tanks 3-5
3.5.1 Aboveground Storage Tanks 3-5
3.5.2 Underground Storage Tanks 3-5
3.5.3 Pipelines, Hydrant Fueling, and Transfer Systems 3-5
3.6 Oil/Water Separators 3-5
3.7 Pesticides 3-5
3.8 Medical or Biohazardous Waste 3-6
3.9 Ordnance 3-6
3.10 Radioactive Wastes 3-6
3.11 Solid Waste 3-6
3.12 Groundwater 3-6
3.13 Wastewater Treatment, Collection, and Disposal 3-6
3.14 Drinking Water Quality 3-7
3.15 Asbestos 3-7

3.16 Polychlorinated Biphenyls 3-7
3.17 Radon 3-7
3.18 Lead-based Paint 3-7

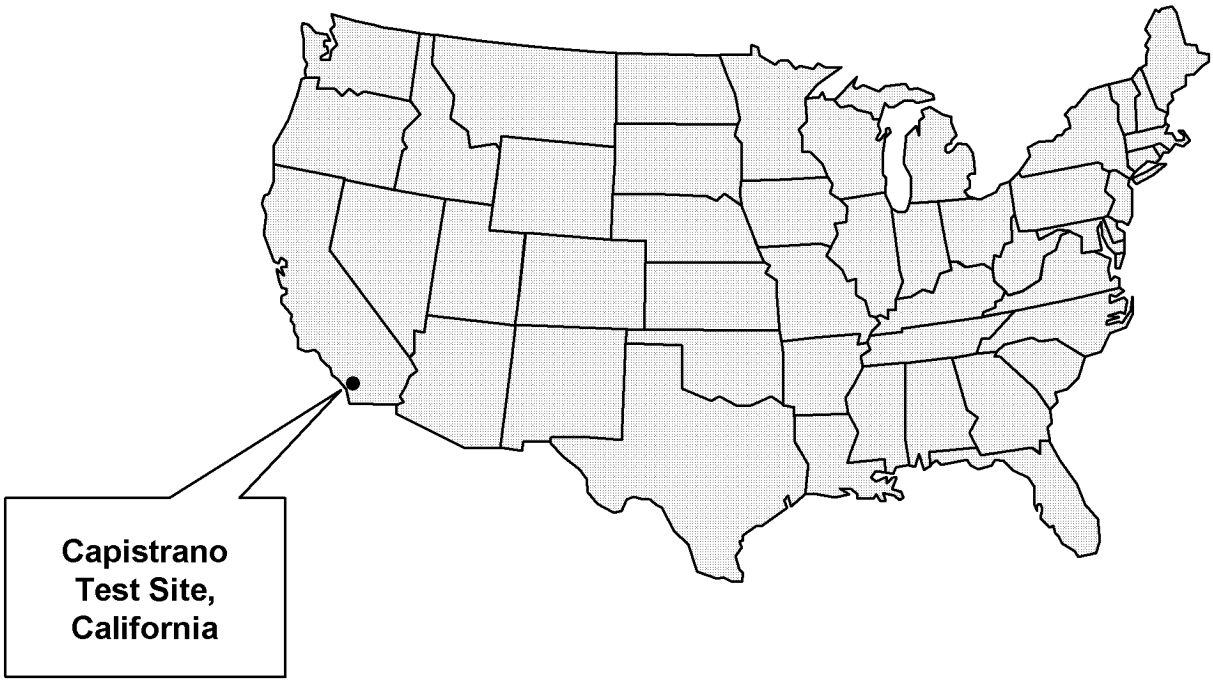
SECTION 4 Findings for Adjacent Properties 4-1
4.1 Land Uses 4-1
4.2 Surveyed Properties 4-1
4.3 Offsite Findings 4-1
4.3.1 Installation Restoration Program Sites 4-2
4.3.2 Underground Storage Tanks 4-2
4.3.3 Federal and State Database Review 4-2

SECTION 5 Applicable Regulatory Compliance Issues 5-1
5.1 List of Compliance Issues 5-1
5.2 Description of Corrective Actions 5-1
5.3 Estimates of Various Alternatives 5-1

SECTION 6 Conclusions 6-1
6.1 Facility Matrix 6-1
6.2 Property Categories Map 6-1
6.3 Resources Map 6-1
6.4 Data Gaps 6-1

SECTION 7 Recommendations 7-1

SECTION 8 Certifications 8-1
APPENDICES:
A: Abbreviations, Acronyms, and Terms
B: References
C: Site Photographs
D: Aerial Photographs
E. Historical Topographic Maps
F: EDR Report
G: HQ USAF/ILEV Memo on Property Categorization Codes



LIST OF FIGURES AND TABLES

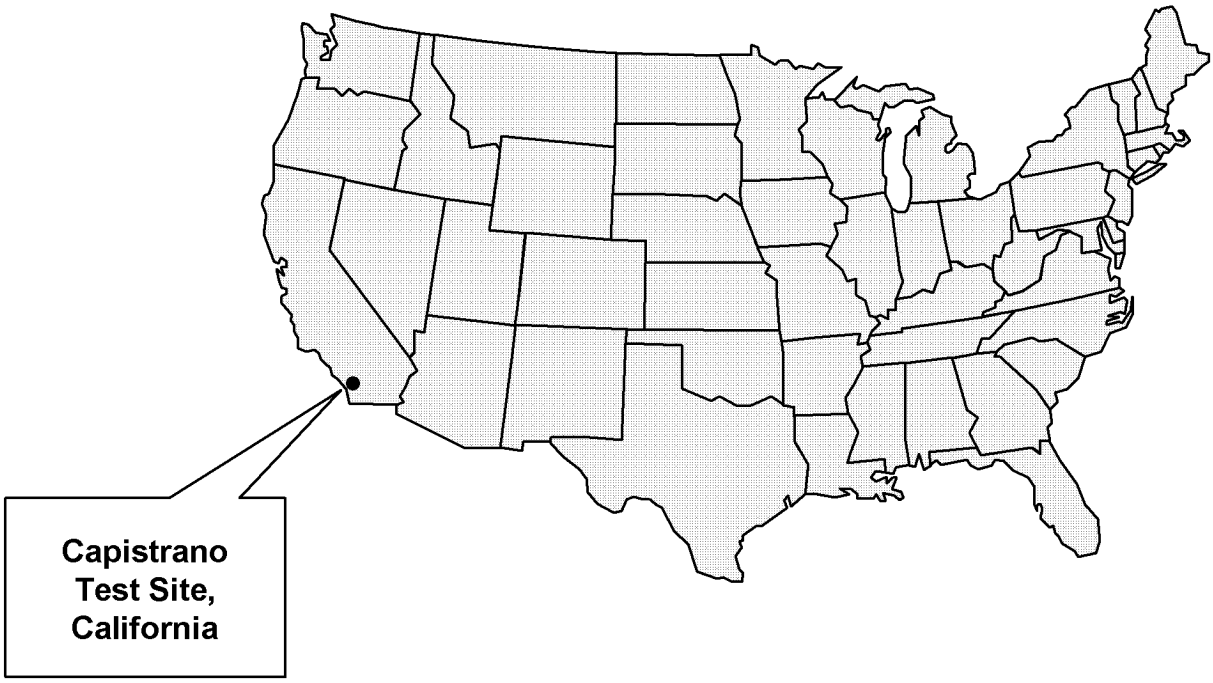
FIGURES

Page

Figure 1-1 Capistrano Test Site, California 1-5
Figure 1-2 Location of Subject Property at CTS 1-7

TABLES

Table 4-1 Minimum Search Distances 4-2



PURPOSE OF THE ENVIRONMENTAL BASELINE SURVEY

SECTION 1

PURPOSE OF THE ENVIRONMENTAL BASELINE SURVEY

1.1 INTRODUCTION

Assets of the Space-Based Laser (SBL) program at Capistrano Test Site (CTS), California, are being transferred from the Ballistic Missile Defense Organization (BMDO) to the United States Air Force (USAF). These assets are situated at three adjacent sites named the High Energy Propellant Test Stand (HEPTS), the Vertical Engine Test Stand (VETS), and the High Altitude Test Stand (HATS). The CTS is operated by TRW Incorporated (TRW) under a long-term lease from the San Juan Company, which owns the Mission Viejo Ranch. This environmental baseline survey (EBS) documents the physical condition of the three sites and adjacent property, collecting into a single document available information to establish a baseline for use by the Air Force.

This EBS assists the Air Force in meeting its obligations under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Community Environmental Response Facilitation Act (CERFA). An EBS is required by Air Force Instruction (AFI) 32-7066 before any property can be sold, leased, transferred, or acquired. This EBS was prepared in accordance with Air Force Instruction 32-7066, *Environmental Baseline Surveys in Real Estate Transactions*, April 25, 1994, and guidelines contained in the American Society for Testing and Materials (ASTM) standard: *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process*, ASTM Designation 1527-97. Categorization was performed in accordance with the HQ USAF/ILEV memorandum on Interim Use of Environmental Baseline Survey Property Categorization Codes dated 9 February 1999.

This EBS assists the Air Force by:

- Documenting the nature, magnitude, and extent of any visible or recorded environmental contamination of property or interests in property considered for acquisition, transfer, lease, sale, or other disposition.
- Defining potential environmental contamination liabilities associated with the subject real property transaction.
- Developing sufficient information to assess the health and safety risks on the property surveyed, and determine what actions are necessary to protect of human health and the environment prior to a real property transaction.

- Providing the basis for notice when required under Section 120(h)(1) of CERCLA, 42 United States Code (USC) 9620(h)(1), of the type, quantity, and time frame of any storage, release, or disposal of a hazardous substance on the property.

The information for the EBS was obtained through a records search, visual site inspection (VSI), and interviews. The records search included a review of real estate information, aerial photographs, and available Air Force and TRW records. These records included environmental restoration and compliance reports, records, audits, and inspections. A VSI of the property and surveys of adjacent properties were conducted. Additionally, the EBS included an assessment of environmental conditions of the properties immediately adjacent to the proposed site that could pose environmental concern and/or affect the subject property. Interviews were conducted with Air Force and TRW personnel.

Based on analysis of available data, the EBS categorizes properties into one of seven categories as defined in the HQ USAF/ILEV memorandum on Interim Use of Environmental Baseline Survey Property Categorization Codes dated 9 February 1999. The seven category codes are:

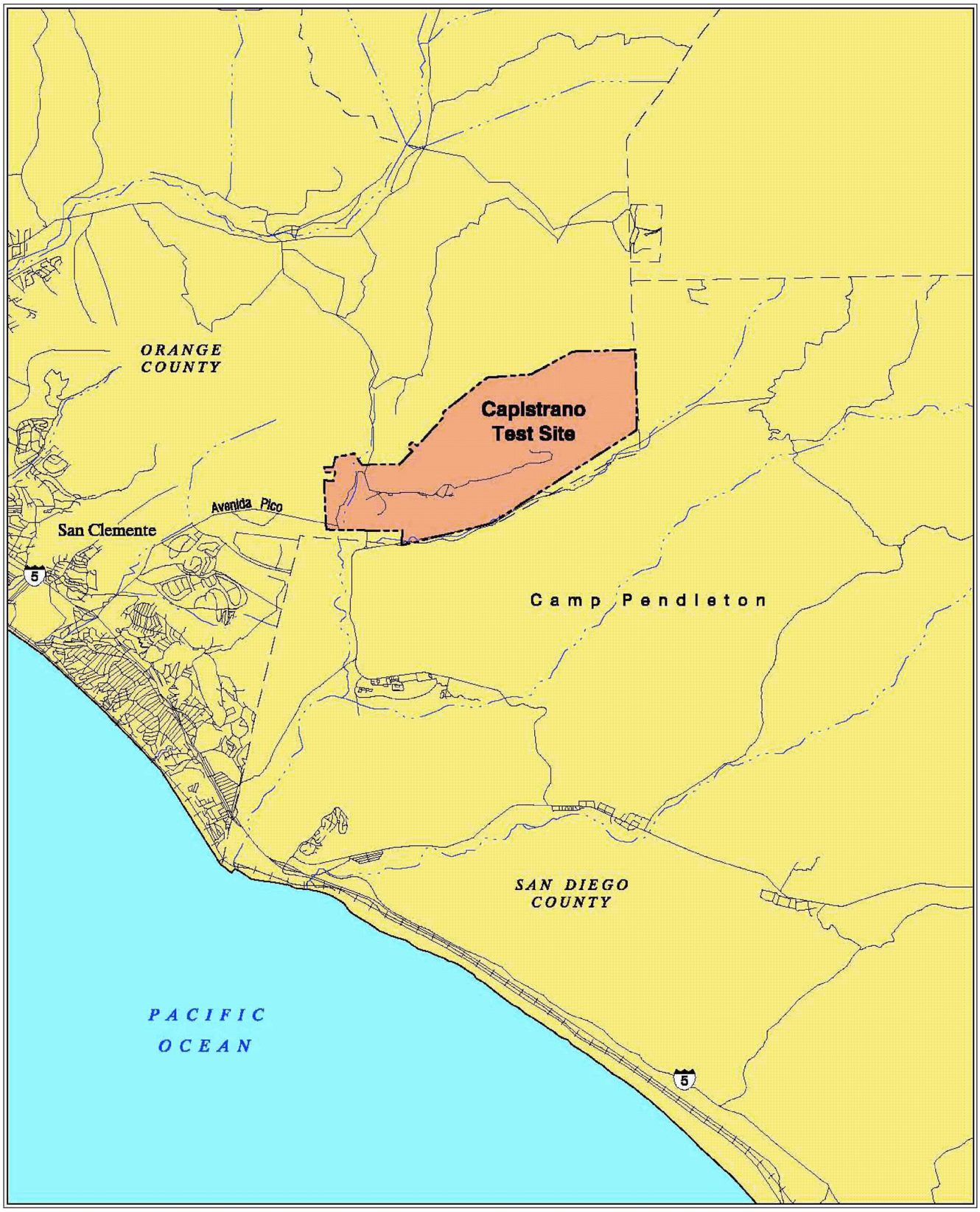
- **Category 1** - Areas where no release or disposal of hazardous substances or petroleum substances has occurred (including no migration of these substances from adjacent areas).
- **Category 2** - Areas where only release or disposal of petroleum substances has occurred.
- **Category 3** - Areas where release, disposal, and/or migration of hazardous substances has occurred, but at concentrations that do not require removal or remedial response.
- **Category 4** - Areas where release, disposal, and/or migration of hazardous substances has occurred, and all removal or remedial actions have been taken.
- **Category 5** - Areas where release, disposal, and/or migration of hazardous substances has occurred, and removal or remedial actions are underway, but not yet taken.
- **Category 6** - Areas where release, disposal, and/or migration of hazardous substances has occurred, but remedial actions have not been implemented.
- **Category 7** - Areas that have not been evaluated or require additional evaluation.

Property transfer or acquisition of tracts in the first four categories would normally be acceptable. Property transfer or acquisition of tracts in the last three categories would normally be deferred until remedial actions or further study have occurred.

1.2 BOUNDARIES OF THE SUBJECT PROPERTY AND SURVEY AREA

The CTS includes approximately 2,770 acres in Orange County, California. The three adjacent sites (styled subject property hereafter) occupy approximately 41 acres. The sites are not separate parcels of property, but are rather the locations where the facilities comprising the HEPTS, VETS, and HATS are situated. The HATS is also known as the Alpha Area. These facilities are owned by TRW, but government equipment is operated within the facilities that will be transferred from the BMDO to the Air Force. The subject property is located on the southern expanse of a topographic height. Adjacent property is defined as areas within one quarter mile of the subject property, but extended to include the Hazardous Fuel Storage Facility (HFSF) to the west, the Preliminary Assessment and Research Building (PARB) to the southwest, and the High Power Microwave (HPM) facility to the south, all located on the CTS.

The general location of the CTS is shown on Figure 1-1 and the structures comprising the subject property facilities and adjacent properties within the survey area are shown on Figure 1-2.



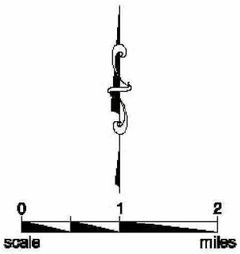


Figure 1-1

Regional Location Map

Capistrano Test Site

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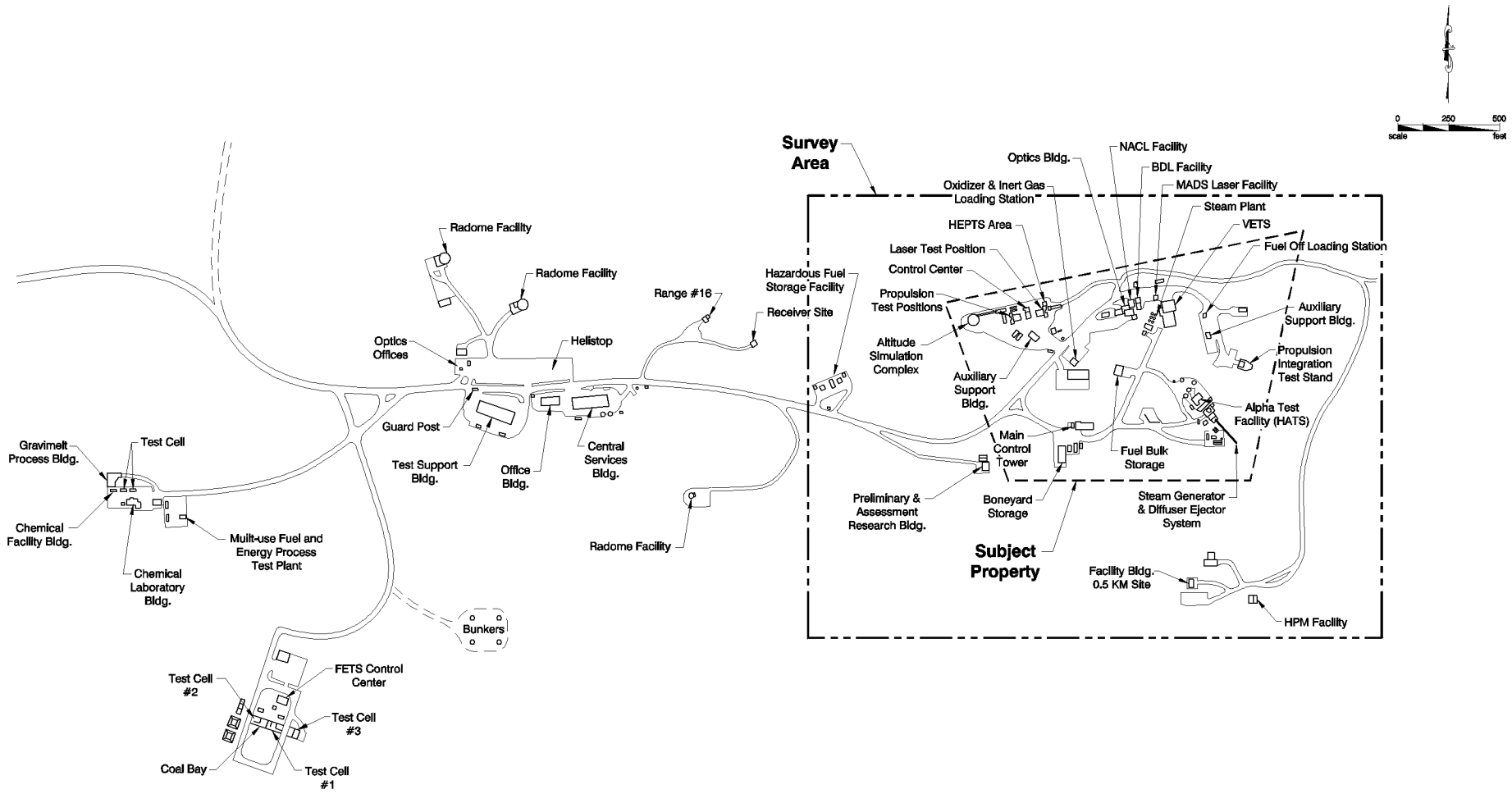

LEGEND	
FETS	Fossil Energy Test Site
HATS	High Altitude Test Stand
HEPTS	High Energy Propellant Test Stand
VETS	Vertical Engine Test Stand
NACL	Navy Chemical Laser
BDL	Baseline Demonstration Laser
MADS	Modular Army Demonstration System
HPM	High Power Microwave
MCC	Main Control Center

Figure 1-2

Survey Area for
Subject Property EBS

Capistrano Test Site

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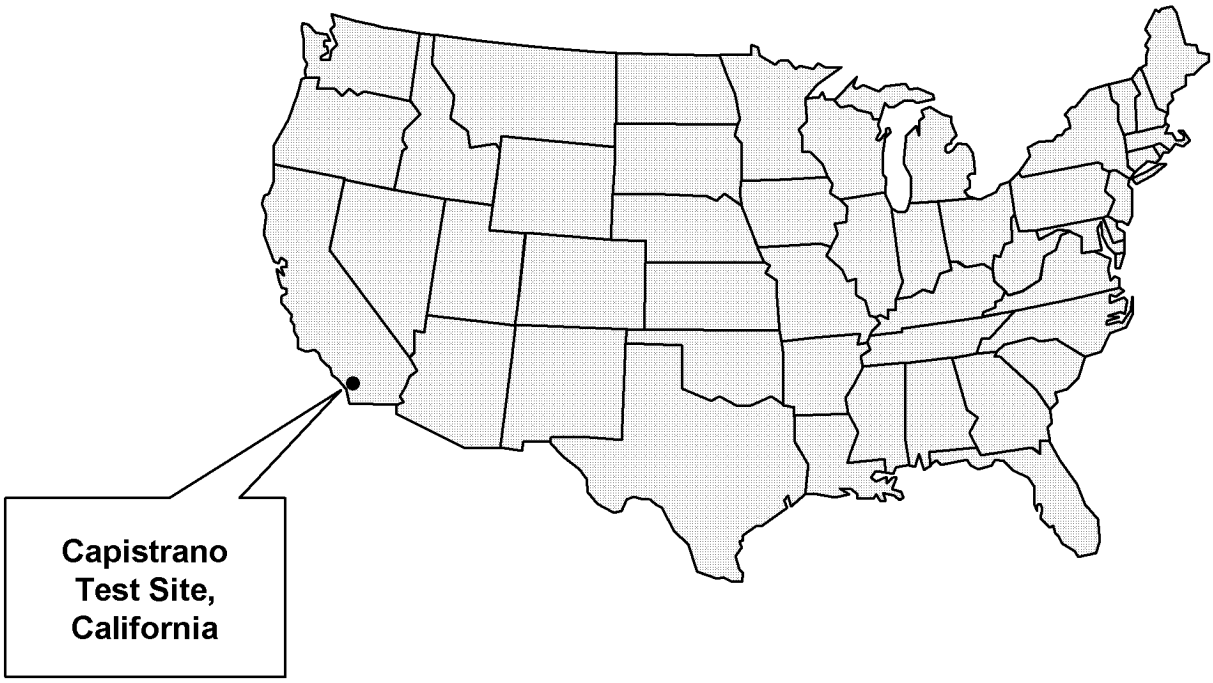


SURVEY METHODOLOGY

SECTION 2

SURVEY METHODOLOGY

The methods used to conduct the EBS for the subject property are described in this section.

2.1 APPROACH AND RATIONALE

The EBS followed a methodical process in which available information was analyzed and conclusions were drawn about the environmental condition of the subject property. First, real estate records, land use maps, and aerial photographs were reviewed to identify historical land uses, a primary indicator of potential contamination. Next, various environmental studies, reports, and field investigations were reviewed to identify areas where the presence (or absence) of contamination had been confirmed. Available local, state, and federal environmental records were reviewed to identify potential areas of concern. Finally, TRW employees were interviewed, and physical inspections of the property and facilities were conducted to identify any additional evidence of staining, distressed vegetation, or other indications of contamination.

The result of the data gathering process was a collection of component information that, when assembled, provides a picture of the property's condition enabling the researchers to sort the property into defined environmental condition categories and identify data gaps.

The major components of this analysis were: a documents review; inspections of property; and interviews with CTS personnel. Each of the major components of the analysis are described below.

2.1.1 Description of Documents Reviewed

The records search of available documentation focused primarily on records, reports, and maps maintained by TRW Incorporated at CTS, and environmental records maintained by local, state, and federal agencies.

Various studies, investigations, and inspections that consider environmental conditions, including regulatory compliance issues, have been conducted by TRW, the Air Force, and other federal and state agencies in the past several years. The results of these studies and investigations provided the initial baseline used in developing this EBS. Upon completion of the records search, actual documents located and reviewed included the following:

- EDR Online Environmental Records Data Search, July 24, 1998.

- Natural Resources Conservation Service, Soil Survey, Orange County and Western Part of Riverside, 1978.
- Strategic Defense Systems Program Office, Environmental Assessment for Continued Development and Operation of the High Power Microwave System, Capistrano Test Site, California, February 1989.
- Environmental Impact Report for Renewal of Use Permit No. 3472, TRW Capistrano Test Site, October 25, 1978.
- Surface Impoundment Closure Plan for the Capistrano Test Site, November 1987.
- Final Closure Report for Surface Impoundments at the TRW Capistrano Test Site, October 12, 1988.
- Final Report for Underground Gasoline Tank Replacements at the TRW Capistrano Test Site, October 1988.
- TRW Capistrano Test Site Biological Resources Assessment and Planning Guidelines, August 1990.
- Transformer PCB Test Results, 1992.
- Water Quality Management Plan A9692, December 7, 1993.
- CTS Asbestos Locations, March 16, 1995.
- TRW Capistrano Test Site Emergency Response Plan, January 1996.
- Spill Prevention Control and Countermeasure Plan, March 21, 1997.
- Aboveground Tank System and Secondary System Inspection Form, June 30, 1999.
- Material Safety Data Sheets for pesticides used at Capistrano Test Site, 1999.
- Presentation material regarding purpose and operation of Capistrano Test Site, July 20, 1999.
- Air Quality Permits, July 21, 1999.
- United States Geological Survey, San Clemente, California, Quadrangle, 7.5 Minutes Series Topographic Map, 1968, Photorevised 1975.
- Aerial photographs from 1952, 1977, 1981, 1987, 1990 and 1993.
- Historical topographic maps from 1902, 1949, 1968 and 1975.

2.1.2 Property Inspection

A VSI of the subject and adjacent property was conducted during a site visit on July 20-21, 1999. The VSI consisted of a vehicle and pedestrian reconnaissance. The purpose of the VSI was to determine or confirm the presence of recognized environmental conditions, including unusual odors, stained soil, stressed vegetation, leachate seeps, or other indications of potential contamination.

2.1.3 Personal Interviews

Primary contacts made during the preparation of the EBS were with TRW personnel from CTS. The following persons were interviewed during the EBS preparation:

Capistrano Test Site

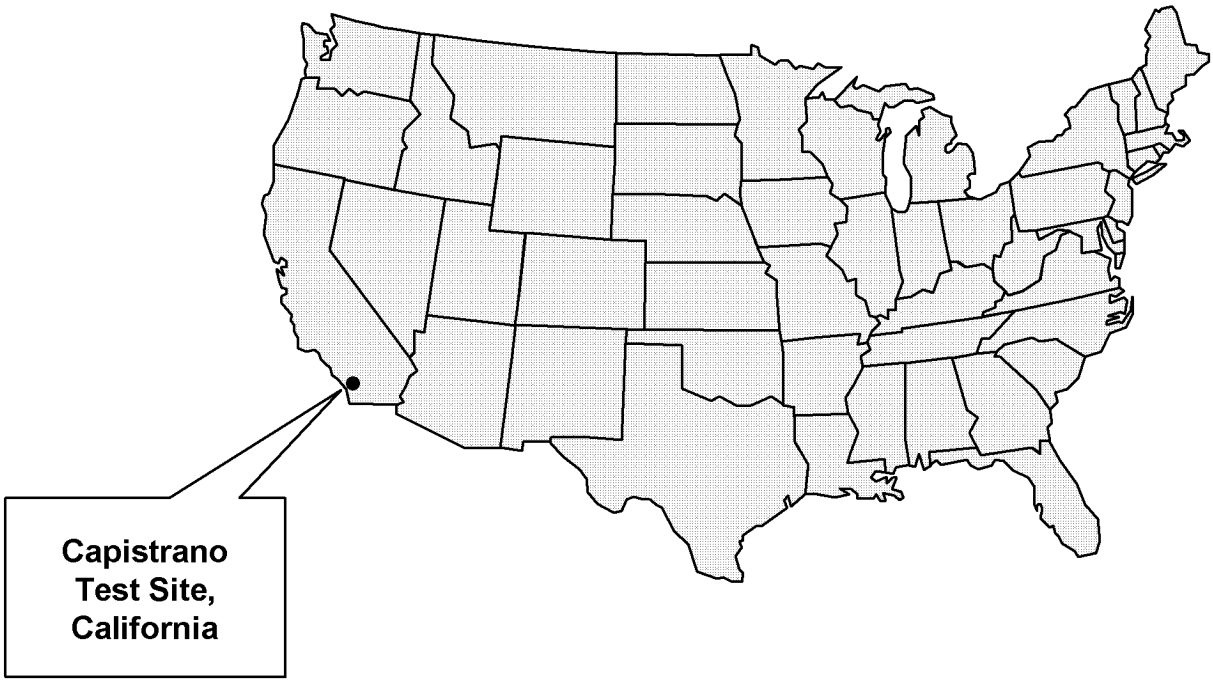
Richard K. Asher, Senior Environmental Engineer
Jerry Buckley, Manager, Facility Operations
Larry L. Gassert, Manager, Capistrano Test Site

Camp Pendleton

Dave Song, Assistant Chief of Staff, Environmental Security, IR Branch

2.1.4 Sampling

No sampling was conducted in support of the EBS.



FINDINGS FOR SUBJECT PROPERTY

SECTION 3

FINDINGS FOR SUBJECT PROPERTY

This section of the EBS presents the findings of the records search, VSI, and interviews for the subject property.

3.1 HISTORY AND CURRENT USE

3.1.1 General Information

The CTS is located in the southernmost portion of Orange County in southern California. The CTS occupies approximately 2,770 acres of land with the subject property located on the southern exposure of a topographic height. San Clemente, California, is located approximately three miles to the west-southwest. The CTS was leased from the San Juan Company (Rancho Mission Viejo) in 1963, and the current lease extends through 2018. The Orange County use permit likewise extends through 2018. All three facilities comprising the subject property were built in the period 1963-1965 (Buckley, 1999).

3.1.2 Historical Use

The land where the CTS is situated is part of the Rancho Mission Viejo (Mission Viejo Grant). Prior to the lease, the land was apparently used for ranching purposes (Gassert, 1999). Developed areas of the CTS include approximately 100 acres out of the 2,770 acres total, with the undeveloped portion used for ranching. The terms of the lease require the removal of all structures and restoration of the property at lease expiration.

The original mission for the CTS was testing of the Apollo Program Lunar Expeditionary Module engine, and testing of rocket engines and systems has continued to the present. The CTS has conducted experimental, development, and qualification engineering test programs for (1) directed energy systems (high energy lasers and high power microwaves), (2) advanced propulsion (rocket engines and systems), (3) space communication (radar, antennas), (4) fossil fuel technologies, and (5) integration of hardware and processes with applications to the space, defense, and energy fields. Uses at the subject property have included (1), (2), and (5) from the previous sentence.

3.1.3 Current Use

The subject property is used for testing and development of directed energy systems and rocket engines and propulsion systems. Personnel levels fluctuate with up to 200

personnel at the site. Current levels are approximately 60. There are no housing facilities at the CTS.

3.2 ENVIRONMENTAL SETTING

3.2.1 Land Use

The Mission Viejo Ranch adjoins the CTS to the north and west; the Cleveland National Forest to the northeast; and Camp Pendleton, a U.S. Marine Corps installation, to the south and east in San Diego County. Portions of Camp Pendleton within one mile of the subject property include firing ranges and maneuver areas. Philco-Ford Aeronutronics previously leased a large tract immediately to the north of the CTS which was reported used for testing of depleted uranium munitions and other munitions research (Buckley, 1999). The facility lease ended in approximately 1990-1991 (Buckley, 1999), and the area has been restored.

3.2.2 Soils and Topography

The CTS is situated within the Pacific Border physiographic province (USGS, 1986), in mountainous terrain with elevations ranging from approximately 200 to 1,100 feet above sea level. Hills with slopes up to 37 degrees in inclination characterize the area. The subject property is located on the southern exposure of a topographic height with elevations ranging from approximately 610 feet to 710 feet above sea level. The Mission Viejo Fault runs from north to south through the CTS just east of the subject property (SDSPO, 1989).

There are no permanent natural surface waters in the CTS area (SDSPO, 1989). Runoff from the CTS drains into one of five canyons: Blind Canyon, Cristianitos Canyon, Gabino Canyon, La Paz Canyon, or Talega Canyon. All of the canyons flow into San Mateo Creek, which empties into the Pacific Ocean on the south side of San Clemente. Drainage from the subject property flows south into an unnamed tributary of Talega Canyon.

The soil under the majority of the site was formed from deposits of stream and marine alluvium. The area is underlain by the Santiago Formation west of the Mission Viejo Fault and the Silverado Formation east of the fault. Soils in the developed portion of the CTS range from one to four feet of silty sand to gravelly clay containing cobbles and pebbles. The upper 12 to 18 inches are generally loose and compressible, but below these depths the soil is dense and essentially non-compressible (TRW, 1978).

3.2.3 Drinking Water and Groundwater

There are no principal aquifers underlying the CTS (USGS, 1985). Drinking water is provided by bottled water, and two wells in the western portion of the CTS supply potable water from an alluvial aquifer for other uses. Depths to groundwater vary from

near surface adjacent to major drainages to over 100 feet. Boreholes drilled for geotechnical studies for facility designs found no free groundwater within 30 feet of the surface at the facility locations (TRW, 1978). Groundwater under the subject property is presumed to flow to the south and southwest to Talega Canyon, following the topographic slope.

3.2.4 Ecology

The CTS includes a variety of native and non-native plant communities. Sensitive communities (those likely to support sensitive plant and animal species) include native grasslands, coastal sage scrub, chaparral, oak woodlands, and willow woodlands. A biological resources assessment and planning guidelines report prepared in association with an application for an Orange County use permit found that the developed areas of the CTS are located where no significant impacts to biological resources would occur (TRW, 1990).

Amphibians and reptiles found in field surveys at the CTS include the western rattlesnake (*Crotalis viridis*), western fence lizard (*Sceloporus occidentalis*), and southern alligator lizard (*Gerrhonotus multicarinatus*), and the Pacific tree frog (*Hyla regilla*) (TRW, 1978). A California protected species, the arroyo toad, reportedly utilizes the Talega Canyon streambed (Asher, 1999).

Mammals include cattle, black-tailed mule deer, mountain lion, coyote, bobcat, and Beechey ground squirrels. Birds include red-tailed hawks, red-shouldered hawk, Cooper's hawk, and American kestrel.

Sensitive species found on the CTS include many-stemmed dudleya (*Dudleya multicaulis*), Orange County Turkish rugging (*Chorizanthe staticoides chrysacantha*), California juniper (*Juniperus californica*), San Diego cactus wren (*Camphlorhynchus brunneicapillus sandiegensis*), and California gnatcatcher (*Polioptila californica*).

3.3 HAZARDOUS SUBSTANCES

3.3.1 Hazardous Materials and Petroleum Products

The VSI, records search, and interviews indicate that hazardous materials currently and historically have been used in buildings on the subject property and at CTS.

In the HATS portion of the subject property, hazardous materials include deuterium, hydrogen, isopropyl alcohol, fluorine, nitrogen trifluoride, liquid nitrogen, helium, gaseous nitrogen, gaseous oxygen, sulfur hexafluoride. There is a 10,000-gallon aboveground tank for storage of isopropyl alcohol. There was no evidence of leakage or spills. Stains were evident on facilities throughout the site. The HATS includes large steam jet ejector systems which vent large quantities of water vapor to the atmosphere

during tests. These stains are reportedly due to rust in the ejector system that is flushed as tests are run (Asher, 1999).

In the HEPTS portion of the subject property, hazardous materials include hydrazine, hydrogen, deuterium, propane, liquid fluorine, nitrogen tetroxide, gaseous nitrogen, gaseous oxygen, sodium hydroxide, liquid nitrogen, nitrogen trifluoride, and hydrogen peroxide. There was no evidence of leakage or spills.

In the VETS portion of the subject property, hazardous materials include nitrogen trifluoride, liquid ammonia, potassium hydroxide, hydrogen hydroxide, deuterium, hydrogen, chlorine, fluorine, liquid nitrogen, helium, gaseous nitrogen, gaseous oxygen, and propane. There was no evidence of leakage or spills.

Secondary containment is included throughout the subject property. Therefore, spills would generally be contained prior to contact with soil or water. The cooling water was injected with chromate until 1986. Since that time, lime has been used to adjust the pH of the cooling water (Buckley, 1999).

There are eleven propane tanks on CTS that fuel emergency generators (Asher, 1999).

Minor releases of fluorine gas have occurred, resulting in minor damage to pipes and electrical systems (Asher, 1999). These releases would not cause contamination of the soil or water. Additionally there was minor leakage from a single drum of hydrazine within the last ten years that did not result in soil or groundwater contamination (Asher, 1999).

With its role as a research and development center, the inventory of chemicals used at CTS includes over 900 types. These types include gases, fuels, lubricants, adhesives, cleansers, solvents, acids, and paints. The material form, quantity, location, and hazardous classification of these chemicals are tracked, and storage and use practices appear excellent.

3.3.2 Hazardous and Petroleum Waste

The CTS disposes of hazardous waste under U.S. Environmental Protection Agency (USEPA) registration CAD000629402. Waste codes from manifests include D001, waste flammables; D002, waste corrosive liquid; D007, waste environmentally hazardous substances; U133 for aqueous hydrazine; and non-hazardous waste that included water and sludge from the cooling towers. The subject property contains several accumulation points for hazardous and petroleum waste. The containers are located in secondary containment palettes, and no evidence of spills or leaks was observed.

3.4 INSTALLATION RESTORATION PROGRAM CONTAMINATION

The CTS is not a government-owned facility and there are no Installation Restoration Program (IRP) sites.

3.5 STORAGE TANKS

3.5.1 Aboveground Storage Tanks

There are 38 aboveground storage tanks (AST) at the CTS containing various liquids, including water, chemicals, waste, and fuel (TRW, 1999a). These are regularly inspected and inspection records are maintained at the facility. Only four contain petroleum, specifically diesel. Capacities of the four diesel ASTs range from 110 gallons to 4,000 gallons, and a spill prevention control and countermeasure plan (SPCC) is in place for all four ASTs (TRW, 1997). Only the two smaller diesel ASTs are located on the subject property, containing 110 gallons and 250 gallons of diesel, respectively. There was no evidence of spills or leaks.

3.5.2 Underground Storage Tanks

According to CTS personnel, there are no underground storage tanks (UST) on the subject property nor have there been in the past (Asher, 1999). Two gasoline USTs (1,000 gallon and 2,000 gallon) at the main administrative center for CTS approximately one mile west of the subject property were replaced in 1988. The replacement tank was a 3,000-gallon double-wall fiberglass coated steel UST installed where the 2,000-gallon tank was located. Soil samples were analyzed for aromatic volatile organics with results below the detection limit for all analytes (TRW, 1988b).

3.5.3 Pipelines, Hydrant Fueling, and Transfer Systems

Based on the VSI and interviews, there are no hydrant fueling or transfer systems on the subject property. A petroleum pipeline crosses the CTS diagonally from northwest to southeast, but is not located on the subject property (TRW, 1996).

3.6 OIL/WATER SEPARATORS

Based on the VSI and interviews, there is no evidence of oil/water separators at the site.

3.7 PESTICIDES

Based on the VSI and interviews, only normal applications of pesticides occurred at the site. Pesticides used at the CTS include insecticides and herbicides (TRW, 1999b).

3.8 MEDICAL OR BIOHAZARDOUS WASTE

Based on the VSI and interviews, there is no evidence that medical or biohazardous waste has been stored or disposed at the subject property. A nurse at the main administrative center approximately one mile west of the subject property performs health monitoring, and sharps and bandage wastes are generated. These are disposed as medical waste (Asher, 1999).

3.9 ORDNANCE

Based on the VSI and interviews, there is no evidence that ordnance or ordnance disposal activities have been located on the subject property.

3.10 RADIOACTIVE WASTES

Based on the VSI and interviews, there is no evidence that radioactive wastes are present on the subject property. Low-level cesium isotopes are used in liquid level-measuring instruments at the subject property (Asher, 1999).

3.11 SOLID WASTE

Based on the VSI and interviews, there is no evidence that solid wastes are disposed on the subject property. Solid waste at the CTS is removed by a contractor.

3.12 GROUNDWATER

The general characteristics of groundwater under the subject property are discussed in Section 3.2.3. Based on the VSI and interviews, there is no evidence that activities at the subject property have contaminated the groundwater. As indicated in Section 3.13, soil and groundwater sampling conducted during closure of surface impoundments in 1987 and 1988 found no evidence of contamination (TRW, 1987; TRW, 1988a).

3.13 WASTEWATER TREATMENT, COLLECTION, AND DISPOSAL

The CTS is not connected to a central wastewater disposal system. Wastewater is treated in nine septic systems, including seven leach fields, one collection tank, and one aboveground aeration pond (TRW, 1993). The subject property is served by two leach fields, and the septic tanks are pumped and sludge disposed at a publicly owned treatment work (Asher, 1999).

The CTS formerly operated seven hypalon-lined surface impoundments that held cooling water or fire extinguishing water, five of which were located at the subject property. These impoundments were closed in 1988 pursuant to provisions of the California Toxic Pits Cleanup Act, and replaced with regulatory-compliant storage systems. Prior to the closure at the subject property, four subsurface soil borings were

drilled, sampled, and completed; and a monitor well was installed at the HATS site, sampled, and abandoned (TRW, 1987). During the closure, soil samples were taken at all of the impoundments (TRW, 1988). The analyses found no evidence of soil or groundwater contamination.

3.14 DRINKING WATER QUALITY

Bottled water is used for drinking purposes, although water produced by the two wells at the CTS is potable. Periodic testing of the water has found that the well water is consistently of good quality (TRW, 1993).

3.15 ASBESTOS

Asbestos is present in the facilities on the subject property, but is not considered a health risk unless disturbed (TRW, 1995). During the VSI, corrugated Transite panels that contain asbestos at the HEPTS site were noted.

3.16 POLYCHLORINATED BIPHENYLS

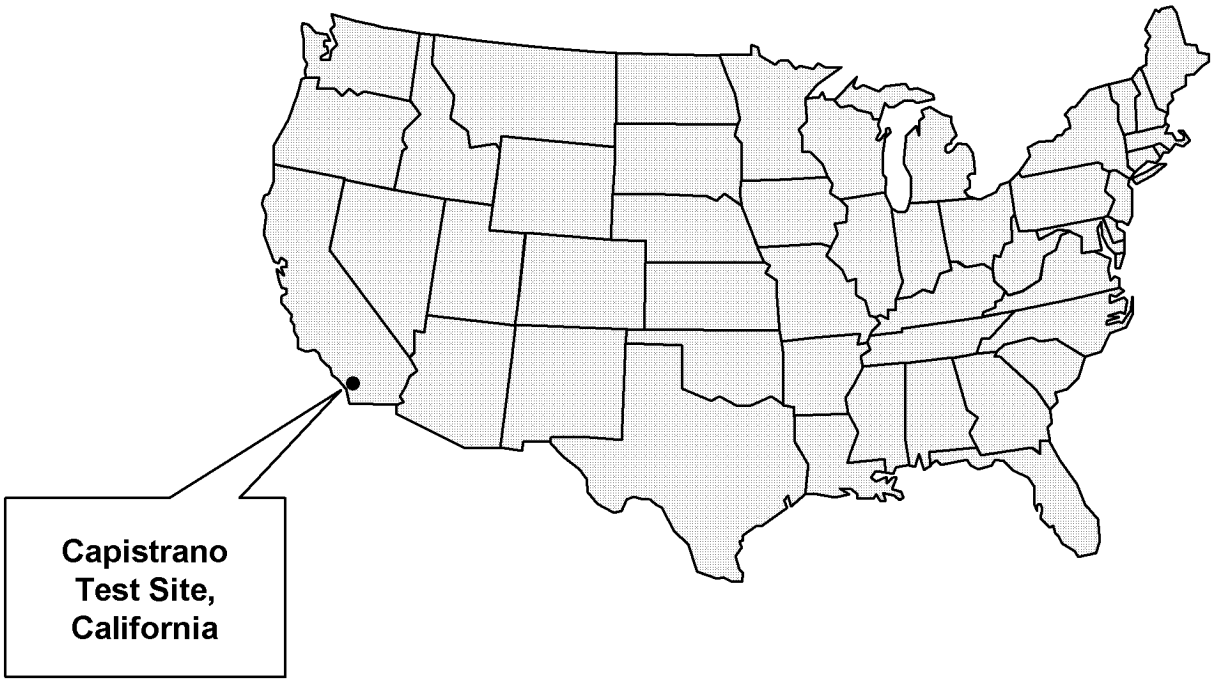
In 1991 and 1992, 96 transformers at the CTS were tested for polychlorinated biphenyls (PCB). Seventeen of the transformers had PCB concentrations in excess of five parts per million. The PCB-contaminated oil was removed from these 17 transformers and disposed (TRW, 1992). Based on the VSI and interviews, there was no evidence of PCB contamination.

3.17 RADON

The USEPA National Radon Database indicates that Orange County is in Radon Zone 3, with average indoor radon levels less than 2 picocuries per liter (p/Ci/L). The radon level above which the USEPA recommends radon mitigation measures is 4.0 pCi/L (EDR, 1999).

3.18 LEAD-BASED PAINT

According to CTS personnel, no lead abatement or testing has been conducted on buildings on the subject property (Asher, 1999). Given the age of the facilities and the types of components, the presence of lead-based paint (LBP) is likely.



FINDINGS FOR ADJACENT PROPERTIES

SECTION 4

FINDINGS FOR ADJACENT PROPERTIES

This section of the EBS presents the findings of the records search, VSIs, and interviews for adjacent properties.

In order to determine the potential for contamination of the property from adjacent sources, a review of local, state, and federal databases was conducted (EDR,1999). In addition, VSIs of adjacent properties were conducted, focusing on potential contamination pathways.

4.1 LAND USES

Adjacent land uses are described in Section 3.2.1, and generally include ranching to the north and west, and military uses to the south and east.

4.2 SURVEYED PROPERTIES

Property located within 0.25 miles of the subject was considered adjacent property and included in the July 20-21, 1999, VSI (Figure 1-3). Three nearby facilities on the CTS that were surveyed included the Hazardous Fuel Storage Facility (HFSF) to the west, the Preliminary Assessment and Research Building (PARB) to the southwest, and the High Power Microwave (HPM) facility to the south, all located on the CTS.

4.3 OFFSITE FINDINGS

No potential sources of contamination from the areas surrounding the subject site that could migrate into or affect the sites were observed during the vehicle and pedestrian reconnaissance (VSI).

The HFSF stores drums of fuel and oxidizers, with fuel in the western part separated by a berm from oxidizers in the eastern part. Each part has its own secondary containment system with locked valves that drain to the north. Fuel storage includes hydrazine, monomethyl hydrazine, Aerozine 50, diesel, and oil. Oxidizer storage includes dinitrogen tetroxide, nitrogen dioxide, chlorine trifluoride, chlorine, sulfuric acid, nitric acid, hydrogen peroxide, and tetrafluorohydrazine. A roof covers these areas which appeared in excellent condition during the VSI. There was no evidence of spills or leakage. Any spills would be directed to the north and would not affect the subject property.

The PARB is a small building used for optics research. There was no evidence of spills or leakage.

The HPM is an abandoned facility. Based on the VSI and interviews, there was no known usage of petroleum. A small domestic water tank with a bib is located near the HPM, along with a corrugated metal cylinder which protects components of the electrical system. A concrete block wall was reportedly used as a stand for a drone helicopter in a laser test (Buckley, 1999). Spent small arms cartridges were found near the facility. These were reportedly blanks used in an exercise by Marines from Camp Pendleton in the past year (Gassert, 1999). There was no evidence of spills or leakage.

Local, state, and federal records were reviewed to determine the potential for offsite contamination from adjacent properties. Table 4-1 identifies the minimum search distances used in the records search.

4.3.1 Installation Restoration Program Sites

Camp Pendleton is the only federal facility adjacent to the CTS, and no IRP sites are located within one mile of the subject property (Song, 1999).

4.3.2 Underground Storage Tanks

Based on the VSI and interviews, there are no USTs located on the subject property or within 0.25 mile of the subject property.

Table 4-1 Minimum Search Distances

Record Source	Minimum Search Distance
Federal NPL site list	1.5 mile
Federal CERCLIS list	1.0 miles
Federal RCRA TSDF list	1.0 mile
Federal RCRA generators list	0.75 miles
Federal ERNS list	Property
State lists of hazardous waste sites identified for investigation or remediation (NPL and CERCLIS equivalents)	1.5 mile
State landfill and/or solid waste disposal site lists	1.0 miles
State leaking UST lists	1.0 miles
State registered UST lists	0.75 miles

Source: EDR, 1999

4.3.3 Federal and State Database Review

The following federal and state databases were reviewed for the property for potential contamination sources. Information from these databases should be considered supplemental to other aspects of the study, and should not be relied on exclusively. The data base search revealed only CTS as a potential contamination source within the minimum search distances of the site.

National Priorities List (NPL) - The NPL is the list compiled by the USEPA pursuant to CERCLA 42 United States Code §9605(a)(8)(B) with the highest priority for cleanup pursuant to a hazard ranking system. A review of the NPL indicated no listed sites within 1 mile of the property (EDR, 1999).

Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) - CERCLIS includes the list of sites compiled by the EPA that have been investigated or are being investigated for a release or threatened release of hazardous substances pursuant to CERCLA. A review of the CERCLIS database indicated no listed sites within 1.0 miles of the property (EDR, 1999).

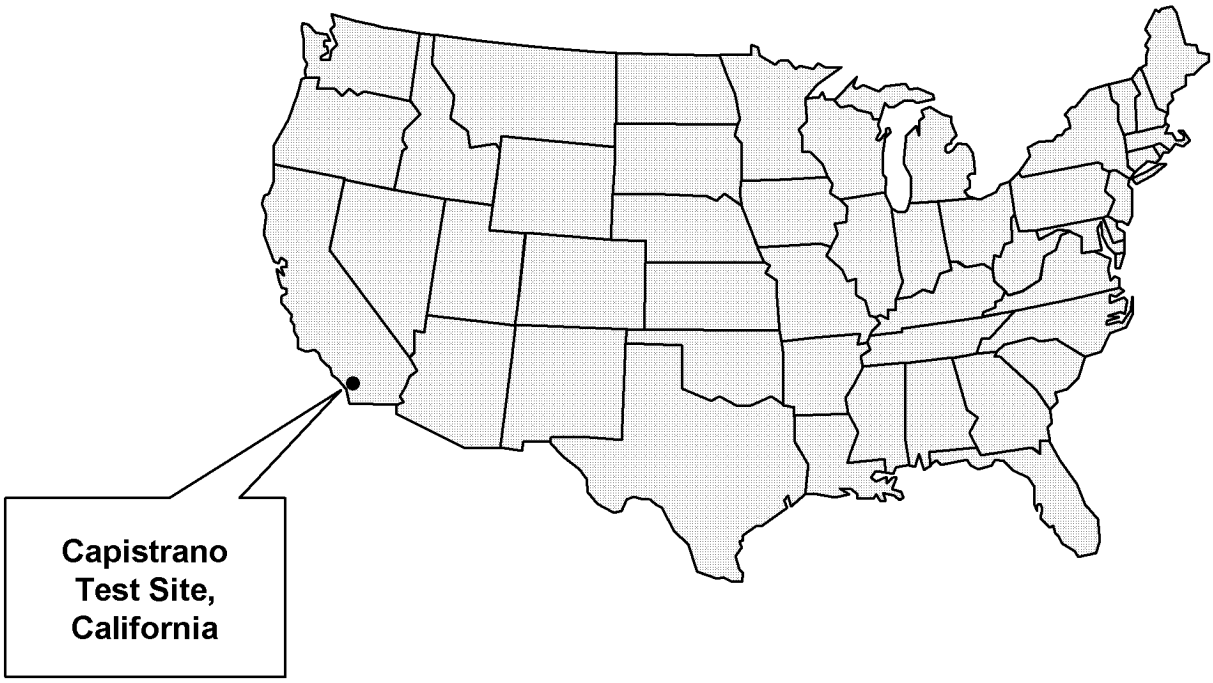
RCRA Generators/Transporters/Treatment, Storage, or Disposal (TSD) Facilities – Resource Conservation and Recovery Act (RCRA) generators are those persons or entities that generate hazardous waste as defined by RCRA. Transporters are those persons or entities that transport hazardous waste as defined and regulated by RCRA. TSD facilities are those facilities where treatment, storage, and/or disposal of hazardous wastes occur, as defined and regulated by RCRA. Columbus AFB is listed in the database as a large quantity generator. No small, or conditionally exempt small quantity generators listed in the RCRA generators database are located within 0.75 miles of the property. No RCRA listed transporters are located within 1.0 miles of the property. No TSD facilities are located within 1.0 miles of the site (EDR, 1999).

Emergency Response Notification System (ERNS) - The ERNS is a national database of reported releases of oil and hazardous substances in quantities greater than specified quantities. A search of the ERNS database found no reported releases on the subject property (EDR, 1999).

Toxic Release Inventory System (TRIS) - Section 313 of the Emergency Planning and Community Right-to-Know Act (also known as Title III of the Superfund Amendments and Reauthorization Act of 1986) requires the USEPA to establish an inventory of toxic chemicals emissions from certain facilities. A search of the TRIS database found no reported incidents for the subject property (EDR, 1999).

Solid Waste Disposal Sites - These are sites used for the disposal of solid wastes as defined by state solid waste regulations. A search of state database of permitted solid waste disposal and processing facilities found no sites within 1.0 miles from the property (EDR, 1999).

Underground Storage Tanks (UST) - These tanks are used to store petroleum products. A search of the state database for USTs and leaking USTs (LUST) found no USTs or LUSTs within 1.0 miles of the property (EDR, 1999).



APPLICABLE REGULATORY COMPLIANCE ISSUES

SECTION 5

APPLICABLE REGULATORY COMPLIANCE ISSUES

This section is an overview of the potential regulatory compliance issues surrounding the lease or purchase of the property. Compliance issues include violations or potential violations of federal, state, or local laws and regulations that have occurred on the property of interest.

5.1 LIST OF COMPLIANCE ISSUES

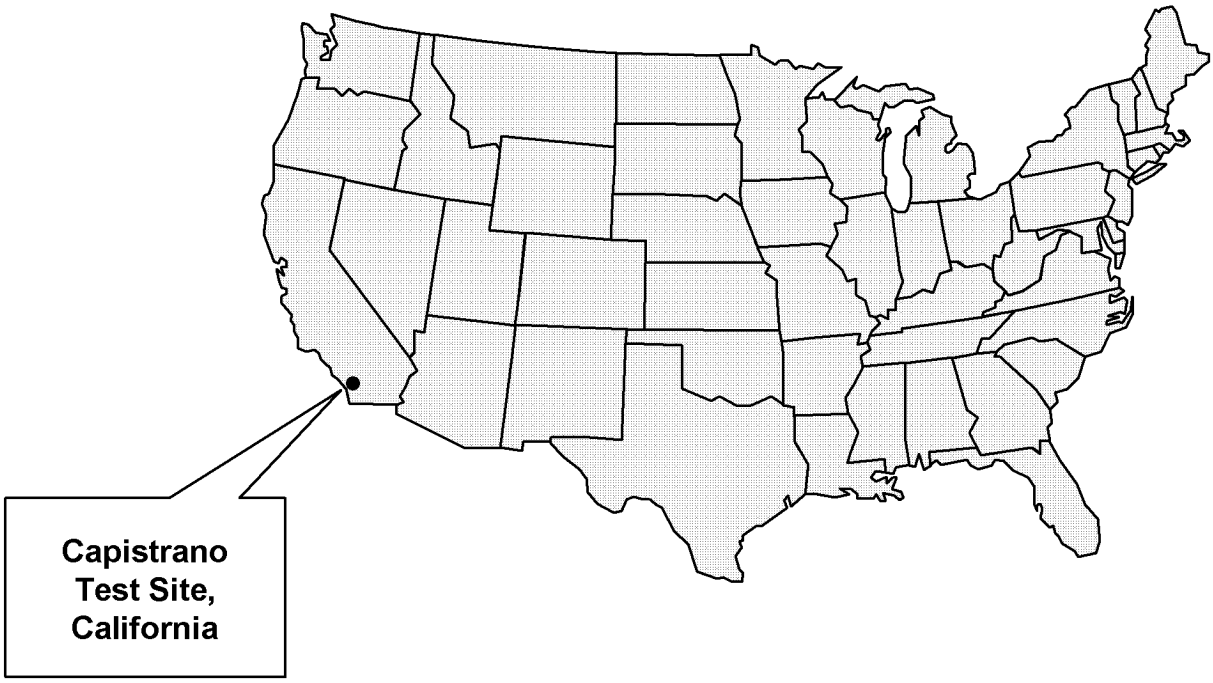
No compliance issues applicable to the proposed property lease were discovered during the EBS.

5.2 DESCRIPTION OF CORRECTIVE ACTIONS

Based on the VSI and interviews, no corrective actions are required.

5.3 ESTIMATES OF VARIOUS ALTERNATIVES

Based on the VSI and interviews, no estimates of various alternatives are required.



CONCLUSIONS

SECTION 6

CONCLUSIONS

Based on the records search, VSI, and interviews, historical use of the property has not caused contamination that would make the decision to conduct a property transaction on the subject site unreasonable. According to the categorization criteria presented in Section 1, the property is classified Category 1.

6.1 FACILITY MATRIX

Section not applicable

6.2 PROPERTY CATEGORIES MAP

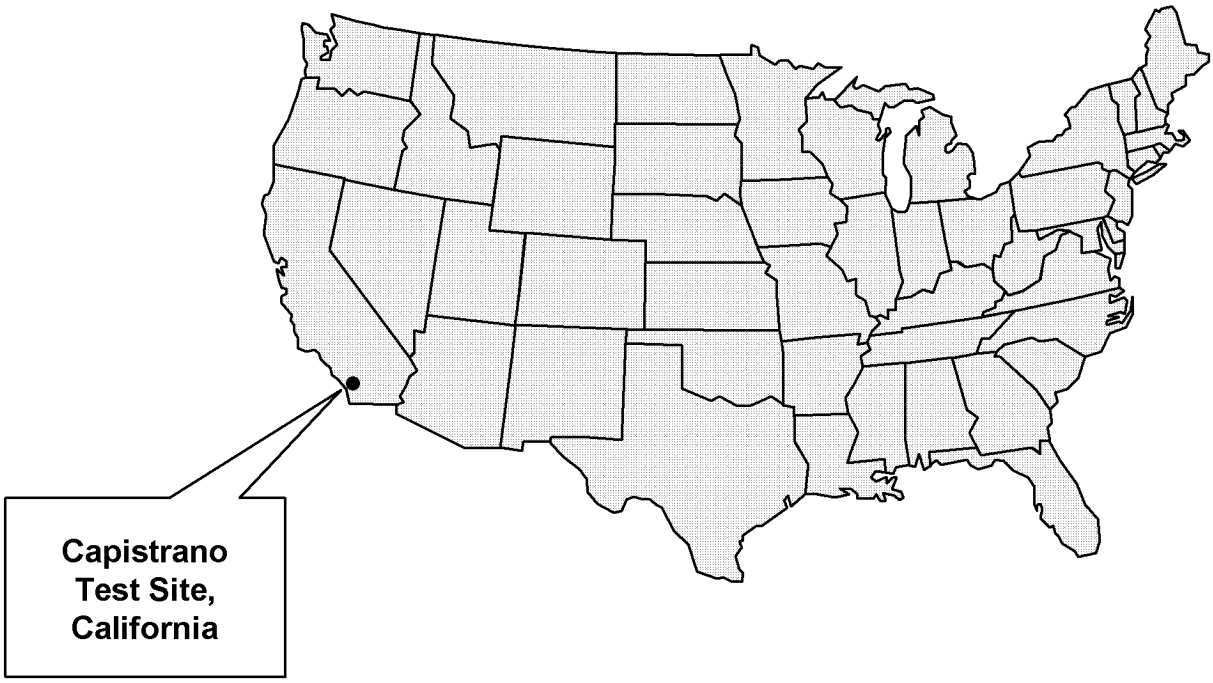
The subject property is considered Category 1.

6.3 RESOURCES MAP

Section not applicable

6.4 DATA GAPS

None.

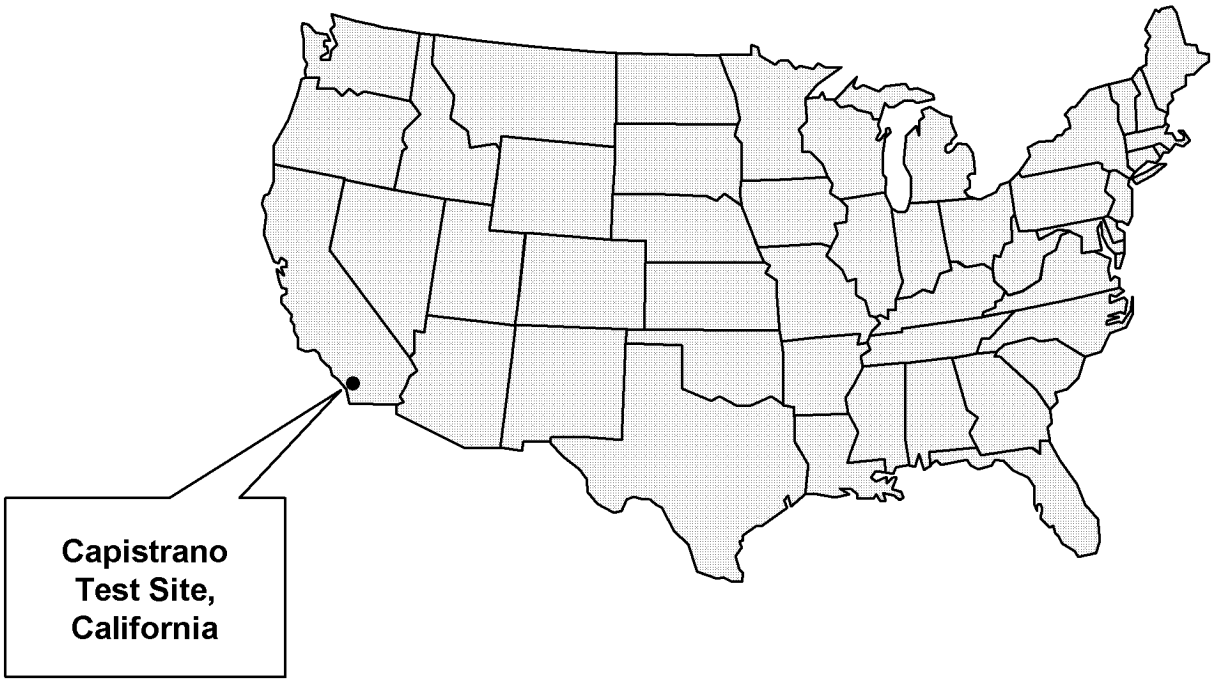


RECOMMENDATIONS

SECTION 7

RECOMMENDATIONS

Based on the records search, VSI, and interviews, the historical use of the property has not caused contamination that would indicate the need for further study of the property. According to the categorization criteria presented in Section 1, the property is classified Category 1.



CERTIFICATIONS

SECTION 8

CERTIFICATIONS

Parsons Engineering Science has conducted this Environmental Baseline Survey on behalf of the Air Force. Parsons Engineering Science has reviewed all appropriate records made available, and conducted visual site inspections of the selected facilities following an analysis of information during the records search. The information contained within the survey report is based on records made available and, to the best of Parsons Engineering Science's knowledge, is correct and current as of the date certified.

Certified by:

_____ _____

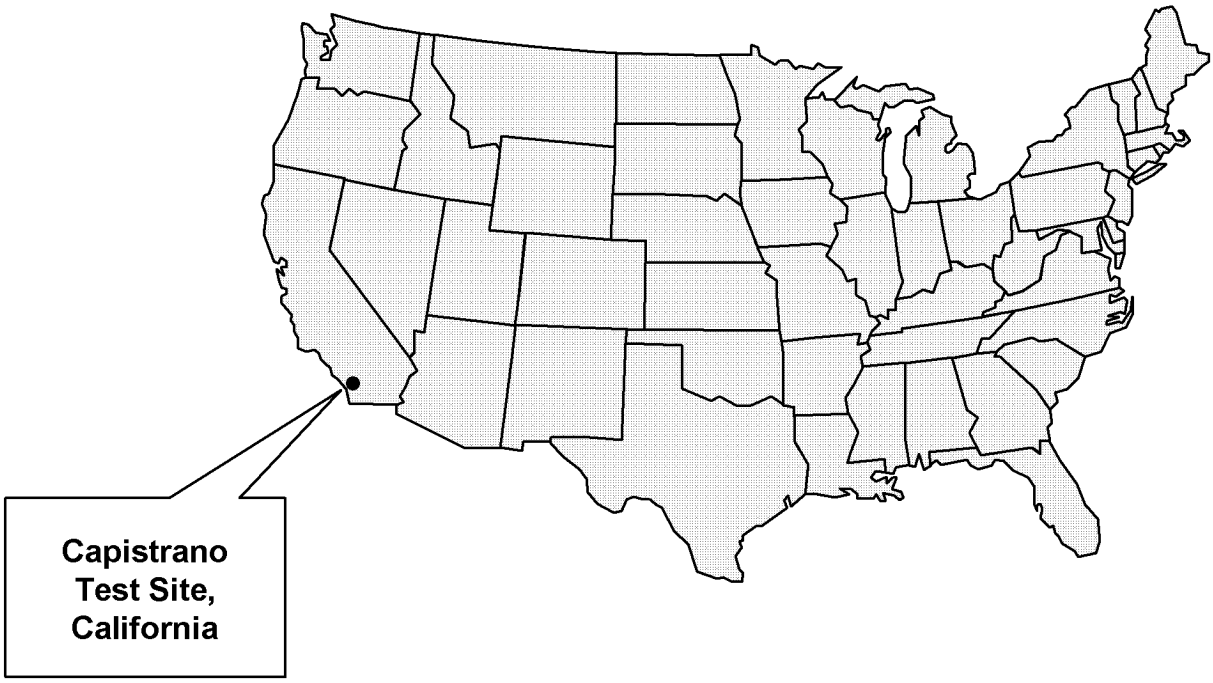
Craig McColloch Date
Parsons Engineering Science

Approved by:

_____ _____

Date

Chief, Environmental Management
Space and Missile Systems Center



APPENDIX A
ABBREVIATIONS, ACRONYMS AND TERMS

APPENDIX A

ABBREVIATIONS, ACRONYMS, AND TERMS

Section A - Abbreviations and Acronyms

AFI	Air Force Instruction
AST	Aboveground storage tank
ASTM	American Society for Testing and Materials
BMDO	Ballistic Missile Defense Organization
CERFA	Community Environmental Response Facilitation Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CTS	Capistrano Test Site
EBS	Environmental Baseline Survey
ERNS	Emergency Response Notification System
HATS	High Altitude Test Stand
HEPTS	High Energy Propellant Test Stand
HFSF	Hazardous Fuel Storage Facility
HPM	High Power Microwave
IRP	Installation Restoration Program
LBP	Lead-Based Paint
LUST	Leaking Underground Storage Tank
NPL	National Priorities List
NRCS	Natural Resources Conservation Service
PCB	polychlorinated biphenyl
pCi/l	pico curies per liter
PARB	Preliminary Assessment and Research Building
RCRA	Resource Conservation and Recovery Act
SBL	Space-Based Laser
SDSPO	Strategic Defense Systems Program Office
SWMU	*Solid Waste Management Unit*
TRIS	Toxic Release Inventory System
TRW	TRW Incorporated
TSD	Treatment, Storage, or Disposal (facility)
USAF	United States Air Force
USC	United States Code
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	Underground Storage Tank
VETS	Vertical Engine Test Stand
VSI	Visual Site Inspection

Section B - Definitions

Acquisition	Any authorized method of obtaining Air Force control of and responsibility for real property. An acquisition may be a temporary or permanent interest in real property. Includes interagency transfers of real property accountability from other federal government agencies. Methods include purchase, condemnation, donation, exchange, leasing, licenses, permits, revestment and recapture.
Adjacent properties	Not only those properties contiguous to the boundaries of the installation or subject property, but also those properties relatively nearby that could pose significant environmental impact or concern on the installation or subject property.
Adjoining properties	Any real property or properties the border of which is contiguous or partially contiguous with that of the property, or that would be contiguous or partially contiguous with that of the property but for a street, road, or other public thoroughfare separating them.
Aerial photographs	Photographs taken from an airplane or helicopter (from a low enough altitude to allow identification of development and activities) of areas encompassing the property. Aerial photographs are often available from government agencies or private collections unique to a local area.
Approximate minimum search distance	The area for which records must be obtained and reviewed pursuant to Section 4.3, Offsite Findings. This may include areas outside the property and shall be measured from the nearest property boundary. This term is used in lieu of radius to include irregularly shaped properties.
Asbestos	Six naturally occurring fibrous minerals found in certain types of rock formations. Of the six, the minerals chrysotile, amosite, and crocidolite have been most commonly used in building products. When mined and processed, asbestos is typically separated into very thin fibers. Because asbestos is strong, incombustible, and corrosion-resistant, asbestos was used in many commercial products beginning early in this century and peaking in the period from World War II into the 1970s. When inhaled in sufficient quantities asbestos fibers can cause serious health problems.
Asbestos containing material (ACM)	Any material or product that contains more than 1% asbestos.
Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS)	The list of sites compiled by EPA that EPA has investigated or is currently investigating for potential hazardous substances contamination for possible inclusion on the National Priorities List.
Construction debris	Concrete, brick, asphalt, and other such building materials discarded in the construction of a building or other improvement to property.

Contaminated public wells	Public wells used for drinking water that have been designated by a government entity as contaminated by toxic substances (e.g., chlorinated solvents), or as having water unsafe to drink without treatment.
Demolition debris	Concrete, brick, asphalt, and other such building materials discarded in the demolition of a building or other improvement to property.
Disposal	Any authorized method of permanently divesting the Air Force of control of and responsibility for real property. Includes fee conveyance and interagency transfers or other disposition.
Disposal by deed	A conveyance of fee or any easement interest in real property.
Drum	A container (typically, but not necessarily, holding 55 gallons (208 liters) of liquid) that may be used to store hazardous substances or petroleum products.
Dry wells	Underground areas where soil has been removed and replaced with pea gravel, coarse sand, or large rocks. Dry wells are used for drainage, to control storm runoff, for the collection of spilled liquids (intentional and non-intentional) and wastewater disposal (often illegal).
Due diligence	The process of inquiring into the environmental characteristics of a parcel of commercial real estate or other conditions, usually in connection with a commercial real estate transaction. The degree and kind of due diligence vary for different properties and differing purposes.
Dwelling	Structure or portion thereof used for residential habitation.
Environmental audit	The investigative process to determine if the operations of an existing facility are in compliance with applicable environmental laws and regulations. An environmental audit may include an environmental site assessment or, if prior audits are available, may be part of an environmental site assessment.
Environmental lien	A charge, security, or encumbrance upon title to a property to secure the payment of a cost, damage, debt, obligation, or duty arising out of response actions, cleanup, or other remediation of hazardous substances or petroleum products upon a property, including (but not limited to) liens imposed pursuant to CERCLA 42 USC § 9607(1) and similar state or local laws.
Environmental professional	A person possessing sufficient training and experience necessary to conduct a site reconnaissance, interviews, and other activities in accordance with ASTM Standard 1527-93, and from the information generated by such activities, having the ability to develop conclusions regarding recognized environmental conditions in connection with the property in question. An individual's status as an environmental professional may be limited to the type of assessment to be performed or to specific segments of the assessment for which the professional is responsible. The person may be an independent contractor or an employee of the user.

Environmental site assessment (ESA)	The process by which a person or entity seeks to determine if a particular parcel of real property (including improvements) is subject to recognized environmental conditions. At the option of the user, an environmental site assessment may include more inquiry than that constituting appropriate inquiry or, if the user is not concerned about qualifying for the innocent landowner defense, less inquiry than that constituting appropriate inquiry. An environmental site assessment is both different from and less rigorous than an environmental audit.
ERNS list	EPA's emergency response notification system list of reported CERCLA hazardous substance releases or spills in quantities greater than the reportable quantity, as maintained at the National Response Center. Notification requirements for such releases or spills are codified in 40 CFR Parts 302 and 355.
Federal Register (FR)	Publication of the United States government published daily (except for federal holidays and weekends) containing all proposed and final regulations and some other activities of the federal government. When regulations become final, they are included in the Code of Federal Regulations (CFR), as well as published in the Federal Register.
Fire insurance maps	Maps produced for private fire insurance map companies that indicate uses of properties at specified dates and that encompass the property. These maps are often available at local libraries, historical societies, private resellers, or from the map companies who produced them.
Hazardous substance	A substance defined as a hazardous substance pursuant to CERCLA 42 USC § 9601(14), as interpreted by EPA regulations and the courts: "(A) any substance designated pursuant to section 1321(b)(2)(A) of Title 33, (B) any element, compound, mixture, solution, or substance designed pursuant to section 9602 of this title, (C) any hazardous waste having the characteristics identified under or listed pursuant to section 3001 of the Solid Waste Disposal Act (42 USC § 6921) (but not including any waste the regulation of which under the Solid Waste Disposal Act (42 USC § 6901 et seq.) has been suspended by Act of Congress), (D) any toxic pollutant listed under section 1317(a) of Title 33, (E) any hazardous air pollutant listed under section 112 of the Clean Air Act (42 USC § 7412), and (F) any imminently hazardous chemical substance or mixture with respect to which the Administrator (of EPA) has taken action pursuant to section 2606 of Title 15. The term does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically listed or designated as a hazardous substance under subparagraphs (A) through (F) of this paragraph, and the term does not include natural gas, natural gas liquids, liquefied natural gas, or synthetic gas usable for fuel (or mixtures of natural gas and such synthetic gas)."

Hazardous waste	Any hazardous waste having the characteristics identified under or listed pursuant to section 3001 of the Solid Waste Disposal Act (42 USC § 6921) (but not including any waste the regulation of which under the Solid Waste Disposal Act (42 USC § 6901 et seq.) has been suspended by Act of Congress). The Solid Waste Disposal Act of 1980 amended RCRA. RCRA defines a hazardous waste, in 42 USC § 6903, as: "a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may (1) cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or (B) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed."
Interagency transfer	Transfer of federal government property accountability to or from other federal government agencies.
Key site manager	The person identified by the owner of a property as having good knowledge of the uses and physical characteristics of the property.
Landfill	A place, location, tract of land, area, or premises used for the disposal of solid wastes as defined by state solid waste regulations. The term is synonymous with the term solid waste disposal site and is also known as a garbage dump, trash dump, or similar term.
Local street directories	Directories published by private (or sometimes government) sources that show ownership, occupancy, and/or use of sites be reference to street addresses. Often local street directories are available at libraries of local governments, colleges or universities, or historical societies.
LUST sites	State lists of leaking underground storage tank sites. Section 9003 (h) of Subtitle I or RCRA gives EPA and states, under cooperative agreements with EPA, authority to clean up releases from UST systems or require owners and operators to do so.
Material safety data sheet (MSDS)	Written or printed material concerning a hazardous substance which is prepared by chemical manufacturers, importers, and employers for hazardous chemicals pursuant to OSHA's Hazard Communication Standard, 29 CFR 1910.1200.
National Contingency Plan (NCP)	The National Oil and Hazardous Substances Pollution Contingency Plan, found at 40 CFR § 300, that is the EPA's blueprint on how hazardous substances are to be cleaned up pursuant to CERCLA.
National Priorities List (NPL)	List compiled by EPA pursuant to CERCLA 42 USC § 9605(a)(8)(B) of properties with the highest priority for cleanup pursuant to EPA's Hazard Ranking System
Obvious	That which is plain or evident; a condition or fact that could not be ignored or overlooked by a reasonable observer while visually or physically observing the property.

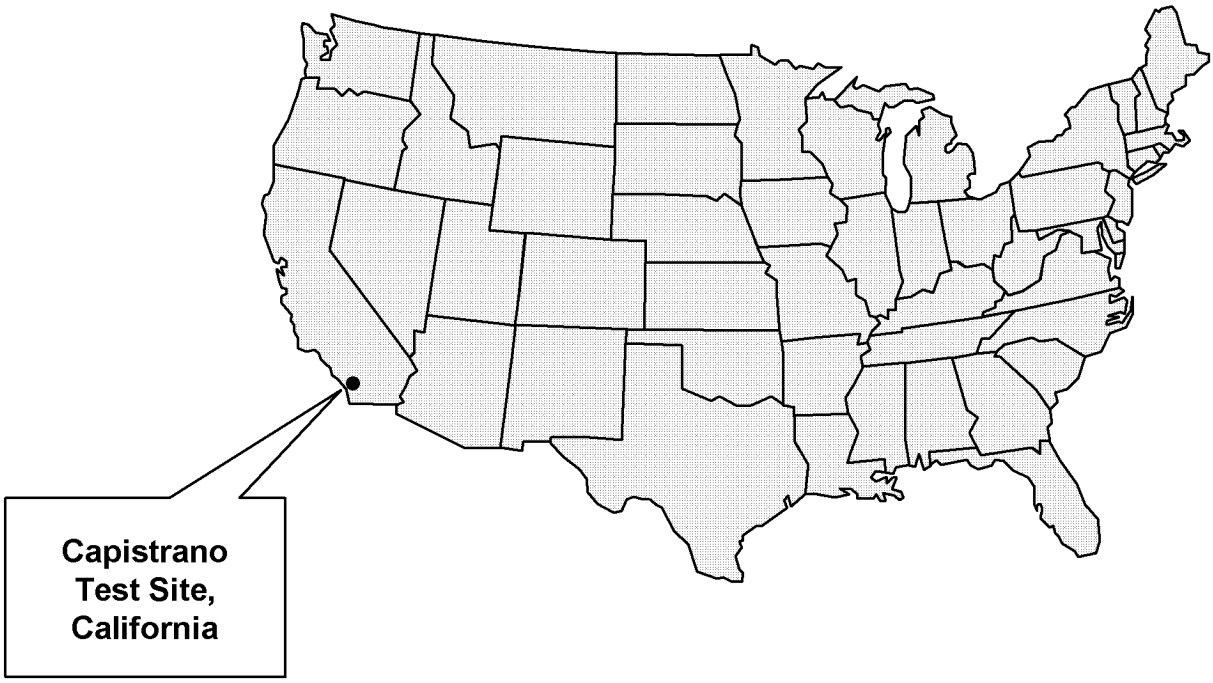
Occupants	Those tenants, subtenants, or other persons or entities using the property or a portion of the property.
Owner	Generally the fee owner of record of the property.
Petroleum exclusion	The exclusion from CERCLA liability provided in 42 USC § 9601(14), as interpreted by the courts and EPA: "the term (hazardous substance) does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically listed or designated as a hazardous substance under subparagraphs (A) through (F) of this paragraph, and the term does not include natural gas, natural gas liquids, liquefied natural gas, or synthetic gas usable for fuel (or mixtures of natural gas and such synthetic gas)."
Petroleum products	Those substances included within the meaning of the petroleum exclusion to CERCLA, 42 USC section 9601(14), as interpreted by the courts and EPA, that is: "petroleum, including crude oil or any fraction thereof which is not otherwise specifically listed or designated as a hazardous substance under subparagraphs (A) through (F) of 42 USC section 9601(14), natural gas, natural gas liquids, liquefied natural gas, and synthetic gas usable for fuel (or mixtures of natural gas and such synthetic gas). (the word fraction refers to certain distillates of crude oil, including gasoline, kerosene, diesel oil, jet fuels, and fuel oil, pursuant to standard definitions of petroleum statistics)".
Physical setting sources	Sources that provide information about the geologic, hydrogeologic, hydrologic, or topographic characteristics of a property.
Pits, ponds, or lagoons	Man-made or natural depressions in a ground surface that are likely to hold liquids or sludge containing hazardous substances or petroleum products. The likelihood of such liquids or sludge being present is determined by evidence of factors associated with the pit, pond, or lagoon, including, but not limited to, discolored water, distressed vegetation, or the presence of an obvious wastewater discharge.
Property	The real property that is the subject of the environmental site assessment. Real property includes buildings and other fixtures and improvements located on the property and affixed to the land.
Property tax files	The files kept for property tax purposes by the local jurisdiction where the property is located and includes records of past ownership, appraisals, maps, sketches, photos, or other information that is reasonably ascertainable and pertaining to the property.
RCRA generators	Those persons or entities that generate hazardous wastes, as defined and regulated by RCRA.
RCRA generators list	List kept by EPA of those persons or entities that generate hazardous wastes, as defined and regulated by RCRA.
RCRA TSD facilities	Those facilities on which treatment, storage, and/or disposal of hazardous wastes takes place, as defined and regulated by RCRA.

RCRA TSD facilities list	List kept by EPA of those facilities on which treatment, storage, and/or disposal of hazardous wastes takes place, as defined and regulated by RCRA.
Real Property	Land and fixtures and other improvements affixed thereto.
Reasonably ascertainable	Information that is (1) publicly available, (2) obtainable from its source within reasonable time and cost constraints, and (3) practically reviewable.
Recognized environmental conditions	The presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater, or surface water of the property. The term is not intended to include *de minimis* conditions that generally do not present a material risk of harm to public health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies.
Recorded land title records	Records of fee ownership, leases, land contracts, easements, liens, and other encumbrances on or of the property recorded in the place where land title records are, by law or custom, recorded of the local jurisdiction in which the property is located. (Often such records are kept by a municipal or county recorder or clerk.) Such records may be obtained from title companies or directly from the local government agency. Information about the title to the property that is recorded in a US district court or any place other than where land title records are, by law or custom, recorded of the local jurisdiction in which the property is located, are not considered part of recorded land title records.
Records of emergency release notifications (SARA §304)	Section 304 of the Emergency Planning and Community Right-to-Know Act (EPCRA) or Title III of the Superfund Amendments and Reauthorization Act (SARA) requires operators of facilities to notify their local emergency planning committee (as defined in EPCRA) and state emergency response commission (as defined in EPCRA) of any release beyond the facility's boundary of any reportable quantity of any extremely hazardous substance. Often the local fire department is the local emergency planning committee. Records of such notifications are "Records of Emergency Release Notifications" (SARA § 304).
Records review	That component of an EBS that addresses what should be done in connection with the site visit. The site reconnaissance includes, but is not limited to, the site visit done in connection with such a Phase I Environmental Site Assessment.
Release	This term shall have the meaning provided in CERCLA, 42 USC. 9601(22).

Report	The written record of a transaction screen process as required by ASTM Standard 1527-93 or the written report prepared by the environmental professional and constituting part of a "Phase I Environmental Site Assessment."
Site visit	The visit to the property during which observations are made constituting the site reconnaissance section of ASTM Standard 1527-93 and the site visit requirement of ASTM Standard 1528-93.
Solid waste disposal site	A place, location, tract of land, area, or premises used for the disposal of solid wastes as defined by state solid waste regulations. The term is synonymous with the term landfill, and is also known as a garbage dump, trash dump, or similar term.
Solvent	A chemical compound that is capable of dissolving another substance and is itself a hazardous substance, used in a number of manufacturing/industrial processes including but not limited to the manufacture of paints and coatings for industrial and household purposes, equipment clean-up, and surface degreasing in metal fabricating industries.
State registered USTs	State lists of underground storage tanks required to be registered under subtitle I, section 9002 of RCRA.
Storage	The holding of hazardous substances for a temporary period prior to the hazardous substances being either used, treated, transported, or disposed of.
Sump	A pit, cistern, cesspool, or similar receptacle where liquids drain, collect, or are stored.
TSD facility	Treatment, storage, or disposal facility (see RCRA TSD facilities).
Underground storage tank	Any tank, including underground piping connected to the tank, that is or has been used to contain hazardous substances or petroleum products and the volume of which is 10% or more beneath the surface of the ground.
USGS 7.5 Minute Topographic Map	The map (if any) available from or produced by the United States Geological Survey, entitled "USGS 7.5 Minute Topographic Map," and showing the property.
Visually and/or physically observed	This term means visual observations made while walking through a property and the structures located on it and observations made by the sense of smell, particularly observations of noxious or foul odors.
Wastewater	Water that is or has been used (1) in an industrial or manufacturing process, (2) in an conveyor that has conveyed sewage, or (3) is directly related to manufacturing, processing, or raw materials storage areas at an industrial plant. Wastewater does not include water originating on or passing through or adjacent to a site, such as stormwater flows, that has not been used in industrial or manufacturing process, has not been combined with sewage, or is not directly related to manufacturing, processing, or raw materials storage areas at an industrial plant.

Zoning/land use records	Those records of the local government pertaining to the property indicating the uses permitted by the local government in particular zones within its jurisdiction. The records may consist of maps and/or written records. They are often located in the planning department of a municipality or county.

Source: ASTM, 1997 and AFI 32-7066



APPENDIX B
REFERENCES

APPENDIX B

REFERENCES

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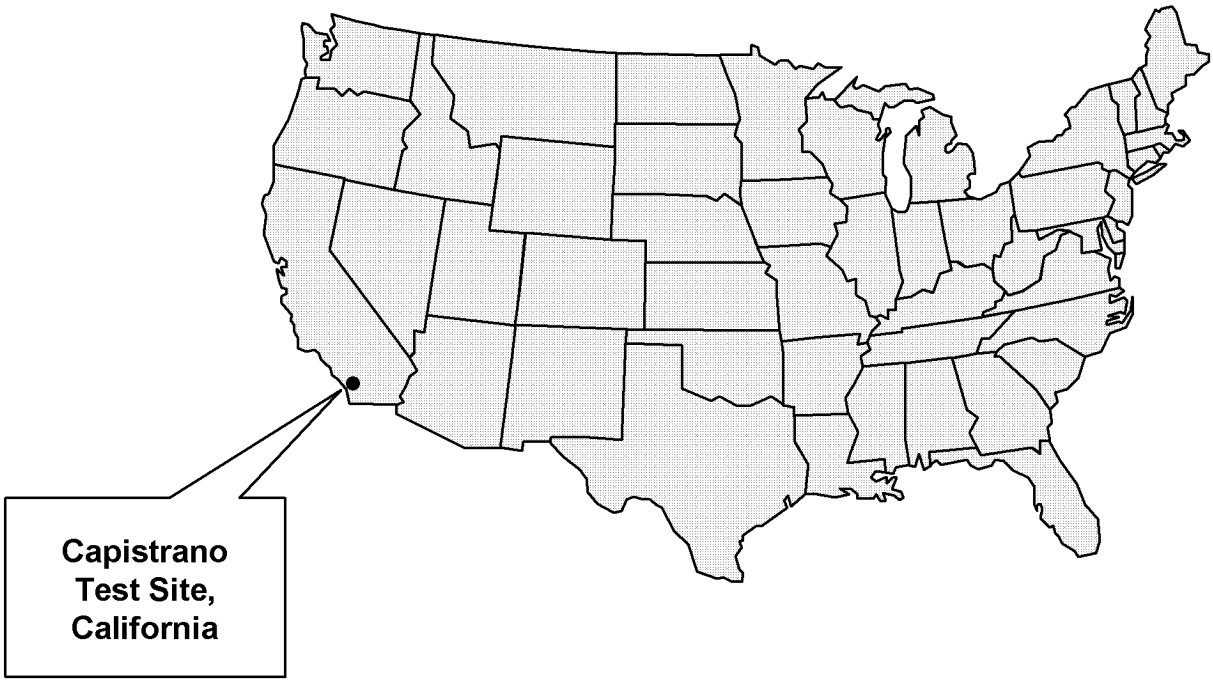
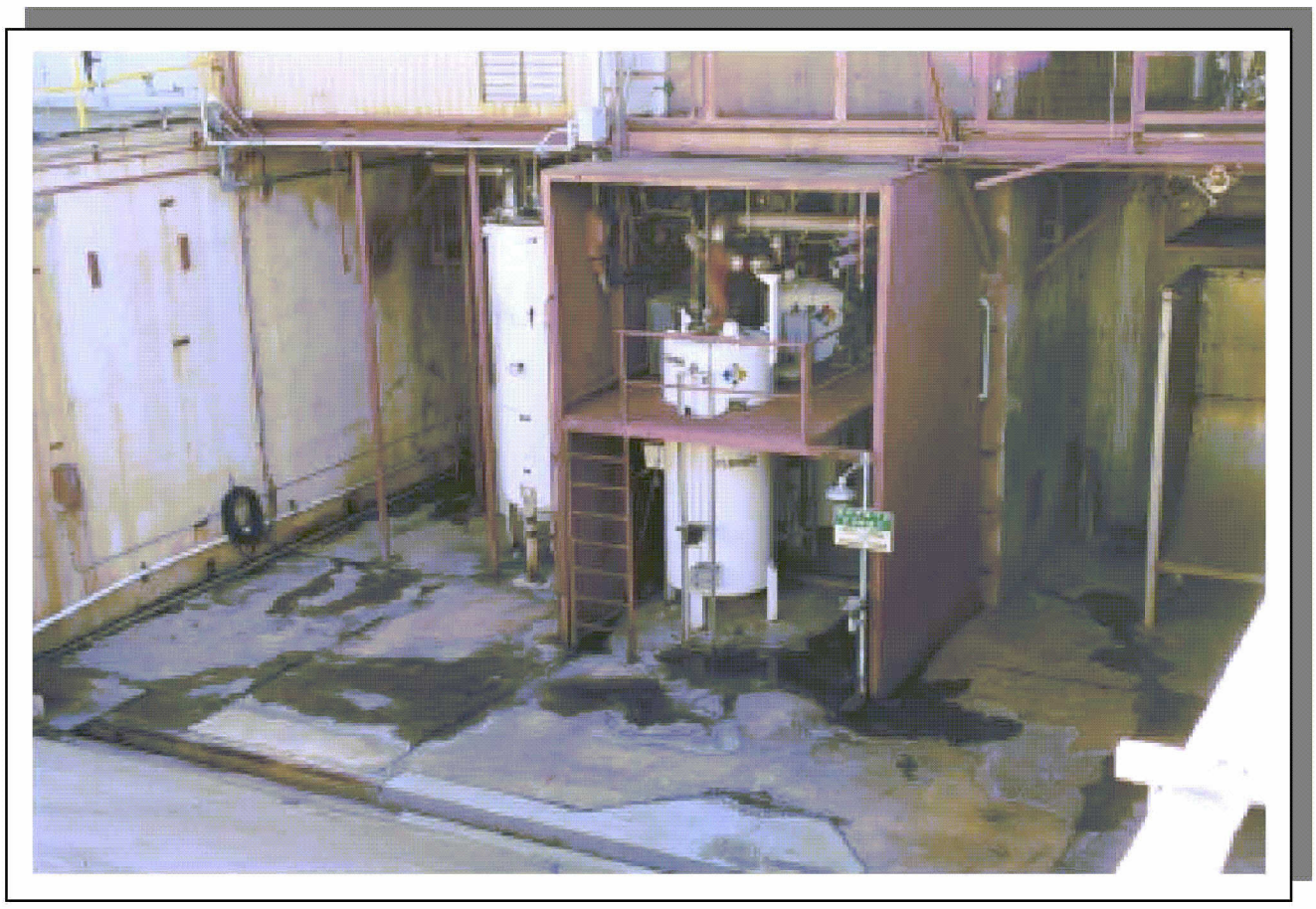


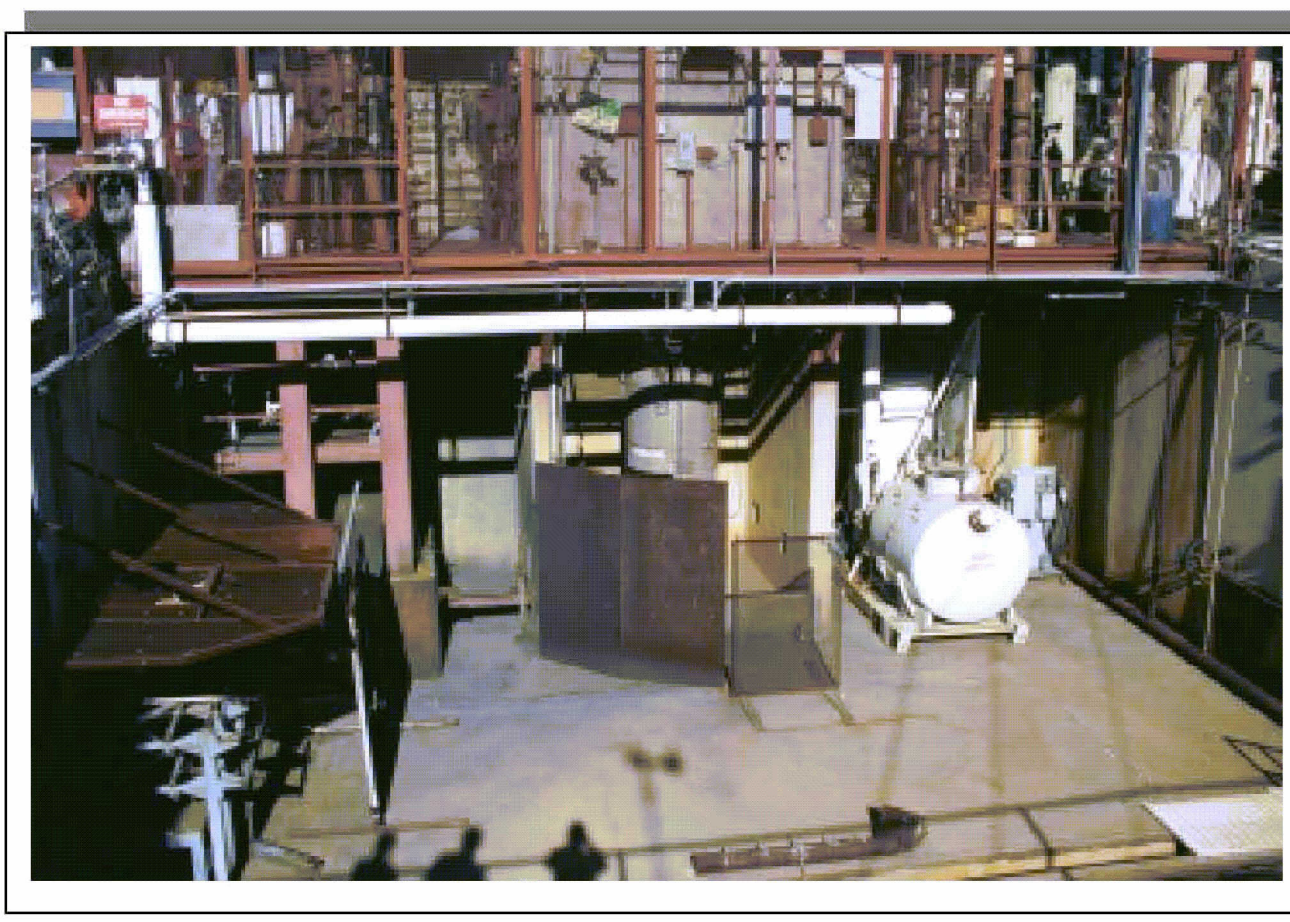
APPENDIX C
SITE PHOTOGRAPHS



Fluorine Tanks at HEPTS.

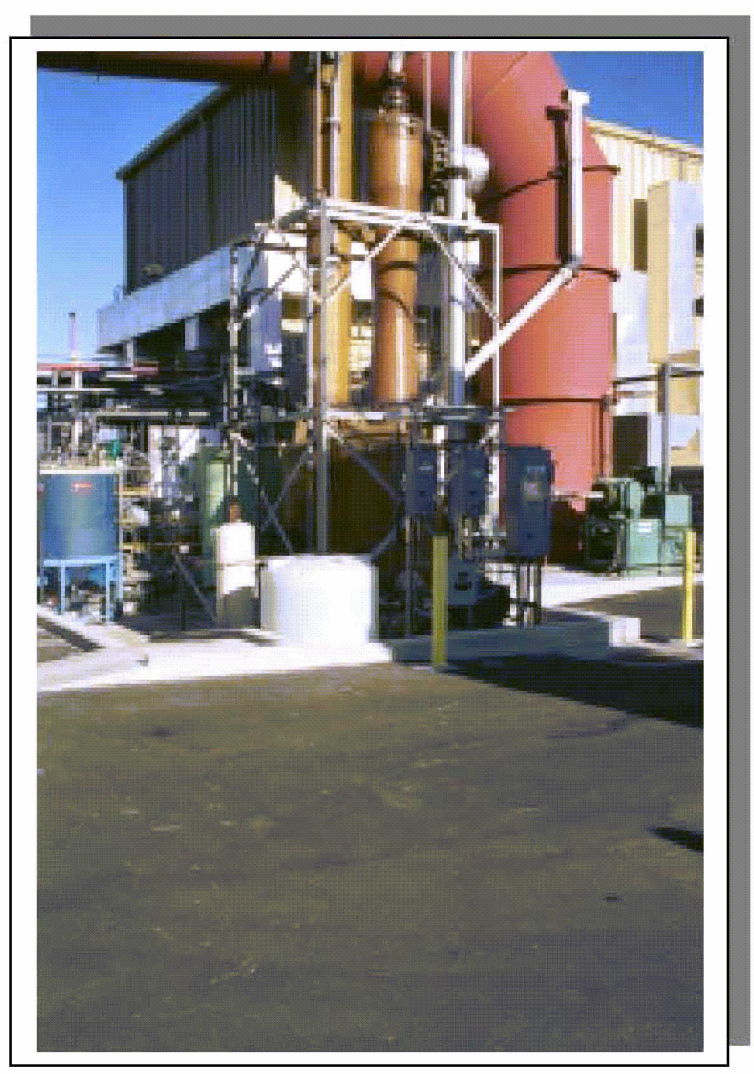
Satellite accumulation points at HATS with rust stains.

Non operating colling tower at HEPTS with asbestos containing panels.



HEPTS fuel and oxidizer tanks.

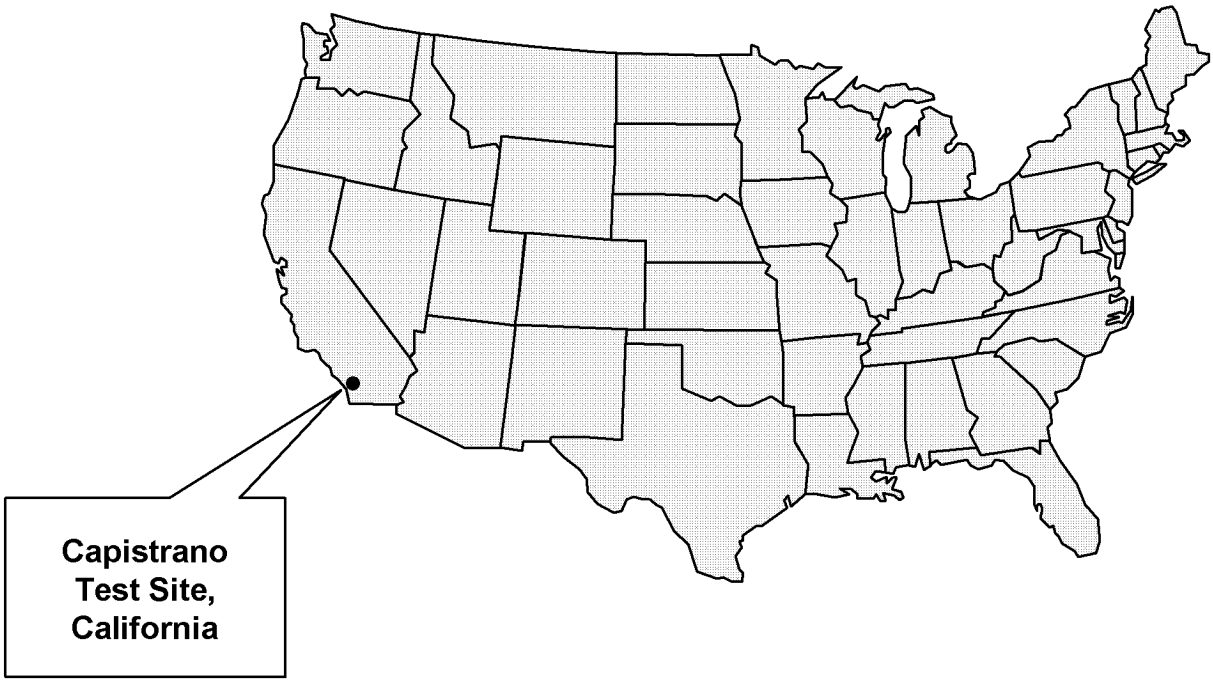
Satellite accumulation points at VETS



Scrubber at VETS

Steam plant and cooling water at VETS.

"Cistern" at high power microwave facility with water tank in background.



APPENDIX D
AERIAL PHOTOGRAPHS

APPENDIX D

SITE PHOTOGRAPHS

1952 AERIAL PHOTOGRAPH

1977 AERIAL PHOTOGRAPH

1981 AERIAL PHOTOGRAPH

1987 AERIAL PHOTOGRAPH (1 OF 3)

1987 AERIAL PHOTOGRAPH (2 OF 3)

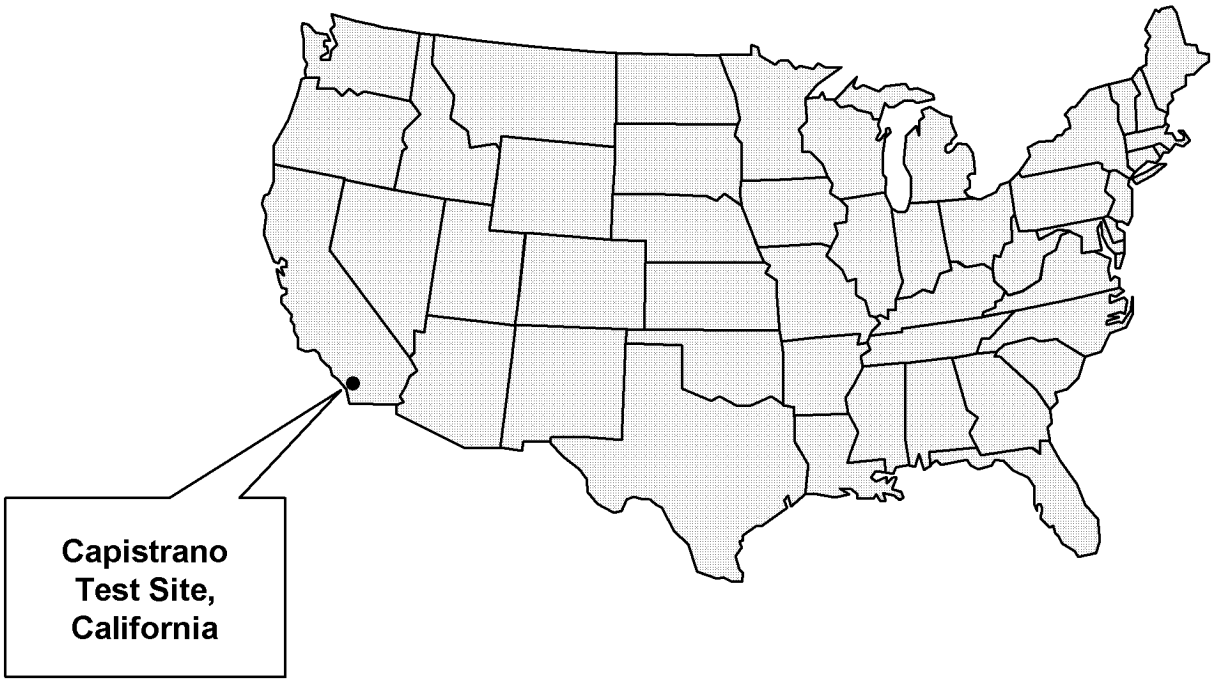
1987 AERIAL PHOTOGRAPH (3 OF 3)

1989 AERIAL PHOTOGRAPH

1990 AERIAL PHOTOGRAPH

1993 AERIAL PHOTOGRAPH

1994 AERIAL PHOTOGRAPH



APPENDIX E
HISTORIAL
TOPOGRAPIC MAPS

APPENDIX E

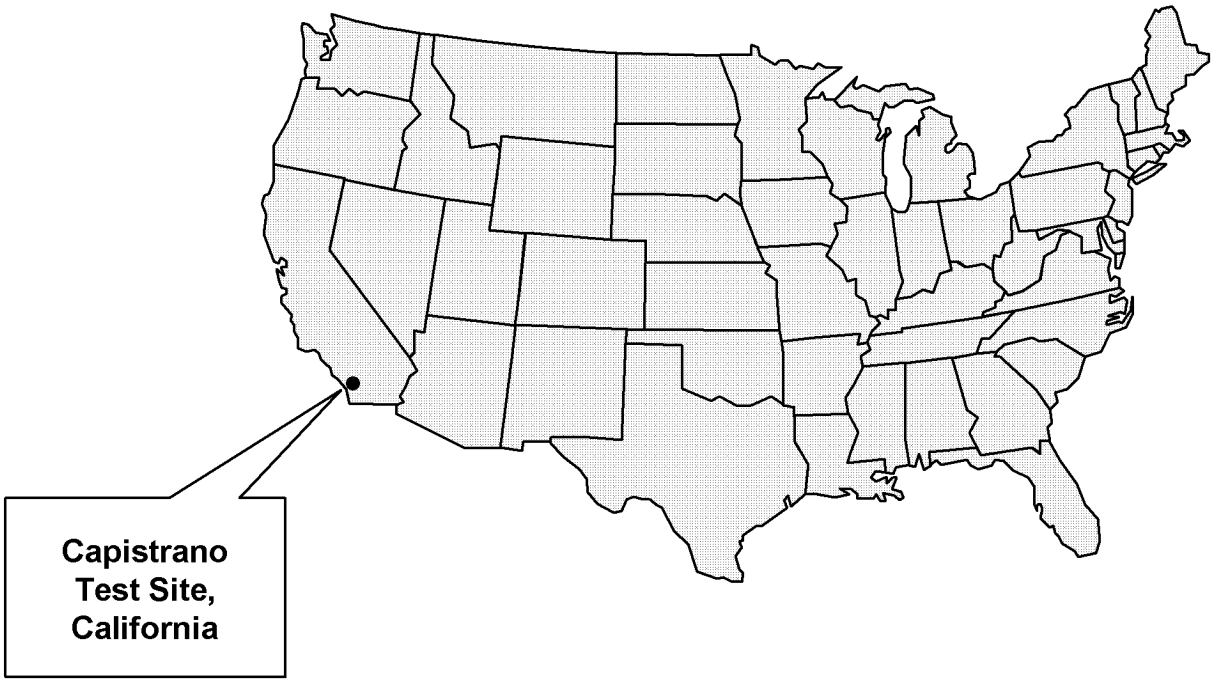
HISTORICAL TOPOGRAPHIC MAPS

1902 HISTORICAL TOPOGRAPHIC MAP

1949 HISTORICAL TOPOGRAPHIC MAP

1968 HISTORICAL TOPOGRAPHIC MAP

1975 HISTORICAL TOPOGRAPHIC MAP



APPENDIX F
EDR REPORT

The EDR-Radius Map
with GeoCheck®

Capistrano Test Site
Near San Clemente
San Juan Capistrano, CA 92675

Inquiry Number: 391992.1s

July 19, 1999

Environmental Data Resources, Inc.
an edr company

***The* Source For Environmental Risk Management Data**

3530 Post Road
Southport, Connecticut 06490

Nationwide Customer Service

Telephone: 1-800-352-0050
Fax: 1-800-231-6802
Internet: www.edrnet.com

TABLE OF CONTENTS

SECTION	PAGE
Executive Summary	ES1
Topographic Map	2
GeoCheck Summary	3
Overview Map	5
Detail Map	6
Map Summary - All Sites	7
Map Summary - Sites with higher or the same elevation as the Target Property	8
Map Findings	9
Orphan Summary	10
Zip Scan Report	11

APPENDICES

GeoCheck Version 2.1	A1
Government Records Searched / Data Currency Tracking Addendum	A3

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

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EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc. (EDR). The report meets the government records search requirements of ASTM Standard Practice for Environmental Site Assessments, E 1527-97. Search distances are per ASTM standard or custom distances requested by the user.

The address of the subject property for which the search was intended is:

NEAR SAN CLEMENTE
SAN JUAN CAPISTRANO, CA 92675

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the subject property or within the ASTM E 1527-97 search radius around the subject property for the following Databases:

NPL: National Priority List
Delisted NPL: NPL Deletions
RCRIS-TSD: Resource Conservation and Recovery Information System
AWP: AWP
Cal-Sites: Cal-Sites
Notify 65: Notify 65
CHMIRS: California Hazardous Material Incident Report System
Cortese: Cortese
Toxic Pits: Toxic Pits
CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System
CERC-NFRAP: Comprehensive Environmental Response, Compensation, and Liability Information System
CORRACTS: Corrective Action Report
SWF/LF: State Landfill
LUST: Leaking Underground Storage Tank Information System
UST: Hazardous Substance Storage Container Database
Ca. FID: CA FID
AST: Aboveground Petroleum Storage Tank Facilities
RAATS: RCRA Administrative Action Tracking System
WMUDS: WMUDS/SWAT
HAZNET: HAZNET
RCRIS-SQG: Resource Conservation and Recovery Information System
RCRIS-LQG: Resource Conservation and Recovery Information System
HMIRS: Hazardous Materials Information Reporting System
PADS: PCB Activity Database System
ERNS: Emergency Response Notification System
FINDS: Facility Index System/Facility Identification Initiative Program Summary Report
TRIS: Toxic Chemical Release Inventory System
TSCA: Toxic Substances Control Act
MLTS: Material Licensing Tracking System
NPL Lien: NPL Liens
Indus Site: Industrial Site
CA SLIC: CA SLIC regions.
Ca. BEP: CA Bond Exp. Plan
ROD: ROD
CONSENT: Superfund (CERCLA) Consent Decrees
Ca. WDS: CA WDS
S Bay Reg. 2: South Bay Region 2
Coal Gas: Former Manufactured gas (Coal Gas) Sites.
MINES: Mines Master Index File

Unmapped (orphan) sites are not considered in the foregoing analysis.

EXECUTIVE SUMMARY

Search Results:

Search results for the subject property and the search radius, are listed below:

Subject Property:

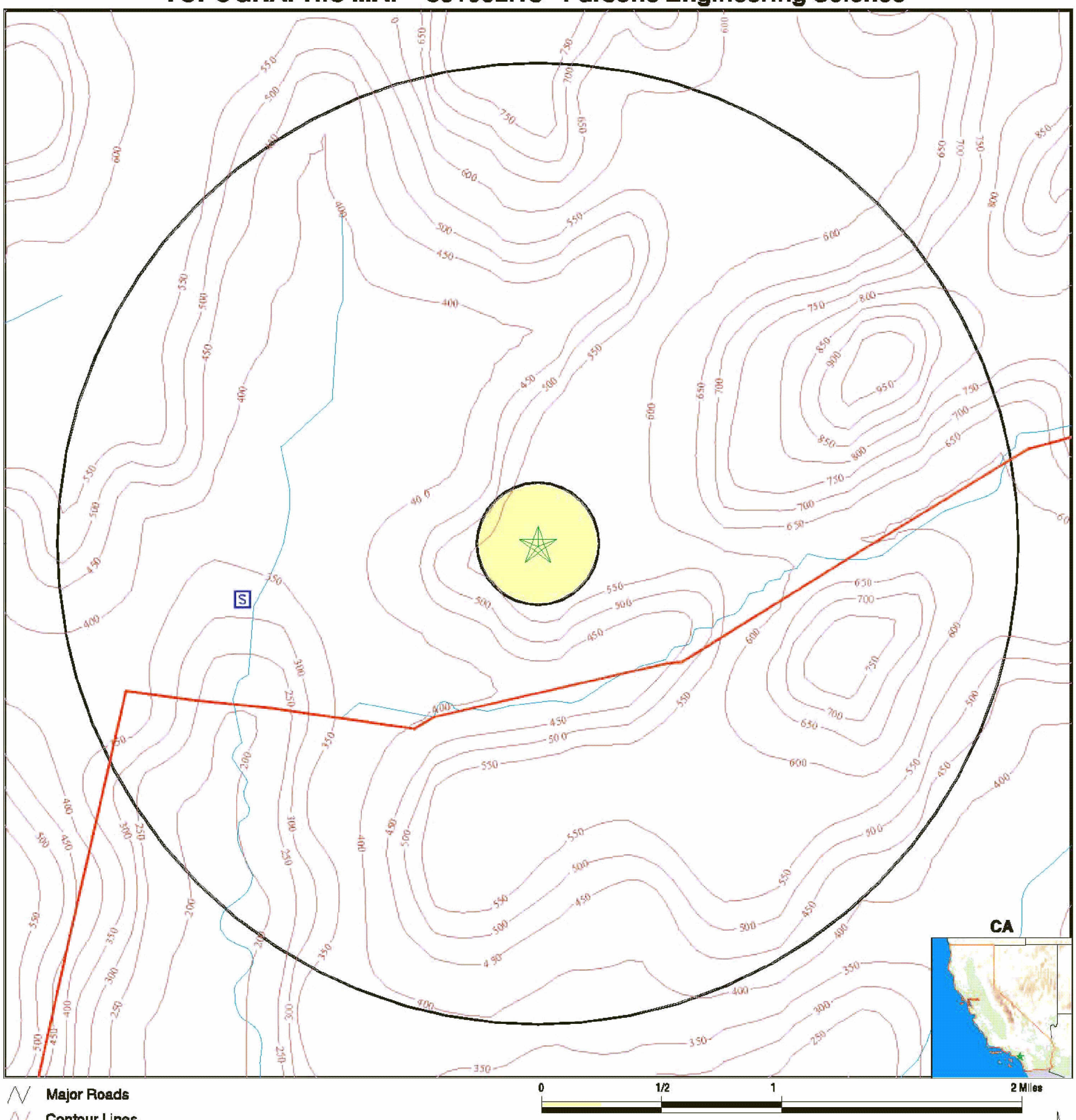
The subject property was not listed in any of the databases searched by EDR.

EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped:

Site Name	Database(s)
SIERRA SOILS	SWF/LF
LOMAS SAN JUAN MODEL HOME SITE	LUST
SAN JUAN COMPANY	UST
LAS PULGAS LANDFILL, IR SITE 8	WMUDS
SAN ONOFRE LANDFILL,IR SITE 14	WMUDS
IR SITE 22 - UNLINED SURFACE I	WMUDS
SITE #6-DRMO SCRAP YARD	WMUDS
SAN JUAN CAPISTRANO LANDFILL	WMUDS
CAPISTRANO USD	HAZNET
SAN JAUN CAPISTRANO EXXON	HAZNET
COUNTY ORANGE/EMA	HAZNET
COUNTY OF ORANGE/HARBORS BEACHES & PARKS	HAZNET
1X FORD MOTOR LAND DEVELOPMENT CO	HAZNET
CAPISTRANO BUSNESS CENTER	HAZNET

TOPOGRAPHIC MAP - 391992.1s - Parsons Engineering Science



- Major Roads
- Contour Lines
- Waterways
- Earthquake Fault Lines
- Earthquake epicenter, Richter 5 or greater
- Closest Federal Well in quadrant
- Closest State Well in quadrant
- Closest Public Water Supply Well
- Closest Hydrogeological Data
- Oil, gas or related wells

TARGET PROPERTY:	Capistrano Test Site	CUSTOMER:	Parsons Engineering Science
ADDRESS:	Near San Clemente	CONTACT:	Craig McColloch
CITY/STATE/ZIP:	San Juan Capistrano CA 92675	INQUIRY #:	391992.1s
LAT/LONG:	33.4628 / 117.5479	DATE:	July 19, 1999 9:34 am

GEOCHECK VERSION 2.1
SUMMARY

TARGET PROPERTY COORDINATES

Latitude (North):	33.462799 - 33˚ 27' 46.1''
Longitude (West):	117.547897 - 117˚ 32' 52.4''
Universal Transverse Mercator:	Zone 11
UTM X (Meters):	449084.9
UTM Y (Meters):	3702536.5

USGS TOPOGRAPHIC MAP ASSOCIATED WITH THIS SITE

Target Property:	2433117-D5 SAN CLEMENTE, CA

GEOLOGIC AGE IDENTIFICATION†

Geologic Code:	uK
Era:	Mesozoic
System:	Cretaceous
Series:	Upper Cretaceous

ROCK STRATIGRAPHIC UNIT†

Category:	Stratified Sequence

GROUNDWATER FLOW INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, including well data collected on nearby properties, regional groundwater flow information (from deep aquifers), or surface topography.‡

AQUIFLOW™** Search Radius: 2.000 Miles

MAP ID	DISTANCE FROM TP	DIRECTION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
Not Reported			

General Topographic Gradient at Target Property: General WSW
General Hydrogeologic Gradient at Target Property: No hydrogeologic data available.
Site-Specific Hydrogeological Data*:

Search Radius:	2.0 miles
Status:	Not found

FEDERAL DATABASE WELL INFORMATION

WELL QUADRANT	DISTANCE FROM TP	LITHOLOGY	DEPTH TO WATER TABLE
NO WELLS FOUND			

STATE DATABASE WELL INFORMATION

WELL QUADRANT	DISTANCE FROM TP
Southern	>2 Miles
Western	1 - 2 Miles

STATE OIL/GAS WELL INFORMATION

API #	DISTANCE FROM TP
NO WELLS FOUND	

† Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).
‡ U.S. EPA Ground Water Handbook, Vol I: Ground Water and Contamination, Office of Research and development EPA/625/6-90/016a,Chapter 4, page 78, September 1990.
** EDR AQUIFLOW™ information System of hydrogeologically determined groundwater flow directions at specific locations. See the date pages at the end of this report for a complete description.

GEOCHECK VERSION 2.1
SUMMARY

PUBLIC WATER SUPPLY SYSTEM INFORMATION

Searched by Nearest PWS.
NOTE: PWS System location is not always the same as well location.

PWS Name: CITY OF SAN CLEMENTE
100 AVENIDA PRESIDIO
SAN CLEMENTE, CA 92672
Location Relative to TP: >2 Miles West
PWS currently has or has had major violation(s) or enforcement: No

AREA RADON INFORMATION

EPA Radon Zone for ORANGE County: 3

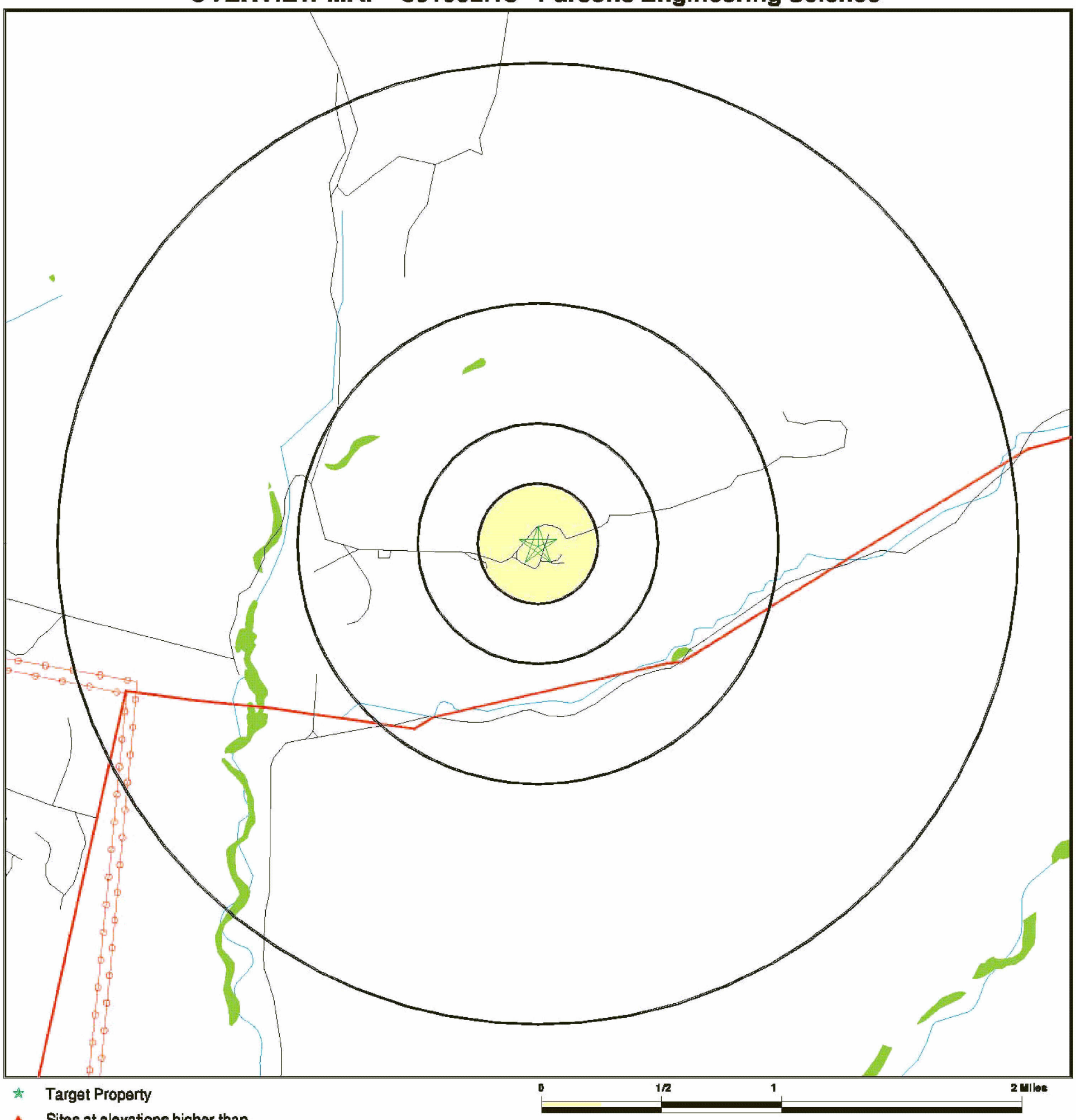
Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.

Zip Code: 92675

Number of sites tested: 1

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	0.500 pCi/L	100%	0%	0%
Living Area - 2nd Floor	Not Reported	Not Reported	Not Reported	Not Reported
Basement	Not Reported	Not Reported	Not Reported	Not Reported

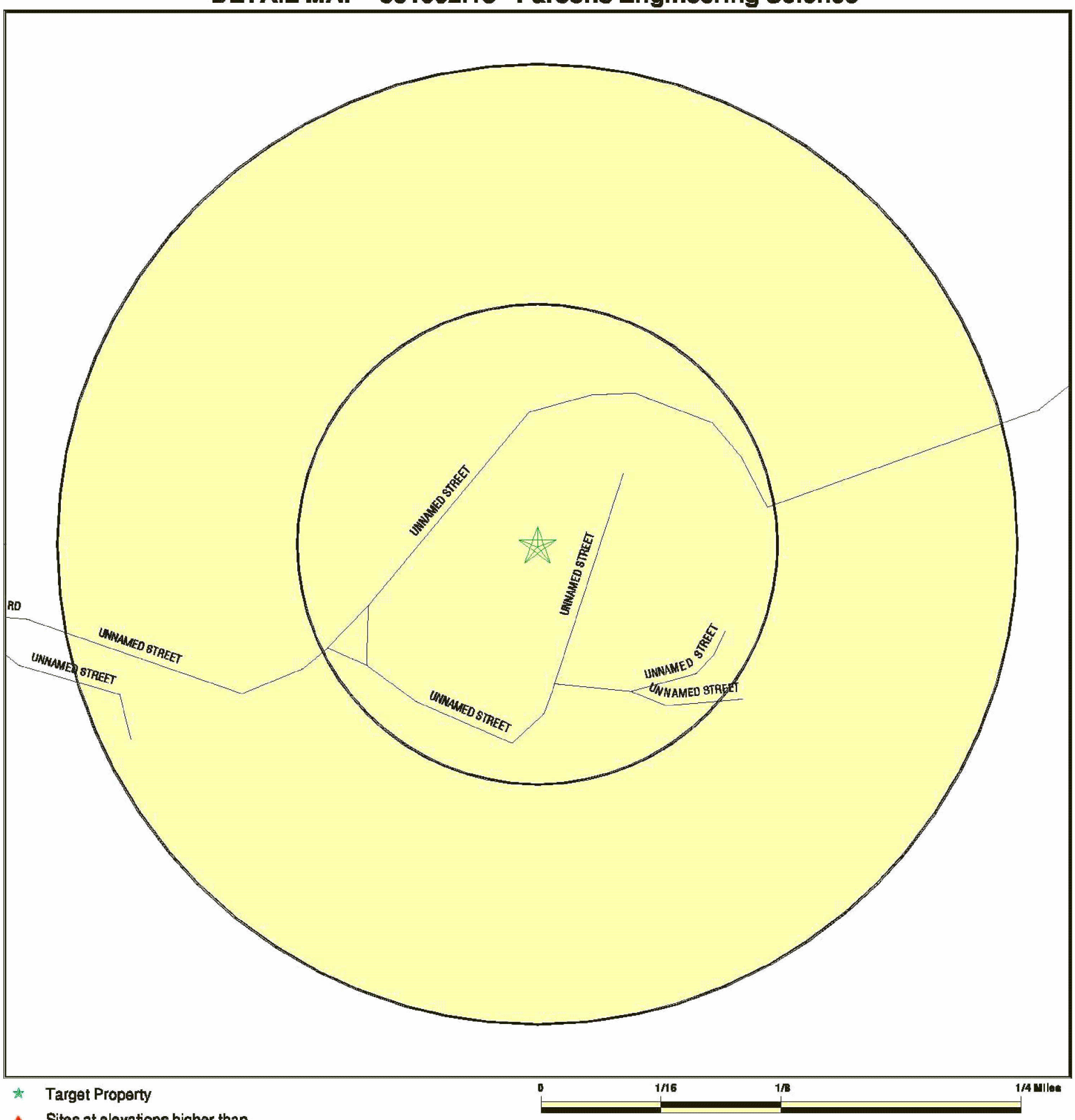
OVERVIEW MAP - 391992.1s - Parsons Engineering Science



- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Coal Gasification Sites (if requested)
- National Priority List Sites
- Landfill Sites
- Power transmission lines
- Oil & Gas pipelines
- 100-year flood zone
- 500-year flood zone
- Wetlands per National Wetlands Inventory (1994)

TARGET PROPERTY:	Capistrano Test Site	CUSTOMER:	Parsons Engineering Science
ADDRESS:	Near San Clemente	CONTACT:	Craig McColloch
CITY/STATE/ZIP:	San Juan Capistrano CA 92675	INQUIRY #:	391992.1s
LAT/LONG:	33.4628 / 117.5479	DATE:	July 19, 1999 9:33 am

DETAIL MAP - 391992.1s - Parsons Engineering Science



- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Coal Gasification Sites (if requested)
- Sensitive Receptors
- National Priority List Sites
- Landfill Sites
- Power transmission lines
- Oil & Gas pipelines
- 100-year flood zone
- 500-year flood zone

TARGET PROPERTY:	Capistrano Test Site	CUSTOMER:	Parsons Engineering Science
ADDRESS:	Near San Clemente	CONTACT:	Craig McColloch
CITY/STATE/ZIP:	San Juan Capistrano CA 92675	INQUIRY #:	391992.1s
LAT/LONG:	33.4628 / 117.5479	DATE:	July 19, 1999 9:33 am

MAP FINDINGS SUMMARY SHOWING ALL SITES

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
NPL		1.500	0	0	0	0	0	0
Delisted NPL		TP	NR	NR	NR	NR	NR	0
RCRIS-TSD		1.000	0	0	0	0	NR	0
AWP		1.500	0	0	0	0	0	0
Cal-Sites		1.500	0	0	0	0	0	0
Notify 65		1.500	0	0	0	0	0	0
CHMIRS		1.500	0	0	0	0	0	0
Cortese		1.500	0	0	0	0	0	0
Toxic Pits		1.500	0	0	0	0	0	0
CERCLIS		1.000	0	0	0	0	NR	0
CERC-NFRAP		TP	NR	NR	NR	NR	NR	0
CORRACTS		1.500	0	0	0	0	0	0
State Landfill		1.000	0	0	0	0	NR	0
LUST		1.000	0	0	0	0	NR	0
UST		0.750	0	0	0	0	NR	0
CA FID		0.750	0	0	0	0	NR	0
AST		TP	NR	NR	NR	NR	NR	0
RAATS		TP	NR	NR	NR	NR	NR	0
WMUDS/SWAT		1.000	0	0	0	0	NR	0
HAZNET		0.750	0	0	0	0	NR	0
RCRIS Sm. Quan. Gen.		0.750	0	0	0	0	NR	0
RCRIS Lg. Quan. Gen.		0.750	0	0	0	0	NR	0
HMIRS		TP	NR	NR	NR	NR	NR	0
PADS		TP	NR	NR	NR	NR	NR	0
ERNS		TP	NR	NR	NR	NR	NR	0
FINDS		TP	NR	NR	NR	NR	NR	0
TRIS		TP	NR	NR	NR	NR	NR	0
TSCA		TP	NR	NR	NR	NR	NR	0
MLTS		TP	NR	NR	NR	NR	NR	0
NPL Liens		TP	NR	NR	NR	NR	NR	0
Industrial Site		TP	NR	NR	NR	NR	NR	0
CA SLIC		1.000	0	0	0	0	NR	0
CA Bond Exp. Plan		1.500	0	0	0	0	0	0
ROD		1.500	0	0	0	0	0	0
CONSENT		1.500	0	0	0	0	0	0
CA WDS		TP	NR	NR	NR	NR	NR	0
South Bay Region 2		TP	NR	NR	NR	NR	NR	0
Coal Gas		1.500	0	0	0	0	0	0
MINES		0.750	0	0	0	0	NR	0

TP = Target Property

NR = Not Requested at this Search Distance

* Sites may be listed in more than one database

MAP FINDINGS SUMMARY SHOWING ONLY SITES HIGHER THAN OR THE SAME ELEVATION AS TP

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
NPL		1.500	0	0	0	0	0	0
Delisted NPL		TP	NR	NR	NR	NR	NR	0
RCRIS-TSD		1.000	0	0	0	0	NR	0
AWP		1.500	0	0	0	0	0	0
Cal-Sites		1.500	0	0	0	0	0	0
Notify 65		1.500	0	0	0	0	0	0
CHMIRS		1.500	0	0	0	0	0	0
Cortese		1.500	0	0	0	0	0	0
Toxic Pits		1.500	0	0	0	0	0	0
CERCLIS		1.000	0	0	0	0	NR	0
CERC-NFRAP		TP	NR	NR	NR	NR	NR	0
CORRACTS		1.500	0	0	0	0	0	0
State Landfill		1.000	0	0	0	0	NR	0
LUST		1.000	0	0	0	0	NR	0
UST		0.750	0	0	0	0	NR	0
CA FID		0.750	0	0	0	0	NR	0
AST		TP	NR	NR	NR	NR	NR	0
RAATS		TP	NR	NR	NR	NR	NR	0
WMUDS/SWAT		1.000	0	0	0	0	NR	0
HAZNET		0.750	0	0	0	0	NR	0
RCRIS Sm. Quan. Gen.		0.750	0	0	0	0	NR	0
RCRIS Lg. Quan. Gen.		0.750	0	0	0	0	NR	0
HMIRS		TP	NR	NR	NR	NR	NR	0
PADS		TP	NR	NR	NR	NR	NR	0
ERNS		TP	NR	NR	NR	NR	NR	0
FINDS		TP	NR	NR	NR	NR	NR	0
TRIS		TP	NR	NR	NR	NR	NR	0
TSCA		TP	NR	NR	NR	NR	NR	0
MLTS		TP	NR	NR	NR	NR	NR	0
NPL Liens		TP	NR	NR	NR	NR	NR	0
Industrial Site		TP	NR	NR	NR	NR	NR	0
CA SLIC		1.000	0	0	0	0	NR	0
CA Bond Exp. Plan		1.500	0	0	0	0	0	0
ROD		1.500	0	0	0	0	0	0
CONSENT		1.500	0	0	0	0	0	0
CA WDS		TP	NR	NR	NR	NR	NR	0
South Bay Region 2		TP	NR	NR	NR	NR	NR	0
Coal Gas		1.500	0	0	0	0	0	0
MINES		0.750	0	0	0	0	NR	0

TP = Target Property

NR = Not Requested at this Search Distance

* Sites may be listed in more than one database

Map ID Direction Distance Distance (ft.) Elevation	Site	Database(s)	EDR ID Number EPA ID Number

Coal Gas Site Search: No site was found in a search of Real Property Scan's ENVIROHAZ database.

NO SITES FOUND

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)	Facility ID
CAMP PENDLETON	S103442730	LAS PULGAS LANDFILL, IR SITE 8	43 AREA	92055	WMUDS	
CAMP PENDLETON	S103442729	SAN ONOFRE LANDFILL,IR SITE 14	52 AREA	92055	WMUDS	
CAMP PENDLETON	S102556699	IR SITE 22 - UNLINED SURFACE I	BLDG 23-88,MUNN FIELD MC AIRST	92055	WMUDS	
CAMP PENDLETON	S103442802	SITE #6-DRMO SCRAP YARD	MARINE CORPS BASE, SITE 6	92055	WMUDS	
SAN JUAN CAPISTRANO	S102807695	CAPISTRANO USD	26126 CALLE PERFECTO	92675	HAZNET	CAD981968951
SAN JUAN CAPISTRANO	S103647937	SAN JAUN CAPISTRANO EXXON	26572 JUNIPERO	92675	HAZNET	CAL000074064
SAN JUAN CAPISTRANO	S103442733	SAN JUAN CAPISTRANO LANDFILL	NEAR SAN JUAN CREEK 300' N		WMUDS	
SAN JUAN CAPISTRANO	S103653287	COUNTY ORANGE/EMA	3301 ORETAGA HWY	92675	HAZNET	CAC001110208
SAN JUAN CAPISTRANO	S103653672	COUNTY OF ORANGE/HARBORS BEACHES & PARKS	33401 ORTEGA HWY/CASPERS PARK	92675	HAZNET	CAC000771808
SAN JUAN CAPISTRANO	U003433403	SAN JUAN COMPANY	31471 ORTEGA HWY # 87	92675	UST	
SAN JUAN CAPISTRANO	S100926569	1X FORD MOTOR LAND DEVELOPMENT CO	3360 ORTIGA HIGHWAY	92675	HAZNET	CAC000749384
SAN JUAN CAPISTRANO	S103648435	CAPISTRANO BUSNESS CENTER	27130 B PASEO ESTADA #501	92675	HAZNET	CAC001223888
SAN JUAN CAPISTRANO	S103340352	SIERRA SOILS	30921 LA PATA ROAD		SWF/LF	30-AB-0372
SAN JUAN CAPISTRANO	S102432719	LOMAS SAN JUAN MODEL HOME SITE	TRACT 10139	92675	LUST	9UT197

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
** - Indicates location may or may not be in requested radius. Site has not been assigned a latitude/longitude coordinate. Further review recommended.								
92055	1001209441		NAVY, DEPARTMENT OF THE		**	CAMP PENDLETON	CA	MLTS
92055	95287307				**	CAMP PENDELTON	CA	ERNS
92055	96323534				**	CAMP PENDELTON	CA	ERNS
92055	963349720				**	CAMP PENDELTON	CA	ERNS
92055	96337731				**	CAMP PENDELTON	CA	ERNS
92055	96359969				**	CAMP PENDELTON	CA	ERNS
92055	96369521				**	CAMP PENDELTON	CA	ERNS
92055	97373372				**	CAMP PENDELTON	CA	ERNS
92055	97380143				**	CAMP PENDELTON	CA	ERNS
92055	97386590				**	OCEANSIDE	CA	ERNS
92055	97388183				**	OCEANSIDE	CA	ERNS
92055	97388333				**	OCEANSIDE	CA	ERNS
92055	S102006558	9 000000718	DEL MAR BOAT BASIN		**	CAMP PENDLETON	CA	WDS
92055	S103442731		BOX CANYON LANDFILL, IR SITE 7		**	CAMP PENDLETON	CA	WMUDS/SWAT
92055	S103472064	9UT631	AREA 16 TANK U16114E #1	U16114E #1 MCB	**	CAMP PENDLETON	CA	LUST
92055	S103472066	9UT633	AREA 16 TANK U16144-E #2	U16144-E 2 MCB	**	CAMP PENDLETON	CA	LUST
92055	S101541387	H32114	SAN ONOFRE TRUCK SCALES	HY 5 SOUTH	**	SAN ONOFRE	CA	HMMD
92055	S101272840	37970009	CAMP PENDLETON MARINE COR	125 000 ACRES 35 MI N. OF SAN		OCEANSIDE	CA	CORTESE, CAL-SITES (ASPIS), CAL-SITES (AWP)
92055	93301625		AIR STATION	AIR STATION	**	CAMP PENDLETON	CA	ERNS
92055	94354004		21 AREA OF THE BASE	21 AREA OF THE BASE	**	CAMP PENDLETON	CA	ERNS
92055	S102556693		31 AREA ACU-5 (LCAC)	31 AREA		CAMP PENDLETON	CA	WMUDS/SWAT
92055	S103442730		LAS PULGAS LANDFILL, IR SITE 8	43 AREA	**	CAMP PENDLETON	CA	WMUDS/SWAT
92055	S103442729		SAN ONOFRE LANDFILL,IR SITE 14	52 AREA	**	CAMP PENDLETON	CA	WMUDS/SWAT
92055	S100740405	H80143	MWR EXCHANGE	AREA 11 BLDG 1106	**	CAMP PENDLETON	CA	HMMD
92055	S100740407	H80145	LIBRARY	AREA 11 BLDG 1122	**	CAMP PENDLETON	CA	HMMD
92055	S100740409	H80147	1ST MAR DIV HQ	AREA 11 BLDG 1133	**	CAMP PENDLETON	CA	HMMD
92055	S100740950	H80713	CIS	AREA 11 BLDG 1164	**	CAMP PENDLETON	CA	HMMD
92055	S100740406	H80144	US MARINE CORP	AREA 11 BLDG 21		CAMP PENDLETON	CA	HMMD
92055	S100740408	H80146	US MARINE CORP	AREA 11 BLDG 31		CAMP PENDLETON	CA	HMMD
92055	S100740410	H80148	US MARINE CORP	AREA 11 BLDG 42		CAMP PENDLETON	CA	HMMD
92055	S100740417	H80155	US MARINE CORP	AREA 11 BLDG 522		CAMP PENDLETON	CA	HMMD
92055	S100740418	H80156	US MARINE CORP	AREA 11 BLDG 588		CAMP PENDLETON	CA	HMMD
92055	S100740411	H80149	US MARINE CORP	AREA 11 BLDG 61		CAMP PENDLETON	CA	HMMD
92055	S100740934	H80696	7TH MOTOR TRANSPORT BN#A	AREA 12 BLDG 12075	**	CAMP PENDLETON	CA	HMMD
92055	S100740935	H80697	7TH MOTOR TRANSPORT BN #B	AREA 12 BLDG 12076	**	CAMP PENDLETON	CA	HMMD
92055	S100833133	H80891	DIVISION REPRODUCTION	AREA 12 BLDG 12102	**	CAMP PENDLETON	CA	HMMD
92055	S100740842	H80595	1ST SRIG HQ CO MOTOR T.	AREA 12 BLDG 1216	**	CAMP PENDLETON	CA	HMMD
92055	S100740412	H80150	HQ 1ST SRIG	AREA 12 BLDG 1223	**	CAMP PENDLETON	CA	HMMD
92055	S100740414	H80152	PROVOST MARSHALL OFFICE	AREA 12 BLDG 1231	**	CAMP PENDLETON	CA	HMMD
92055	S100740416	H80154	MWR MOTOR POOL	AREA 12 BLDG 1255	**	CAMP PENDLETON	CA	HMMD
92055	S100740421	H80159	HQ MSSG-11	AREA 12 BLDG 1261	**	CAMP PENDLETON	CA	HMMD
92055	S100740413	H80157	US MARINE CORP	AREA 12 BLDG 2276		CAMP PENDLETON	CA	HMMD
92055	S103818582	H80151	CDR NAVY REGION SOUTHWEST	AREA 12 BLDG 24	**	CAMP PENDLETON	CA	HMMD
92055	S100740415	H80153	CID CENTRAL PRECINCT	AREA 12 BLDG 44	**	CAMP PENDLETON	CA	HMMD
92055	S103818583	H80166	M C C S	AREA 12 BLDG 94	**	CAMP PENDLETON	CA	HMMD
92055	S100740661	H80401	MWR MOTOR TRANS LOGISTICS	AREA 12-BL 1292 / 1297	**	CAMP PENDLETON	CA	HMMD
92055	S100740430	H80168	US MARINE CORP	AREA 13		CAMP PENDLETON	CA	HMMD
92055	S102018013	H36261	THE OIL EXCHANGE	AREA 13 BLDG 13031	**	CAMP PENDLETON	CA	HMMD
92055	S100740452	H54065	13 AREA MEDICAL CLINIC	AREA 13 BLDG 13129	**	CAMP PENDLETON	CA	HMMD
92055	S100740827	H80580	1ST FSSG MSSG 11 AND 13	AREA 13 BL 13161-177	**	CAMP PENDLETON	CA	HMMD
92055	S100740350	H80048	MWR GAS STATION	AREA 13 BLDG 13026	**	CAMP PENDLETON	CA	HMMD
92055	S100740846	H80599	1 MEF MOTOR TRANSPORT MAINT	AREA 13 BLDG 13053	**	CAMP PENDLETON	CA	HMMD
92055	S103818595	H80598	09TH COMBAT, IMHG	AREA 13 BLDG 13053#A	**	CAMP PENDLETON	CA	HMMD
92055	S100740446	H80184	BASE PHOTO LAB (TAVSC)	AREA 13 BLDG 13103		CAMP PENDLETON	CA	HMMD
92055	S100740447	H80185	BEQ 9TH COMM	AREA 13 BLDG 13110	**	CAMP PENDLETON	CA	HMMD
92055	S100740449	H80187	MWR FITNESS CENTER	AREA 13 BLDG 13113	**	CAMP PENDLETON	CA	HMMD
92055	S100740451	H80189	HQ & SUPPORT BN ADMIN	AREA 13 BLDG 13115	**	CAMP PENDLETON	CA	HMMD
92055	S100740669	H80410	AREA 13 NINETY DAY SITE	AREA 13 BLDG 13116	**	CAMP PENDLETON	CA	HMMD
92055	S100739478	H52004	AREA 13 DENTAL CLINIC	AREA 13 BLDG 13128	**	CAMP PENDLETON	CA	HMMD
92055	S100740431	H80169	SWIMMING POOL	AREA 13 BLDG 1313	**	CAMP PENDLETON	CA	HMMD
92055	S100740453	H80191	JOINT LEGAL ASSISTANCE	AREA 13 BLDG 13131	**	CAMP PENDLETON	CA	HMMD
92055	S100740455	H80193	H AND S BN	AREA 13 BLDG 13142	**	CAMP PENDLETON	CA	HMMD
92055	S100740457	H80195	1ST TOPOGRAPHIC PLATOON	AREA 13 BLDG 13144		CAMP PENDLETON	CA	HMMD
92055	S100740458	H80196	1ST SRIG 1ST INTEL CO	AREA 13 BLDG 13145	**	CAMP PENDLETON	CA	HMMD
92055	S100740462	H80200	FIRE STATION	AREA 13 BLDG 13164	**	CAMP PENDLETON	CA	HMMD
92055	S100740353	H80051	MWR AUTO HOBBY SHOP	AREA 13 BLDG 13191	**	CAMP PENDLETON	CA	HMMD
92055	S100740435	H80173	MWR GAS LANES	AREA 13 BLDG 1327	**	CAMP PENDLETON	CA	HMMD
92055	S100740436	H80174	MILITARY HUMAN RESOURCES	AREA 13 BLDG 1331	**	CAMP PENDLETON	CA	HMMD

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
92055	S100740437	H80175	TRAINING AUDIOVISUAL SUP CEN	AREA 13 BLDG 1333	**	CAMP PENDLETON	CA	HMMD
92055	S100740438	H80176	RELIGIOUS DEVELOPMENT CENTER	AREA 13 BLDG 1344	**	CAMP PENDLETON	CA	HMMD
92055	S100740441	H80179	DISBURSING OFFICE	AREA 13 BLDG 1364	**	CAMP PENDLETON	CA	HMMD
92055	S100740443	H80181	BASE GYM	AREA 13 BLDG 1376		CAMP PENDLETON	CA	HMMD
92055	S100740444	H80182	TRAINING AUDIOVISUAL SUP CTR	AREA 13 BLDG 1395	**	CAMP PENDLETON	CA	HMMD
92055	S100740440	H80178	1ST MAR DIV BAND	AREA 13 BLDG 63	**	CAMP PENDLETON	CA	HMMD
92055	S100740471	H80209	US MARINE CORP	AREA 14 BLDG 008		CAMP PENDLETON	CA	HMMD
92055	S100740473	H80211	US MARINE CORP	AREA 14 BLDG 015		CAMP PENDLETON	CA	HMMD
92055	S100740474	H80212	US MARINE CORP	AREA 14 BLDG 107		CAMP PENDLETON	CA	HMMD
92055	S100740476	H80214	US MARINE CORP	AREA 14 BLDG 116		CAMP PENDLETON	CA	HMMD
92055	S100740465	H80203	US MARINE CORP	AREA 14 BLDG 12		CAMP PENDLETON	CA	HMMD
92055	S100740995	H80761	BEQ BOILER ROOM	AREA 14 BLDG 140008	**	CAMP PENDLETON	CA	HMMD
92055	S100740952	H80717	1ST FSSG SERV CO H&S BN BEQ	AREA 14 BLDG 140032	**	CAMP PENDLETON	CA	HMMD
92055	S100740953	H80718	BEQ STEAM PLANT	AREA 14 BLDG 14011	**	CAMP PENDLETON	CA	HMMD
92055	S100740472	H80210	MESS HALL	AREA 14 BLDG 14013	**	CAMP PENDLETON	CA	HMMD
92055	S100740929	H80691	AREA 14 FUEL STATION	AREA 14 BLDG 140134	**	CAMP PENDLETON	CA	HMMD
92055	S100740826	H80579	1ST FSSG 7TH ENGINEERS	AREA 14 BLDG 140178	**	CAMP PENDLETON	CA	HMMD
92055	S100741110	H80877	7TH ENGINEERS BN BULK FUEL	AREA 14 BLDG 140200	**	CAMP PENDLETON	CA	HMMD
92055	S100740825	H80578	1ST FSSG HS BN	AREA 14 BLDG 140210	**	CAMP PENDLETON	CA	HMMD
92055	S100740475	H80213	SWIMMING POOL	AREA 14 BLDG 14112	**	CAMP PENDLETON	CA	HMMD
92055	S100740829	H80582	US MARINE CORP	AREA 14 BLDG 141200		CAMP PENDLETON	CA	HMMD
92055	S100740478	H80216	GROUP SURGEON 1ST FSSG	AREA 14 BLDG 14125	**	CAMP PENDLETON	CA	HMMD
92055	S100740828	H80581	1ST FSSG G-4 INDUSTRL HYGIENE	AREA 14 BLDG 14126	**	CAMP PENDLETON	CA	HMMD
92055	S100740466	H80204	1ST MEF SURGEON	AREA 14 BLDG 1413	**	CAMP PENDLETON	CA	HMMD
92055	S100740480	H80218	HQ 1ST FSSG	AREA 14 BLDG 14131	**	CAMP PENDLETON	CA	HMMD
92055	S100740481	H80219	COMBAT SKILLS TRAINING SCHOOL	AREA 14 BLDG 14137	**	CAMP PENDLETON	CA	HMMD
92055	S100740482	H80220	FUEL FARM	AREA 14 BLDG 14155	**	CAMP PENDLETON	CA	HMMD
92055	S100740484	H80222	BULK FUEL STORAGE	AREA 14 BLDG 14173	**	CAMP PENDLETON	CA	HMMD
92055	S100740485	H80223	BULK FUEL STORAGE	AREA 14 BLDG 14174	**	CAMP PENDLETON	CA	HMMD
92055	S100740486	H80224	BULK FUEL STORAGE	AREA 14 BLDG 14177	**	CAMP PENDLETON	CA	HMMD
92055	S100740468	H80206	15TH COUNTERINTELL TEAM	AREA 14 BLDG 1441	**	CAMP PENDLETON	CA	HMMD
92055	S100740677	H80418	DELUZ HOUSING MAINT	AREA 14 BLDG 14523	**	CAMP PENDLETON	CA	HMMD
92055	S100740469	H80207	EXCHANGE	AREA 14 BLDG 1482	**	CAMP PENDLETON	CA	HMMD
92055	S100740470	H80208	HEADQUARTERS 1ST FSSG	AREA 14 BLDG 1491	**	CAMP PENDLETON	CA	HMMD
92055	S100740483	H80221	US MARINE CORP	AREA 14 BLDG 171		CAMP PENDLETON	CA	HMMD
92055	S100740467	H80205	US MARINE CORP	AREA 14 BLDG 31		CAMP PENDLETON	CA	HMMD
92055	S100741088	H80854	HORSE STABLES	AREA 15 BLDG 1509	**	CAMP PENDLETON	CA	HMMD
92055	S100740487	H80225	1ST MEF HQ	AREA 15 BLDG 1523	**	CAMP PENDLETON	CA	HMMD
92055	S100740489	H80227	SERRA MESA HOUSING OFFICE	AREA 15 BLDG 1536	**	CAMP PENDLETON	CA	HMMD
92055	S100740488	H80226	US MARINE CORP	AREA 15 BLDG 24		CAMP PENDLETON	CA	HMMD
92055	S100740495	H80233	US MARINE CORP	AREA 15 BLDG 31R		CAMP PENDLETON	CA	HMMD
92055	S100740490	H80228	US MARINE CORP	AREA 15 BLDG 61		CAMP PENDLETON	CA	HMMD
92055	S100740491	H80229	US MARINE CORP	AREA 15 BLDG 75		CAMP PENDLETON	CA	HMMD
92055	S100740492	H80230	US MARINE CORP	AREA 15 BLDG 81		CAMP PENDLETON	CA	HMMD
92055	S100740493	H80231	US MARINE CORP	AREA 15 BLDG 94		CAMP PENDLETON	CA	HMMD
92055	S100740494	H80232	US MARINE CORP	AREA 15 BLDG 95		CAMP PENDLETON	CA	HMMD
92055	S100833138	H80896	1ST BRIG H & S	AREA 16 BLDG #16137	**	CAMP PENDLETON	CA	HMMD
92055	S102626489	H81087	1ST SRIG HQ. CO MOTOR T	AREA 16 BLDG 16135	**	CAMP PENDLETON	CA	HMMD
92055	S100740513	H80251	US MARINE CORP	AREA 16 BLDG 105		CAMP PENDLETON	CA	HMMD
92055	S100740514	H80252	US MARINE CORP	AREA 16 BLDG 115		CAMP PENDLETON	CA	HMMD
92055	S100740516	H80254	US MARINE CORP	AREA 16 BLDG 126		CAMP PENDLETON	CA	HMMD
92055	S100740511	H80249	1ST MAR DIV, DIV SURGEON	AREA 16 BLDG 16103	**	CAMP PENDLETON	CA	HMMD
92055	S100740512	H80250	FISCAL ACCOUNTING OFFICE	AREA 16 BLDG 16104	**	CAMP PENDLETON	CA	HMMD
92055	S100740515	H80253	FAMILY SERVICE CENTER	AREA 16 BLDG 16124	**	CAMP PENDLETON	CA	HMMD
92055	S100740517	H80255	BASE CLUB SYSTEMS	AREA 16 BLDG 16144		CAMP PENDLETON	CA	HMMD
92055	S100740500	H80238	MESS HALL	AREA 16 BLDG 1645	**	CAMP PENDLETON	CA	HMMD
92055	S100740504	H80242	NON-APPROPRIATED FUND AUDIT	AREA 16 BLDG 1656	**	CAMP PENDLETON	CA	HMMD
92055	S100740505	H80243	MWR HOBBY SHOP	AREA 16 BLDG 1657	**	CAMP PENDLETON	CA	HMMD
92055	S100740506	H80244	CHAPLAIN'S OFFICE	AREA 16 BLDG 1661	**	CAMP PENDLETON	CA	HMMD
92055	S100740662	H80403	CAREER RESOURCE MGMT CENTER	AREA 16 BLDG 1671	**	CAMP PENDLETON	CA	HMMD
92055	S100741087	H80853	POST OFFICE	AREA 16 BLDG 1674	**	CAMP PENDLETON	CA	HMMD
92055	S100740508	H80246	US MARINE CORP	AREA 16 BLDG 1685		CAMP PENDLETON	CA	HMMD
92055	S100740510	H80248	13TH MAR EXPEDITIONARY UNIT	AREA 16 BLDG 1692	**	CAMP PENDLETON	CA	HMMD
92055	S100740496	H80234	US MARINE CORP	AREA 16 BLDG 21		CAMP PENDLETON	CA	HMMD
92055	S100740497	H80235	US MARINE CORP	AREA 16 BLDG 23		CAMP PENDLETON	CA	HMMD
92055	S100740498	H80236	US MARINE CORP	AREA 16 BLDG 41		CAMP PENDLETON	CA	HMMD
92055	S100740499	H80237	US MARINE CORP	AREA 16 BLDG 42		CAMP PENDLETON	CA	HMMD
92055	S100740501	H80239	US MARINE CORP	AREA 16 BLDG 46		CAMP PENDLETON	CA	HMMD
92055	S100740502	H80240	US MARINE CORP	AREA 16 BLDG 54		CAMP PENDLETON	CA	HMMD
92055	S100740503	H80241	US MARINE CORP	AREA 16 BLDG 55		CAMP PENDLETON	CA	HMMD
92055	S100740507	H80245	US MARINE CORP	AREA 16 BLDG 84		CAMP PENDLETON	CA	HMMD

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
92055	S100740509	H80247	US MARINE CORP	AREA 16 BLDG 87		CAMP PENDLETON	CA	HMMD
92055	S100740847	H80600	MWR RECREATION CHECK OUT	AREA 17 BLDG 1713	**	CAMP PENDLETON	CA	HMMD
92055	S100740518	H80256	CHILD DEVELOPMENT CENTER	AREA 17 BLDG 1781	**	CAMP PENDLETON	CA	HMMD
92055	S100740519	H80257	O'CLUB SWIM POOL/STEAM PLANT	AREA 17 BLDG 1791	**	CAMP PENDLETON	CA	HMMD
92055	S100740849	H80602	MWR GOLF COURSE MAINT	AREA 18 BLDG 18412	**	CAMP PENDLETON	CA	HMMD
92055	S100740520	H80258	MWR GOLF CLUB HOUSE	AREA 18 BLDG 18415	**	CAMP PENDLETON	CA	HMMD
92055	S100741119	H80888	SOUTH MESA HOUSING MAINT	AREA 20 BLDG 20006	**	CAMP PENDLETON	CA	HMMD
92055	S100741040	H80806	POLLUTION ABATEMENT PAD	AREA 20 BLDG 201019	**	OCEANSIDE	CA	HMMD
92055	S100740521	H80259	SEWAGE TREATMENT PLANT	AREA 20 BLDG 20752	**	CAMP PENDLETON	CA	HMMD
92055	S100741090	H80856	PUMP STATION	AREA 20 BLDG 20816	**	CAMP PENDLETON	CA	HMMD
92055	S100740819	H80570	LANDING SUPPORT EQUIP CO	AREA 21 BL 21605 / 544	**	CAMP PENDLETON	CA	HMMD
92055	S100740539	H80279	US MARINE CORP	AREA 21 BLDG 0636		CAMP PENDLETON	CA	HMMD
92055	S100740541	H80281	US MARINE CORP	AREA 21 BLDG 0735		CAMP PENDLETON	CA	HMMD
92055	S100740542	H80282	US MARINE CORP	AREA 21 BLDG 0821		CAMP PENDLETON	CA	HMMD
92055	S100740545	H80285	US MARINE CORP	AREA 21 BLDG 1735		CAMP PENDLETON	CA	HMMD
92055	S100740546	H80286	US MARINE CORP	AREA 21 BLDG 1764		CAMP PENDLETON	CA	HMMD
92055	S100741114	H80881	AMPHIBIAN VEHICLE TEST BRANCH	AREA 21 BLDG 210533	**	CAMP PENDLETON	CA	HMMD
92055	S100741113	H80880	AMPHIBIAN VEHICLE TEST BRANCH	AREA 21 BLDG 210536	**	CAMP PENDLETON	CA	HMMD
92055	S100741115	H80882	AMPHIBIAN VEHICLE TEST BRANCH	AREA 21 BLDG 210540	**	CAMP PENDLETON	CA	HMMD
92055	S103818594	H80587	CDR NAVY REGION SOUTHWEST	AREA 21 BLDG 210577	**	CAMP PENDLETON	CA	HMMD
92055	S100740931	H80693	AREA 21 FUEL STATION	AREA 21 BLDG 210587	**	CAMP PENDLETON	CA	HMMD
92055	S100740352	H80050	MWR GAS LANES	AREA 21 BLDG 210620	**	CAMP PENDLETON	CA	HMMD
92055	S100740949	H80712	3RD AA BN BEQ	AREA 21 BLDG 210628	**	CAMP PENDLETON	CA	HMMD
92055	S100741112	H80879	GSM BATTERY BLDG	AREA 21 BLDG 210670	**	CAMP PENDLETON	CA	HMMD
92055	S100740540	H80280	BEQ ASSAULT CRAFT UNIT 5	AREA 21 BLDG 210713	**	CAMP PENDLETON	CA	HMMD
92055	S100740947	H80710	BEQ	AREA 21 BLDG 210717	**	CAMP PENDLETON	CA	HMMD
92055	S100739477	H52003	21 AREA MEDICAL/DENTAL CLINIC	AREA 21 BLDG 210735	**	CAMP PENDLETON	CA	HMMD
92055	S100741041	H80807	POLLUTION ABATEMENT PAD	AREA 21 BLDG 210753	**	OCEANSIDE	CA	HMMD
92055	S100741111	H80878	1ST FSSG, GSM CO.	AREA 21 BLDG 210840	**	CAMP PENDLETON	CA	HMMD
92055	S101854912	H80284	1ST MAINT. BAT GENERAL MOTOR	AREA 21 BLDG 210846	**	CAMP PENDLETON	CA	HMMD
92055	S100741086	H80852	FITNESS CENTER	AREA 21 BLDG 21426	**	CAMP PENDLETON	CA	HMMD
92055	S100740525	H80263	NCO BASIC COURSE SCHOOLS BN	AREA 21 BLDG 21441	**	CAMP PENDLETON	CA	HMMD
92055	S100740526	H80264	THEATER	AREA 21 BLDG 21443	**	CAMP PENDLETON	CA	HMMD
92055	S100741085	H80851	BULK FUEL FARM	AREA 21 BLDG 21451	**	CAMP PENDLETON	CA	HMMD
92055	S100740670	H80411	OLD FUEL STATION	AREA 21 BLDG 21453	**	CAMP PENDLETON	CA	HMMD
92055	S100740671	H80412	OLD FUEL STATION	AREA 21 BLDG 21454	**	CAMP PENDLETON	CA	HMMD
92055	S100740528	H80266	1ST ANGLICO	AREA 21 BLDG 21471	**	CAMP PENDLETON	CA	HMMD
92055	S100740531	H80269	BEQ	AREA 21 BLDG 21474	**	CAMP PENDLETON	CA	HMMD
92055	S100740532	H80270	BEQ	AREA 21 BLDG 21478	**	CAMP PENDLETON	CA	HMMD
92055	S100740938	H80700	OLD GAS STATION	AREA 21 BLDG 21503	**	CAMP PENDLETON	CA	HMMD
92055	S100740672	H80413	LANDING SUPPORT EQUIPMENT CO.	AREA 21 BLDG 21513	**	CAMP PENDLETON	CA	HMMD
92055	S100740937	H80699	LANDING SUPPORT EQUIPMENT CO	AREA 21 BLDG 21516/5	**	CAMP PENDLETON	CA	HMMD
92055	S100740984	H80749	POWER STATION	AREA 21 BLDG 21537	**	CAMP PENDLETON	CA	HMMD
92055	S100741117	H80885	AMPHIBIAN VEHICLE TEST BRANCH	AREA 21 BLDG 21548	**	CAMP PENDLETON	CA	HMMD
92055	S100740939	H80701	ENGINE LAB CLASSROOM	AREA 21 BLDG 21563	**	CAMP PENDLETON	CA	HMMD
92055	S100740534	H80272	BOILER PLANT	AREA 21 BLDG 21565	**	CAMP PENDLETON	CA	HMMD
92055	S100740535	H80273	ASSAULT AMPHIBIAN SCHOOL	AREA 21 BLDG 21571	**	CAMP PENDLETON	CA	HMMD
92055	S100740843	H80596	1ST SRIG AIR NAVAL GUNFIRE CO	AREA 21 BLDG 21576	**	CAMP PENDLETON	CA	HMMD
92055	S100740844	H80597	1ST SRIG FORCE RECON CO	AREA 21 BLDG 21576#A	**	CAMP PENDLETON	CA	HMMD
92055	S100740537	H80276	MWR LOGISTICS MAINT. DIV.	AREA 21 BLDG 21601	**	CAMP PENDLETON	CA	HMMD
92055	S100740543	H80283	GSM PAINT AND BODY SHOP	AREA 21 BLDG 21668	**	CAMP PENDLETON	CA	HMMD
92055	S100741098	H80865	3RD AAV BN 1ST MAR DIV	AREA 21 BLDG 21671	**	CAMP PENDLETON	CA	HMMD
92055	S103548002	H80278	DEL MAR E CLUB	AREA 21 BLDG 21713	**	CAMP PENDLETON	CA	HMMD
92055	S100740940	H80702	US ARMY RESERVE	AREA 21 BLDG 21AMSA	**	CAMP PENDLETON	CA	HMMD
92055	S100740522	H80260	US MARINE CORP	AREA 21 BLDG 401		CAMP PENDLETON	CA	HMMD
92055	S100740523	H80261	US MARINE CORP	AREA 21 BLDG 415		CAMP PENDLETON	CA	HMMD
92055	S100740524	H80262	US MARINE CORP	AREA 21 BLDG 425		CAMP PENDLETON	CA	HMMD
92055	S100740527	H80265	US MARINE CORP	AREA 21 BLDG 445		CAMP PENDLETON	CA	HMMD
92055	S100740529	H80267	US MARINE CORP	AREA 21 BLDG 472		CAMP PENDLETON	CA	HMMD
92055	S100740530	H80268	US MARINE CORP	AREA 21 BLDG 473		CAMP PENDLETON	CA	HMMD
92055	S100740533	H80271	US MARINE CORP	AREA 21 BLDG 533		CAMP PENDLETON	CA	HMMD
92055	S102363733	H80274	US MARINE CORP	AREA 21 BLDG 576		CAMP PENDLETON	CA	HMMD
92055	S100740536	H80275	US MARINE CORP	AREA 21 BLDG 587		CAMP PENDLETON	CA	HMMD
92055	S100740538	H80277	US MARINE CORP	AREA 21 BLDG 674		CAMP PENDLETON	CA	HMMD
92055	S102866685	H81103	1ST MARINE BOAT HOUSE	AREA 21 BLDG, 210552	**	CAMP PENDLETON	CA	HMMD
92055	S103548003	H80546	FUEL BRANCH, LOGISTICS	AREA 22 BLDG 22300	**	CAMP PENDLETON	CA	HMMD
92055	S102866688	H81107	BASE PHOTO LAB (TAVSC)	AREA 22 2238	**	CAMP PENDLETON	CA	HMMD
92055	S102866687	H81105	1ST FSSG MED BN MOTOR TRANS	AREA 22 2275	**	CAMP PENDLETON	CA	HMMD
92055	S100740547	H80287	US MARINE CORP	AREA 22 BLDG 13		CAMP PENDLETON	CA	HMMD
92055	S100740554	H80294	US MARINE CORP	AREA 22 BLDG 187		CAMP PENDLETON	CA	HMMD
92055	S100740555	H80295	US MARINE CORP	AREA 22 BLDG 190		CAMP PENDLETON	CA	HMMD

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
92055	S103818635	H81110	FACILITIES MAINTENANCE	AREA 22 BLDG 220109 2293	**	CAMP PENDLETON	CA	HMMD
92055	S100740832	H80585	1ST SUPPLY BN MED LOG CO.	AREA 22 BLDG 220110	**	CAMP PENDLETON	CA	HMMD
92055	S100741109	H80876	PWR ARMORY	AREA 22 BLDG 22048	**	CAMP PENDLETON	CA	HMMD
92055	S100833137	H80895	1ST FSSG SUPPLY BN WASTE SITE	AREA 22 BLDG 22053	**	CAMP PENDLETON	CA	HMMD
92055	S100740347	H80045	MWR GAS LANES	AREA 22 BLDG 22124	**	CAMP PENDLETON	CA	HMMD
92055	S100740817	H80568	1ST FSSG MED BN MOTOR TRANS	AREA 22 BLDG 22124	**	CAMP PENDLETON	CA	HMMD
92055	S100740550	H80290	FIRE DEPT HQ	AREA 22 BLDG 22131	**	CAMP PENDLETON	CA	HMMD
92055	S100740551	H80291	AREA 22 FUEL STATION	AREA 22 BLDG 22141	**	CAMP PENDLETON	CA	HMMD
92055	S100740552	H80292	MOTOR TRANSPORT DEPT.	AREA 22 BLDG 22150	**	CAMP PENDLETON	CA	HMMD
92055	S100740553	H80293	MOTOR TRANSPORT DEPT.	AREA 22 BLDG 22151	**	CAMP PENDLETON	CA	HMMD
92055	S100740823	H80574	1ST FSSG ELECT MAINT CO	AREA 22 BLDG 22220	**	CAMP PENDLETON	CA	HMMD
92055	S100740830	H80583	1ST FSSG SUPPLY BN MOTOR T	AREA 22 BLDG 22225	**	CAMP PENDLETON	CA	HMMD
92055	S100740833	H80586	1ST FSSG SUPPLY BN PP&P	AREA 22 BLDG 2246	**	CAMP PENDLETON	CA	HMMD
92055	S100740548	H80288	AC/S LOGISTICS	AREA 22 BLDG 2264	**	CAMP PENDLETON	CA	HMMD
92055	S100741089	H80855	SEWAGE TREATMENT PLANT #3	AREA 22 BLDG 22831	**	CAMP PENDLETON	CA	HMMD
92055	S100740824	H80575	1ST FSSG READINESS/SUPPORT	AREA 22 BLDG 2291	**	CAMP PENDLETON	CA	HMMD
92055	S103241562	H80706	CRSP LOT 1ST FSSG CRSP	AREA 22 BLDG 2291	**	CAMP PENDLETON	CA	HMMD
92055	S100740549	H80289	FACILITIES MAINTENANCE	AREA 22 BLDG 2296	**	CAMP PENDLETON	CA	HMMD
92055	S102866609	H54104	ARMY VETERINARY CLINIC	AREA 22 BLDG. 22103	**	CAMP PENDLETON	CA	HMMD
92055	S100740831	H80584	1ST FSSG LOT 3 ALPHA	AREA 22 LOT 3 ALPHA	**	CAMP PENDLETON	CA	HMMD
92055	93301307		AREA 23 AT THE AIR STATION	AREA 23 AT THE AIR STATION	**	CAMP PENDLETON	CA	ERNS
92055	S100740674	H80415	AIR STATION FUEL FARM	AREA 23 BLDG 23102	**	CAMP PENDLETON	CA	HMMD
92055	S100740841	H80594	MARINE CORPS AIR STA	AREA 23 BLDG 23105	**	CAMP PENDLETON	CA	HMMD
92055	S100740691	H80432	U S NAVY AVIATION SUPPLY	AREA 23 BLDG 23122 #122	**	CAMP PENDLETON	CA	HMMD
92055	S102866680	H80994	MCAS REFUELING STATION	AREA 23 BLDG 23159 2354	**	OCEANSIDE	CA	HMMD
92055	S100740556	H80296	MARINE OBSERVATION SQDN2	AREA 23 BLDG 2360		CAMP PENDLETON	CA	HMMD
92055	S100740936	H80698	MALS 39 ORDNANCE	AREA 23 BLDG 2378	**	CAMP PENDLETON	CA	HMMD
92055	S100740557	H80297	MALS 39 GSE	AREA 23 BLDG 2385	**	CAMP PENDLETON	CA	HMMD
92055	S100741093	H80860	HMLA-367	AREA 23 BLDG 2386	**	CAMP PENDLETON	CA	HMMD
92055	S100740954	H80719	MCAS MECHANICAL ROOM	AREA 23 BLDG 2387	**	CAMP PENDLETON	CA	HMMD
92055	S100740694	H80436	BACKUP GENERATOR	AREA 23 BLDG 2389	**	CAMP PENDLETON	CA	HMMD
92055	S100741094	H80861	PUMP STATION	AREA 23 BLDG 2390	**	CAMP PENDLETON	CA	HMMD
92055	S100741116	H80884	FLIGHT TRAINER BLDG	AREA 23 BLDG 2394	**	CAMP PENDLETON	CA	HMMD
92055	S100741095	H80862	HMT-303	AREA 23 BLDG 2396	**	CAMP PENDLETON	CA	HMMD
92055	S100741096	H80863	HMLA-267	AREA 23 BLDG 2397	**	CAMP PENDLETON	CA	HMMD
92055	S100741097	H80864	AIR STATION TOWER	AREA 23 BLDG 2399	**	CAMP PENDLETON	CA	HMMD
92055	S100740558	H80298	US MARINE CORP	AREA 24 BLDG 01		CAMP PENDLETON	CA	HMMD
92055	S100740569	H80309	US MARINE CORP	AREA 24 BLDG 026		CAMP PENDLETON	CA	HMMD
92055	S100740559	H80299	US MARINE CORP	AREA 24 BLDG 03		CAMP PENDLETON	CA	HMMD
92055	S100740560	H80300	MESS HALL	AREA 24 BLDG 2404	**	CAMP PENDLETON	CA	HMMD
92055	S100740673	H80414	MILITARY FUEL STATION	AREA 24 BLDG 2406	**	CAMP PENDLETON	CA	HMMD
92055	S100740568	H80308	BEQ CORRECTION BN	AREA 24 BLDG 24098	**	CAMP PENDLETON	CA	HMMD
92055	S100740996	H54050	24 AREA BRIG MED CLINIC	AREA 24 BLDG 24100		CAMP PENDLETON	CA	HMMD
92055	S100740951	H80716	CAMP PENDLETON BASE BRIG	AREA 24 BLDG 24110		CAMP PENDLETON	CA	HMMD
92055	S100740564	H80304	COMMUNICATION ELECTRONICS	AREA 24 BLDG 2459	**	CAMP PENDLETON	CA	HMMD
92055	S100740566	H80306	BEQ	AREA 24 BLDG 2482	**	CAMP PENDLETON	CA	HMMD
92055	S100740663	H80404	USMC CAMP PENDLETON	AREA 24 BLDG 2484		CAMP PENDLETON	CA	HMMD
92055	S100741103	H80870	PUMP STATION	AREA 24 BLDG 2492	**	CAMP PENDLETON	CA	HMMD
92055	S100740561	H80301	US MARINE CORP	AREA 24 BLDG 37		CAMP PENDLETON	CA	HMMD
92055	S100740562	H80302	US MARINE CORP	AREA 24 BLDG 51		CAMP PENDLETON	CA	HMMD
92055	S100740563	H80303	US MARINE CORP	AREA 24 BLDG 58		CAMP PENDLETON	CA	HMMD
92055	S100740565	H80305	US MARINE CORP	AREA 24 BLDG 63		CAMP PENDLETON	CA	HMMD
92055	S100740567	H80307	US MARINE CORP	AREA 24 BLDG 83		CAMP PENDLETON	CA	HMMD
92055	S100740358	H80056	MWSS 372 3RD MAW FMC PAC	AREA 25 BLD 25250/58	**	CAMP PENDLETON	CA	HMMD
92055	S100740957	H80722	MCAS CRASH CREW TRNG SITE	AREA 25 BLDG 2517945	**	CAMP PENDLETON	CA	HMMD
92055	S100740948	H80711	AIRFIELD OPERATIONS DEPT	AREA 25 BLDG 25259	**	CAMP PENDLETON	CA	HMMD
92055	S100740836	H80589	4TH LAI	AREA 25 BLDG 2531	**	CAMP PENDLETON	CA	HMMD
92055	S100740570	H80310	MESS HALL	AREA 25 BLDG 2581	**	CAMP PENDLETON	CA	HMMD
92055	S100740359	H80057	US MARINE CORP	AREA 25, BLDG 104	**	CAMP PENDLETON	CA	HMMD
92055	S102363745	H81081	RANGE CONTROL	AREA 26 BLDG 2612	**	CAMP PENDLETON	CA	HMMD
92055	S100833131	H80883	LAWN MOWER REPAIR SHOP	AREA 26 BLDG 26056	**	CAMP PENDLETON	CA	HMMD
92055	S100740572	H80312	FACILITIES MAINT. EQUIP.	AREA 26 BLDG 2652	**	CAMP PENDLETON	CA	HMMD
92055	S100740573	H80313	FACILITIES MAINT. EQUIP.	AREA 26 BLDG 2653	**	CAMP PENDLETON	CA	HMMD
92055	S100740576	H80316	MWR MAINTENANCE	AREA 26 BLDG 2662	**	CAMP PENDLETON	CA	HMMD
92055	S100740853	H80607	BASE LAUNDRY & DRY CLEANERS	AREA 26 BLDG 2664		CAMP PENDLETON	CA	HMMD
92055	S100740577	H80317	BASE LAUNDRY BOILER	AREA 26 BLDG 2666		CAMP PENDLETON	CA	HMMD
92055	S100740850	H80603	MWR LAKE O'NEILL REC AREA	AREA 26 BLDG 2680	**	CAMP PENDLETON	CA	HMMD
92055	S100740346	H80044	MWR BOAT HOUSE	AREA 26 BLDG 2685	**	CAMP PENDLETON	CA	HMMD
92055	S100740571	H80311	US MARINE CORP	AREA 26 BLDG 51		CAMP PENDLETON	CA	HMMD
92055	S100740574	H80314	US MARINE CORP	AREA 26 BLDG 54		CAMP PENDLETON	CA	HMMD
92055	S100740575	H80315	US MARINE CORP	AREA 26 BLDG 58		CAMP PENDLETON	CA	HMMD

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
92055	S100740578	H80318	US MARINE CORP	AREA 26 BLDG 99		CAMP PENDLETON	CA	HMMD
92055	S102866610	H54105	NAVAL ADDICT REHAB & ED DEPT.	AREA 26 BLDG H-49	**	CAMP PENDLETON	CA	HMMD
92055	S100740579	H80319	ASPHALT PLANT	AREA 27 BLDG 27917	**	CAMP PENDLETON	CA	HMMD
92055	S100740973	H80738	MILITARY GAS STATION	AREA 27 BLDG H-10	**	CAMP PENDLETON	CA	HMMD
92055	S100740762	H80505	NAVAL HOSPITAL, CAMP PENDLETON	AREA 27 BLDG H-100		CAMP PENDLETON	CA	HMMD
92055	S100740682	H80423	HOSPITAL TANK FARM	AREA 27 BLDG H-102	**	CAMP PENDLETON	CA	HMMD
92055	S100740974	H80739	BOILER PLANT	AREA 27 BLDG H-12	**	CAMP PENDLETON	CA	HMMD
92055	S100740679	H80420	FOCSLE CLUB	AREA 27 BLDG H-49	**	CAMP PENDLETON	CA	HMMD
92055	S100740975	H80740	SWIMMING POOL	AREA 27 BLDG H-63	**	CAMP PENDLETON	CA	HMMD
92055	S100740678	H80419	HOSPITAL	AREA 27 BLDG H-9	**	CAMP PENDLETON	CA	HMMD
92055	S100740680	H80421	HOSPITAL GYM	AREA 27 BLDG H-94	**	CAMP PENDLETON	CA	HMMD
92055	S100740976	H80741	BEQ	AREA 27 BLDG H-96	**	CAMP PENDLETON	CA	HMMD
92055	S100740681	H80422	HOSPITAL BOILER PLANT	AREA 27 BLDG H-99	**	CAMP PENDLETON	CA	HMMD
92055	S100740959	H80724	SEWAGE PUMP STATION	AREA 31 BLDG 31220	**	CAMP PENDLETON	CA	HMMD
92055	S100740837	H80590	MCTSSA	AREA 31 BLDG 31338	**	CAMP PENDLETON	CA	HMMD
92055	S100740960	H80725	BEQ WEAPONS FIELD TRNG BN	AREA 31 BLDG 31511	**	CAMP PENDLETON	CA	HMMD
92055	S100739476	H52002	31 AREA MEDICAL/DENTAL CLINIC	AREA 31 BLDG 31515	**	CAMP PENDLETON	CA	HMMD
92055	S100740958	H80723	SEWAGE PUMP STATION	AREA 31 BLDG 31520	**	CAMP PENDLETON	CA	HMMD
92055	S100740838	H80591	WEAPONS/FIELD TRAINING BATT	AREA 31 BLDG 31620	**	CAMP PENDLETON	CA	HMMD
92055	S100740962	H80727	ACU-5 MAINTENANCE SHOPS	AREA 31 BLDG 31904	**	CAMP PENDLETON	CA	HMMD
92055	S100740963	H80728	ACU-5 MAINTENANCE BAY	AREA 31 BLDG 31905	**	CAMP PENDLETON	CA	HMMD
92055	S100741120	H80889	ACU-5 MAINTENANCE BAY	AREA 31 BLDG 31907	**	CAMP PENDLETON	CA	HMMD
92055	S100740580	H80320	ACU-5 FUELING STATION	AREA 31 BLDG 31910	**	CAMP PENDLETON	CA	HMMD
92055	S100740961	H80726	ACU-5 HAZ WASTE SITE	AREA 31 BLDG 31914	**	CAMP PENDLETON	CA	HMMD
92055	S100740964	H80729	ACU-5 FIRESTATION	AREA 31 BLDG 31921	**	CAMP PENDLETON	CA	HMMD
92055	S100740965	H80730	ACU-5 CONTROL TOWER	AREA 31 BLDG 31930	**	CAMP PENDLETON	CA	HMMD
92055	S101613580		LANDING CRAFT AIR CUSHION	AREA 31, CAMP PENDLETON,SITE19		CAMP PENDLETON	CA	WMUDS/SWAT
92055	S100741165	H80946	USN	AREA 31/LCACC	**	CAMP PENDLETON	CA	HMMD
92055	S100740840	H80593	3RD LAAD	AREA 32 BLDG 32867	**	CAMP PENDLETON	CA	HMMD
92055	S100740839	H80592	MASS 3	AREA 32 BLDG 32869	**	CAMP PENDLETON	CA	HMMD
92055	S100740851	H80604	MACS 1	AREA 32 BLDG 32872	**	CAMP PENDLETON	CA	HMMD
92055	S100740595	H80335	US MARINE CORP	AREA 33 BLDG 0612		CAMP PENDLETON	CA	HMMD
92055	S100740581	H80321	US MARINE CORP	AREA 33 BLDG 327		CAMP PENDLETON	CA	HMMD
92055	S100740582	H80322	US MARINE CORP	AREA 33 BLDG 329		CAMP PENDLETON	CA	HMMD
92055	S100740349	H80047	MWR GAS LANES	AREA 33 BLDG 330360	**	CAMP PENDLETON	CA	HMMD
92055	S100740676	H80417	BATTERY SHOP 1ST MAR DIV	AREA 33 BLDG 330543	**	CAMP PENDLETON	CA	HMMD
92055	S100741102	H80869	MESS HALL	AREA 33 BLDG 33302	**	CAMP PENDLETON	CA	HMMD
92055	S100741101	H54148	33 AREA MEDICAL DENTAL CLINIC	AREA 33 BLDG 33306	**	CAMP PENDLETON	CA	HMMD
92055	S100741100	H80867	BARBER SHOP	AREA 33 BLDG 33308	**	CAMP PENDLETON	CA	HMMD
92055	S100740665	H80406	GYNASIUM	AREA 33 BLDG 33402	**	CAMP PENDLETON	CA	HMMD
92055	S100740997	H80763	BEQ/OFFICES	AREA 33 BLDG 33421	**	CAMP PENDLETON	CA	HMMD
92055	S103548043	H81124	COMBAT CAMERA & PRINTING	AREA 33 BLDG 33422	**	CAMP PENDLETON	CA	HMMD
92055	S100740664	H80405	BEQ	AREA 33 BLDG 33427	**	CAMP PENDLETON	CA	HMMD
92055	S100740666	H80407	MESS HALL	AREA 33 BLDG 33502	**	CAMP PENDLETON	CA	HMMD
92055	S100740835	H80588	1ST MAR DIV HQ BN	AREA 33 BLDG 33543	**	CAMP PENDLETON	CA	HMMD
92055	S100740592	H80332	FMO BOILER PLANT	AREA 33 BLDG 33550	**	CAMP PENDLETON	CA	HMMD
92055	S100740589	H80329	1ST MAR DIV HQ BN TRUCK CO.	AREA 33 BLDG 33571	**	CAMP PENDLETON	CA	HMMD
92055	S100740594	H80334	SWIMMING POOL	AREA 33 BLDG 33581	**	CAMP PENDLETON	CA	HMMD
92055	S100740583	H80323	US MARINE CORP	AREA 33 BLDG 343		CAMP PENDLETON	CA	HMMD
92055	S100740584	H80324	US MARINE CORP	AREA 33 BLDG 346		CAMP PENDLETON	CA	HMMD
92055	S100740585	H80325	US MARINE CORP	AREA 33 BLDG 379		CAMP PENDLETON	CA	HMMD
92055	S100740586	H80326	US MARINE CORP	AREA 33 BLDG 424		CAMP PENDLETON	CA	HMMD
92055	S100740587	H80327	US MARINE CORP	AREA 33 BLDG 426		CAMP PENDLETON	CA	HMMD
92055	S100740588	H80328	US MARINE CORP	AREA 33 BLDG 428		CAMP PENDLETON	CA	HMMD
92055	S100740590	H80330	US MARINE CORP	AREA 33 BLDG 521		CAMP PENDLETON	CA	HMMD
92055	S100740591	H80331	US MARINE CORP	AREA 33 BLDG 523		CAMP PENDLETON	CA	HMMD
92055	S100740593	H80333	US MARINE CORP	AREA 33 BLDG 580		CAMP PENDLETON	CA	HMMD
92055	S101102298	H80898	1ST RECON MOTOR POOL	AREA 41 BLDG 410251	**	CAMP PENDLETON	CA	HMMD
92055	S100740687	H80428	MOTOR TRANSPORT	AREA 41 BLDG 41251	**	CAMP PENDLETON	CA	HMMD
92055	S100741107	H80874	1ST ANGLICO, 1ST SRIG	AREA 41 BLDG 41252	**	CAMP PENDLETON	CA	HMMD
92055	S100740596	H80336	BEQ	AREA 41 BLDG 41304	**	CAMP PENDLETON	CA	HMMD
92055	S100740597	H80337	MILITARY FUEL STATION	AREA 41 BLDG 41311	**	CAMP PENDLETON	CA	HMMD
92055	S100741104	H80871	11TH MAR REG ENG SECT	AREA 41 BLDG 41312	**	CAMP PENDLETON	CA	HMMD
92055	S100741105	H80872	LAS FLORES ENLISTED CLUB	AREA 41 BLDG 41315	**	CAMP PENDLETON	CA	HMMD
92055	S100741106	H80873	LUBE RACK	AREA 41 BLDG 41319	**	CAMP PENDLETON	CA	HMMD
92055	S100833012	H53039	41 AREA MEDICAL/DENTAL CLINIC	AREA 41 BLDG 41352	**	CAMP PENDLETON	CA	HMMD
92055	S100741108	H80875	COMM SECT 5TH BN 11TH MAR	AREA 41 BLDG 41362	**	CAMP PENDLETON	CA	HMMD
92055	S100833135	H80893	5TH BN 11TH MARINES MOTOR TRAN	AREA 41 BLDG 41366	**	CAMP PENDLETON	CA	HMMD
92055	S100740598	H80338	MOTOR TRANS SECT 5TH BN 11 MAR	AREA 41 BLDG 41368	**	CAMP PENDLETON	CA	HMMD
92055	S100741039	H80805	POLLUTION ABATEMENT PAD	AREA 41 BLDG 41409	**	OCEANSIDE	CA	HMMD
92055	S100740998	H80764	PUMP STATION	AREA 41 BLDG 41611	**	CAMP PENDLETON	CA	HMMD

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
92055	S100741118	H80887	PUMP STATION	AREA 41 BLDG 41613	**	CAMP PENDLETON	CA	HMMD
92055	S100740848	H80601	1ST LIGHT ARMOR RECON BN	AREA 41 BLDG 41800	**	CAMP PENDLETON	CA	HMMD
92055	S101310479		STUART MESA STABILIZATION POND	AREA 41, SITE 9		CAMP PENDLETON	CA	WMUDS/SWAT
92055	S100740623	H80363	US MARINE CORP	AREA 43 BLDG 0124		CAMP PENDLETON	CA	HMMD
92055	S100740600	H80340	US MARINE CORP	AREA 43 BLDG 105		CAMP PENDLETON	CA	HMMD
92055	S100740601	H80341	US MARINE CORP	AREA 43 BLDG 106		CAMP PENDLETON	CA	HMMD
92055	S100740602	H80342	US MARINE CORP	AREA 43 BLDG 107		CAMP PENDLETON	CA	HMMD
92055	S100740603	H80343	US MARINE CORP	AREA 43 BLDG 201		CAMP PENDLETON	CA	HMMD
92055	S100740604	H80344	US MARINE CORP	AREA 43 BLDG 259		CAMP PENDLETON	CA	HMMD
92055	S100740607	H80347	US MARINE CORP	AREA 43 BLDG 302		CAMP PENDLETON	CA	HMMD
92055	S100740608	H80348	US MARINE CORP	AREA 43 BLDG 315		CAMP PENDLETON	CA	HMMD
92055	S100740610	H80350	US MARINE CORP	AREA 43 BLDG 333	**	CAMP PENDLETON	CA	HMMD
92055	S100740611	H80351	US MARINE CORP	AREA 43 BLDG 336		CAMP PENDLETON	CA	HMMD
92055	S100740612	H80352	US MARINE CORP	AREA 43 BLDG 402		CAMP PENDLETON	CA	HMMD
92055	S100740613	H80353	US MARINE CORP	AREA 43 BLDG 421		CAMP PENDLETON	CA	HMMD
92055	S100740614	H80354	US MARINE CORP	AREA 43 BLDG 422		CAMP PENDLETON	CA	HMMD
92055	S100740615	H80355	US MARINE CORP	AREA 43 BLDG 425		CAMP PENDLETON	CA	HMMD
92055	S100740930	H80692	AREA 43 FUEL STATION	AREA 43 BLDG 430704	**	CAMP PENDLETON	CA	HMMD
92055	S100740599	H80339	BULK FUEL STORAGE TANKS	AREA 43 BLDG 43104	**	CAMP PENDLETON	CA	HMMD
92055	S100740933	H80695	RANGE CONTROL	AREA 43 BLDG 43131	**	CAMP PENDLETON	CA	HMMD
92055	S100740605	H80345	BEQ HQ BATTERY 1ST BN 11TH MAR	AREA 43 BLDG 43260	**	CAMP PENDLETON	CA	HMMD
92055	S100740345	H80043	MWR GAS LINES	AREA 43 BLDG 43286	**	CAMP PENDLETON	CA	HMMD
92055	S100740606	H80346	MESS HALL	AREA 43 BLDG 43292	**	CAMP PENDLETON	CA	HMMD
92055	S100741000	H80766	PUMP STATION	AREA 43 BLDG 43310	**	CAMP PENDLETON	CA	HMMD
92055	S100740609	H80349	SWIMMING POOL	AREA 43 BLDG 43317	**	CAMP PENDLETON	CA	HMMD
92055	S100741091	H80857	ARMORY	AREA 43 BLDG 43410	**	CAMP PENDLETON	CA	HMMD
92055	S100740616	H80356	US MARINE CORP	AREA 43 BLDG 435		CAMP PENDLETON	CA	HMMD
92055	S100740667	H54043	43 AREA MEDICAL CLINIC	AREA 43 BLDG 43505	**	CAMP PENDLETON	CA	HMMD
92055	S100833013	H53040	AREA 43 DENTAL CLINIC	AREA 43 BLDG 43506	**	CAMP PENDLETON	CA	HMMD
92055	S101854916	H80573	1ST MN BN EMC	AREA 43 BLDG 43542	**	CAMP PENDLETON	CA	HMMD
92055	S100740688	H80429	11TH REG, 1ST MAR DIV	AREA 43 BLDG 43574	**	CAMP PENDLETON	CA	HMMD
92055	S100741099	H80866	HQ 11TH MAR REG 1ST MAR DIV	AREA 43 BLDG 43575	**	CAMP PENDLETON	CA	HMMD
92055	S100740617	H80357	US MARINE CORP	AREA 43 BLDG 436		CAMP PENDLETON	CA	HMMD
92055	S101854914	H80571	1ST MN BN ORDINANCE	AREA 43 BLDG 43601	**	CAMP PENDLETON	CA	HMMD
92055	S101854913	H80569	H & S COMPANY	AREA 43 BLDG 43602	**	CAMP PENDLETON	CA	HMMD
92055	S100741008	H80774	ABANDONED TANK	AREA 43 BLDG 43626	**	CAMP PENDLETON	CA	HMMD
92055	S100740945	H80708	LAS PULGAS BEQ	AREA 43 BLDG 43700	**	CAMP PENDLETON	CA	HMMD
92055	S100740946	H80709	LAS PULGAS BEQ	AREA 43 BLDG 43706	**	CAMP PENDLETON	CA	HMMD
92055	S100741092	H80859	AMMUNITION SUPPLY POINT	AREA 43 BLDG 43960	**	CAMP PENDLETON	CA	HMMD
92055	S100833132	H80886	AMMUNITION SUPPLY POINT	AREA 43 BLDG 43970	**	CAMP PENDLETON	CA	HMMD
92055	S100740618	H80358	US MARINE CORP	AREA 43 BLDG 502		CAMP PENDLETON	CA	HMMD
92055	S100740619	H80359	US MARINE CORP	AREA 43 BLDG 521		CAMP PENDLETON	CA	HMMD
92055	S100740620	H80360	US MARINE CORP	AREA 43 BLDG 525		CAMP PENDLETON	CA	HMMD
92055	S100740621	H80361	US MARINE CORP	AREA 43 BLDG 526		CAMP PENDLETON	CA	HMMD
92055	S100740622	H80362	US MARINE CORP	AREA 43 BLDG 535		CAMP PENDLETON	CA	HMMD
92055	S101854915	H80572	MTN 1ST MAINT. BAT.	AREA 43 BLDG. 43543	**	CAMP PENDLETON	CA	HMMD
92055	S100740357	H80055	US MARINE CORP	AREA 43, BLDG 454	**	CAMP PENDLETON	CA	HMMD
92055	S100740356	H80054	AREA 51 MWR GAS STATION	AREA 51 BLDG 51091	**	CAMP PENDLETON	CA	HMMD
92055	S100740852	H80605	MWR SAN ONOFRE BEACH	AREA 51 BLDG 51816	**	CAMP PENDLETON	CA	HMMD
92055	93301222		AREA 52	AREA 52	**	CAMP PENDLETON	CA	ERNS
92055	S102626360	H53214	AREA 52 DENTAL CLINIC	AREA 52 BLDG 520448	**	CAMP PENDLETON	CA	HMMD
92055	S103818642	H81129	SOI - MOTOR T	AREA 52 BLDG 520590	**	CAMP PENDLETON	CA	HMMD
92055	S103818641	H81128	SOI - 60 DAY SITE	AREA 52 BLDG 52188	**	CAMP PENDLETON	CA	HMMD
92055	S103818644	H81131	MCCS AREA 52 HOBBY SHOP	AREA 52 BLDG. 520170	**	CAMP PENDLETON	CA	HMMD
92055	S100740632	H80372	US MARINE CORP	AREA 52 BLDG 0512		CAMP PENDLETON	CA	HMMD
92055	S100740624	H80364	US MARINE CORP	AREA 52 BLDG 162		CAMP PENDLETON	CA	HMMD
92055	S100740628	H80368	US MARINE CORP	AREA 52 BLDG 293		CAMP PENDLETON	CA	HMMD
92055	S100740629	H80369	US MARINE CORP	AREA 52 BLDG 294		CAMP PENDLETON	CA	HMMD
92055	S100740633	H80373	US MARINE CORP	AREA 52 BLDG 3175		CAMP PENDLETON	CA	HMMD
92055	S100740932	H80694	AREA 52 FUEL STATION	AREA 52 BLDG 520167	**	CAMP PENDLETON	CA	HMMD
92055	S100740354	H80052	MWR GAS LANES	AREA 52 BLDG 520400	**	CAMP PENDLETON	CA	HMMD
92055	S102626444	H54041	SPORTS MEDICINE	AREA 52 BLDG 520420	**	CAMP PENDLETON	CA	HMMD
92055	S100740630	H80370	MESS HALL	AREA 52 BLDG 520430	**	CAMP PENDLETON	CA	HMMD
92055	S100740631	H52000	52 AREA DENTAL CLINIC	AREA 52 BLDG 520448	**	CAMP PENDLETON	CA	HMMD
92055	S100739475	H52001	52 AREA MEDICAL CLINIC	AREA 52 BLDG 520450	**	CAMP PENDLETON	CA	HMMD
92055	S100740955	H80720	ARMORY	AREA 52 BLDG 520452	**	CAMP PENDLETON	CA	HMMD
92055	S100740943	H80705	SCHOOL OF INFANTRY	AREA 52 BLDG 520594	**	CAMP PENDLETON	CA	HMMD
92055	S100740625	H80365	MILITARY FUEL STATION	AREA 52 BLDG 52167	**	CAMP PENDLETON	CA	HMMD
92055	S100740627	H80367	BULK FUEL STORAGE	AREA 52 BLDG 52291	**	CAMP PENDLETON	CA	HMMD
92055	S100740941	H80703	AREA 52 BEQ	AREA 52 BLDG 52610	**	CAMP PENDLETON	CA	HMMD
92055	S100741033	H80799	SAC CLASSROOM	AREA 52 BLDG 52655	**	CAMP PENDLETON	CA	HMMD

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
92055	S100740634	H80374	US MARINE CORP	AREA 53 BLDG 22		CAMP PENDLETON	CA	HMMD
92055	S100740636	H80376	US MARINE CORP	AREA 53 BLDG 305		CAMP PENDLETON	CA	HMMD
92055	S100740637	H80377	US MARINE CORP	AREA 53 BLDG 306		CAMP PENDLETON	CA	HMMD
92055	S100740640	H80380	US MARINE CORP	AREA 53 BLDG 417		CAMP PENDLETON	CA	HMMD
92055	S100741014	H80780	BARRACKS	AREA 53 BLDG 421	**	CAMP PENDLETON	CA	HMMD
92055	S100740643	H80383	US MARINE CORP	AREA 53 BLDG 457		CAMP PENDLETON	CA	HMMD
92055	S100740644	H80384	1ST MAR REG MOTOR TRANS.	AREA 53 BLDG 470 / 4	**	CAMP PENDLETON	CA	HMMD
92055	S100740645	H80385	US MARINE CORP	AREA 53 BLDG 495		CAMP PENDLETON	CA	HMMD
92055	S100740646	H80386	US MARINE CORP	AREA 53 BLDG 498		CAMP PENDLETON	CA	HMMD
92055	S100740647	H80387	US MARINE CORP	AREA 53 BLDG 499		CAMP PENDLETON	CA	HMMD
92055	S100740635	H80375	FITNESS CENTER	AREA 53 BLDG 53302	**	CAMP PENDLETON	CA	HMMD
92055	S100740638	H80378	EXCHANGE	AREA 53 BLDG 53319	**	CAMP PENDLETON	CA	HMMD
92055	S100741073	H80839	BARRACKS	AREA 53 BLDG 53320	**	CAMP PENDLETON	CA	HMMD
92055	S100741074	H80840	BARRACKS	AREA 53 BLDG 53321	**	CAMP PENDLETON	CA	HMMD
92055	S100740956	H80721	ARMORY	AREA 53 BLDG 53322	**	CAMP PENDLETON	CA	HMMD
92055	S100741080	H80846	BARRACKS	AREA 53 BLDG 53324	**	CAMP PENDLETON	CA	HMMD
92055	S100741011	H80777	BARRACKS	AREA 53 BLDG 53325	**	CAMP PENDLETON	CA	HMMD
92055	S100741012	H80778	BARRACKS	AREA 53 BLDG 53326	**	CAMP PENDLETON	CA	HMMD
92055	S100741079	H80845	BARRACKS	AREA 53 BLDG 53327	**	CAMP PENDLETON	CA	HMMD
92055	S100740970	H80735	DISBURSING OFFICE	AREA 53 BLDG 53330	**	CAMP PENDLETON	CA	HMMD
92055	S100741078	H80844	BARRACKS	AREA 53 BLDG 53333	**	CAMP PENDLETON	CA	HMMD
92055	S100741077	H80843	BARRACKS	AREA 53 BLDG 53334	**	CAMP PENDLETON	CA	HMMD
92055	S100741076	H80842	BARRACKS	AREA 53 BLDG 53335	**	CAMP PENDLETON	CA	HMMD
92055	S100741075	H80841	BARRACKS	AREA 53 BLDG 53336	**	CAMP PENDLETON	CA	HMMD
92055	S100740639	H80379	GARY MARTIN MESS HALL	AREA 53 BLDG 53402	**	CAMP PENDLETON	CA	HMMD
92055	S100741032	H80798	SWIMMING POOL	AREA 53 BLDG 53415	**	CAMP PENDLETON	CA	HMMD
92055	S100741013	H80779	BARRACKS	AREA 53 BLDG 53420	**	CAMP PENDLETON	CA	HMMD
92055	S100740983	H80748	BARRACKS	AREA 53 BLDG 53424	**	CAMP PENDLETON	CA	HMMD
92055	S100741015	H80781	BARRACKS	AREA 53 BLDG 53425	**	CAMP PENDLETON	CA	HMMD
92055	S100741016	H80782	BARRACKS	AREA 53 BLDG 53426	**	CAMP PENDLETON	CA	HMMD
92055	S100741017	H80783	BARRACKS	AREA 53 BLDG 53427	**	CAMP PENDLETON	CA	HMMD
92055	S100741055	H80821	BARRACKS	AREA 53 BLDG 53430	**	CAMP PENDLETON	CA	HMMD
92055	S100740982	H80747	BARRACKS	AREA 53 BLDG 53433	**	CAMP PENDLETON	CA	HMMD
92055	S100741018	H80784	BARRACKS	AREA 53 BLDG 53434	**	CAMP PENDLETON	CA	HMMD
92055	S100741019	H80785	BARRACKS	AREA 53 BLDG 53435	**	CAMP PENDLETON	CA	HMMD
92055	S100740981	H80746	BARRACKS	AREA 53 BLDG 53436	**	CAMP PENDLETON	CA	HMMD
92055	S100740641	H80381	BEQ	AREA 53 BLDG 53450	**	CAMP PENDLETON	CA	HMMD
92055	S100740642	H80382	BEQ	AREA 53 BLDG 53451	**	CAMP PENDLETON	CA	HMMD
92055	S100740675	H80416	TRAINING FACILITY	AREA 53 BLDG 53459	**	CAMP PENDLETON	CA	HMMD
92055	S100740648	H80388	MESS HALL	AREA 53 BLDG 53502	**	CAMP PENDLETON	CA	HMMD
92055	S100833015	H53050	53 AREA MEDICAL CLINIC	AREA 53 BLDG 53505	**	CAMP PENDLETON	CA	HMMD
92055	S100833024	H53068	53 AREA DENTAL CLINIC	AREA 53 BLDG 53506	**	CAMP PENDLETON	CA	HMMD
92055	S100741005	H80771	EXCHANGE CLEANERS	AREA 53 BLDG 53508	**	CAMP PENDLETON	CA	HMMD
92055	S100740649	H80389	GYM	AREA 53 BLDG 53528	**	CAMP PENDLETON	CA	HMMD
92055	S100740684	H80425	BEQ	AREA 53 BLDG 53571	**	CAMP PENDLETON	CA	HMMD
92055	S100740650	H80390	1ST MARINE REGIMENT	AREA 53 BLDG 53670		CAMP PENDLETON	CA	HMMD
92055	S100740966	H80731	PUMP STATION	AREA 61 BLDG 61511	**	CAMP PENDLETON	CA	HMMD
92055	S100740967	H80732	PUMP STATION	AREA 61 BLDG 61514	**	CAMP PENDLETON	CA	HMMD
92055	S100741007	H80773	PUMP STATION	AREA 61 BLDG 61521	**	CAMP PENDLETON	CA	HMMD
92055	S103472043	9UT3319	AREA 61 SAN CLEMENTE RANCH	AREA 61 MCB	**	CAMP PENDLETON	CA	LUST
92055	93305471		AREA 62	AREA 62	**	CAMP PENDLETON	CA	ERNS
92055	S100740656	H80396	US MARINE CORP	AREA 62 BLDG 0596		CAMP PENDLETON	CA	HMMD
92055	S100740652	H80392	US MARINE CORP	AREA 62 BLDG 431		CAMP PENDLETON	CA	HMMD
92055	S100740653	H80393	US MARINE CORP	AREA 62 BLDG 433		CAMP PENDLETON	CA	HMMD
92055	S100740657	H80397	5TH MAR REG, 1ST MAR DIV	AREA 62 BLDG 620588/	**	CAMP PENDLETON	CA	HMMD
92055	S100741009	H80775	MESS HALL	AREA 62 BLDG 62302	**	CAMP PENDLETON	CA	HMMD
92055	S100833045	H53094	MEDICAL CLINIC	AREA 62 BLDG 62305	**	CAMP PENDLETON	CA	HMMD
92055	S100833030	H53077	62 AREA DENTAL CLINIC	AREA 62 BLDG 62306	**	CAMP PENDLETON	CA	HMMD
92055	S100741071	H80837	BARRACKS	AREA 62 BLDG 62322	**	CAMP PENDLETON	CA	HMMD
92055	S100741070	H80836	BARRACKS	AREA 62 BLDG 62324	**	CAMP PENDLETON	CA	HMMD
92055	S100741069	H80835	BARRACKS	AREA 62 BLDG 62325	**	CAMP PENDLETON	CA	HMMD
92055	S100741068	H80834	BARRACKS	AREA 62 BLDG 62326	**	CAMP PENDLETON	CA	HMMD
92055	S100741067	H80833	USN-MIRAMAR/FISC-REUSE	AREA 62 BLDG 62327	**	CAMP PENDLETON	CA	HMMD
92055	S100741066	H80832	BARRACKS	AREA 62 BLDG 62329	**	CAMP PENDLETON	CA	HMMD
92055	S100741065	H80831	BARRACKS	AREA 62 BLDG 62330	**	CAMP PENDLETON	CA	HMMD
92055	S100741064	H80830	BARRACKS	AREA 62 BLDG 62332	**	CAMP PENDLETON	CA	HMMD
92055	S100741063	H80829	BARRACKS	AREA 62 BLDG 62333	**	CAMP PENDLETON	CA	HMMD
92055	S100741062	H80828	BARRACKS	AREA 62 BLDG 62336	**	CAMP PENDLETON	CA	HMMD
92055	S100741061	H80827	BARRACKS	AREA 62 BLDG 62337	**	CAMP PENDLETON	CA	HMMD
92055	S100741060	H80826	BARRACKS	AREA 62 BLDG 62341	**	CAMP PENDLETON	CA	HMMD
92055	S100741059	H80825	BARRACKS	AREA 62 BLDG 62342	**	CAMP PENDLETON	CA	HMMD

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
92055	S100741058	H80824	BARRACKS	AREA 62 BLDG 62344	**	CAMP PENDLETON	CA	HMMD
92055	S100741057	H80823	BARRACKS	AREA 62 BLDG 62345	**	CAMP PENDLETON	CA	HMMD
92055	S100741056	H80822	BARRACKS	AREA 62 BLDG 62347	**	CAMP PENDLETON	CA	HMMD
92055	S100741072	H80838	BARRACKS	AREA 62 BLDG 62348	**	CAMP PENDLETON	CA	HMMD
92055	S100740651	H80391	MESS HALL	AREA 62 BLDG 62402	**	CAMP PENDLETON	CA	HMMD
92055	S100741010	H80776	MWR EXCHANGE	AREA 62 BLDG 62408	**	CAMP PENDLETON	CA	HMMD
92055	S100741081	H80847	BARRACKS	AREA 62 BLDG 62420	**	CAMP PENDLETON	CA	HMMD
92055	S100741082	H80848	BARRACKS	AREA 62 BLDG 62421	**	CAMP PENDLETON	CA	HMMD
92055	S100740971	H80736	BARRACKS	AREA 62 BLDG 62424	**	CAMP PENDLETON	CA	HMMD
92055	S100741027	H80793	BARRACKS	AREA 62 BLDG 62425	**	CAMP PENDLETON	CA	HMMD
92055	S100741028	H80794	BARRACKS	AREA 62 BLDG 62426	**	CAMP PENDLETON	CA	HMMD
92055	S100740972	H80737	BARRACKS	AREA 62 BLDG 62428	**	CAMP PENDLETON	CA	HMMD
92055	S100741029	H80795	BARRACKS	AREA 62 BLDG 62429	**	CAMP PENDLETON	CA	HMMD
92055	S100741083	H80849	BARRACKS	AREA 62 BLDG 62434	**	CAMP PENDLETON	CA	HMMD
92055	S100741030	H80796	BARRACKS	AREA 62 BLDG 62435	**	CAMP PENDLETON	CA	HMMD
92055	S100741031	H80797	BARRACKS	AREA 62 BLDG 62436	**	CAMP PENDLETON	CA	HMMD
92055	S100741084	H80850	BARRACKS	AREA 62 BLDG 62437	**	CAMP PENDLETON	CA	HMMD
92055	S100740654	H80394	MESS HALL	AREA 62 BLDG 62502	**	CAMP PENDLETON	CA	HMMD
92055	S100740351	H80049	MWR GAS LANES	AREA 62 BLDG 62507	**	CAMP PENDLETON	CA	HMMD
92055	S100740355	H80053	PUMP STATION	AREA 62 BLDG 62510	**	CAMP PENDLETON	CA	HMMD
92055	S100740655	H80395	SWIMMING POOL	AREA 62 BLDG 62515	**	CAMP PENDLETON	CA	HMMD
92055	S100740977	H80742	BARRACKS	AREA 62 BLDG 62520	**	CAMP PENDLETON	CA	HMMD
92055	S100740978	H80743	BARRACKS	AREA 62 BLDG 62521	**	CAMP PENDLETON	CA	HMMD
92055	S100740979	H80744	BARRACKS	AREA 62 BLDG 62524	**	CAMP PENDLETON	CA	HMMD
92055	S100741020	H80786	BARRACKS	AREA 62 BLDG 62525	**	CAMP PENDLETON	CA	HMMD
92055	S100740980	H80745	BARRACKS	AREA 62 BLDG 62526	**	CAMP PENDLETON	CA	HMMD
92055	S100741021	H80787	BARRACKS	AREA 62 BLDG 62528	**	CAMP PENDLETON	CA	HMMD
92055	S100741022	H80788	BARRACKS	AREA 62 BLDG 62529	**	CAMP PENDLETON	CA	HMMD
92055	S100741023	H80789	BARRACKS	AREA 62 BLDG 62534	**	CAMP PENDLETON	CA	HMMD
92055	S100741024	H80790	BARRACKS	AREA 62 BLDG 62535	**	CAMP PENDLETON	CA	HMMD
92055	S100741025	H80791	BARRACKS	AREA 62 BLDG 62536	**	CAMP PENDLETON	CA	HMMD
92055	S100741026	H80792	BARRACKS	AREA 62 BLDG 62537	**	CAMP PENDLETON	CA	HMMD
92055	S103548000	H80046	1ST COMBAT ENGINEERS BATALLION	AREA 62 BLDG 62580	**	CAMP PENDLETON	CA	HMMD
92055	S100833134	H80892	5TH REG 1ST MAR DIV BAT SHOP	AREA 62 BLDG 62597	**	CAMP PENDLETON	CA	HMMD
92055	S100833136	H80894	ARMORY	AREA 62 BLDG 62598	**	CAMP PENDLETON	CA	HMMD
92055	S100740668	H80409	BUNK HOUSE	AREA 62 BLDG 62711	**	CAMP PENDLETON	CA	HMMD
92055	S100740659	H80399	US MARINE CORP	AREA 63 BLDG 102		CAMP PENDLETON	CA	HMMD
92055	S100740660	H80400	US MARINE CORP	AREA 63 BLDG 1173		CAMP PENDLETON	CA	HMMD
92055	S100741006	H80772	PUMP STATION	AREA 63 BLDG 63093	**	CAMP PENDLETON	CA	HMMD
92055	S100740968	H80733	CHRISTIANITOS SNCO CLUB	AREA 63 BLDG 63122	**	CAMP PENDLETON	CA	HMMD
92055	S100740942	H80704	FLEET HOSPITAL OPERATIONS	AREA 63 BLDG 63234	**	CAMP PENDLETON	CA	HMMD
92055	S100740658	H80398	US MARINE CORP	AREA 63 BLDG 71		CAMP PENDLETON	CA	HMMD
92055	S102363734	H80402	US MARINE CORP	AREA B BLDG 1010		CAMP PENDLETON	CA	HMMD
92055	S101614094		DEBRIS PILES AREA BEHIND PLT11	52 AREA, SITE 36		CAMP PENDLETON	CA	WMUDS/SWAT
92055	S101670053	H80990	US MARINE CORP	AREAS VARIOUS		CAMP PENDLETON	CA	HMMD
92055	S103818645	H86902	FAC MAINT DEPT	BASILONE RD	**	CAMP PENDLETON	CA	HMMD
92055	S103818646	H86903	FAC MAINT DEPT	BASILONE RD	**	CAMP PENDLETON	CA	HMMD
92055	S101612633	9 000000012	SAN ONOFRE SANITARY LANDFILL	BASILONE RD* E OF BASILONE GT		CAMP PENDLETON	CA	WDS
92055	S100838452	9 000000013	LAS PULGAS SANITARY LANDFILL	BASILONE RD* N OF CP PULGAS		CAMP PENDLETON	CA	WDS
92055	S103723429		AREA 25 CRASH CREW TRAINING SI	BLD2517945 MCB	**	CAMP PENDLETON	CA	LUST
92055	S103678287	CA2170023533	US MARINE CORPS-CAMP PENDLETON	BLDG #22165__ASSISTANT CHIEF O	**	CAMP PENDLETON	CA	HAZNET
92055	S103472044		AREA 11	BLDG 1122 MCB	**	CAMP PENDLETON	CA	LUST
92055	S102444623	9UT3306	AREA 11	BLDG 1133 MCB		CAMP PENDLETON	CA	LUST
92055	S102424503	9UT2922	AREA 11	BLDG 1142 MCB		CAMP PENDLETON	CA	LUST
92055	S102590488	9UT3440	AREA 11	BLDG 1161 MCB		CAMP PENDLETON	CA	LUST
92055	S102532375	9UT3397	AREA 12	BLDG 1223 MCB		CAMP PENDLETON	CA	LUST
92055	S102424507	9UT637	AREA 12(24) & AREA 13(72) *	BLDG 1224 MCB		CAMP PENDLETON	CA	LUST
92055	S102424505	9UT2923	AREA 12	BLDG 1255 MCB		CAMP PENDLETON	CA	LUST
92055	S102424506	9UT2841	AREA 12	BLDG 1294 MCB		CAMP PENDLETON	CA	LUST
92055	S103296769	9UT3554	AREA 13	BLDG 13053 MCB		CAMP PENDLETON	CA	LUST
92055	S102532360	9UT3367	AREA 13	BLDG 13103 MCB		CAMP PENDLETON	CA	LUST
92055	S103296770	9UT3553	AREA 13	BLDG 13110 MCB		CAMP PENDLETON	CA	LUST
92055	S102424508	9UT1008	AREA 13	BLDG 13111 MCB		CAMP PENDLETON	CA	LUST
92055	S102424510	9UT3074	AREA 13	BLDG 13129 MCB		CAMP PENDLETON	CA	LUST
92055	S102532365	9UT3387	AREA 13	BLDG 13131 MCB		CAMP PENDLETON	CA	LUST
92055	S102444624	9UT3297	AREA 13	BLDG 13142 MCB		CAMP PENDLETON	CA	LUST
92055	S102532366	9UT3388	AREA 13	BLDG 13144 MCB		CAMP PENDLETON	CA	LUST
92055	S102444625	9UT3292	AREA 13	BLDG 13145 MCB		CAMP PENDLETON	CA	LUST
92055	S102444626	9UT3266	AREA 13	BLDG 13164 MCB		CAMP PENDLETON	CA	LUST
92055	S102424514	9UT2976	AREA 13 BLDG 163 & 176 *	BLDG 13176 MCB		CAMP PENDLETON	CA	LUST
92055	S102424512	9UT2925	AREA 13	BLDG 1324 MCB		CAMP PENDLETON	CA	LUST

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
92055	S102444627	9UT3296	AREA 13	BLDG 1344 MCB		CAMP PENDLETON	CA	LUST
92055	S102444628	9UT3295	AREA 13	BLDG 1363 MCB		CAMP PENDLETON	CA	LUST
92055	S102532367	9UT3389	AREA 13	BLDG 1364 MCB		CAMP PENDLETON	CA	LUST
92055	S102532368	9UT3390	AREA 13	BLDG 1376 MCB		CAMP PENDLETON	CA	LUST
92055	S102590489	9UT3413	AREA 13	BLDG 1395 MCB		CAMP PENDLETON	CA	LUST
92055	S102590490	9UT3046	AREA 14	BLDG 14008 MCB		CAMP PENDLETON	CA	LUST
92055	S102444629	9UT3293	AREA 14	BLDG 14121 MCB		CAMP PENDLETON	CA	LUST
92055	S102532364	9UT3357	AREA 14	BLDG 14125 MCB		CAMP PENDLETON	CA	LUST
92055	S103472045	9UT623	AREA 14 FUEL ST BLDG 14184-197	BLDG 14125 MCB	**	CAMP PENDLETON	CA	LUST
92055	S102532369	9UT3391	AREA 14	BLDG 14127 MCB		CAMP PENDLETON	CA	LUST
92055	S102532370	9UT3392	AREA 14	BLDG 1413 MCB		CAMP PENDLETON	CA	LUST
92055	S102424522	9UT2926	AREA 14	BLDG 14133 MCB		CAMP PENDLETON	CA	LUST
92055	S102424523	9UT628	AREA 14	BLDG 14156 MCB		CAMP PENDLETON	CA	LUST
92055	S101301385	9UT2300	AREA 14	BLDG 14170 MCB		CAMP PENDLETON	CA	LUST
92055	S102424524	9UT636	AREA 14	BLDG 14173 MCB		CAMP PENDLETON	CA	LUST
92055	S102532371	9UT3393	AREA 14	BLDG 1431 MCB		CAMP PENDLETON	CA	LUST
92055	S102590492	9UT3424	AREA 14	BLDG 1441 MCB		CAMP PENDLETON	CA	LUST
92055	S103472046	9UT3559	AREA 14	BLDG 14519 MCB	**	CAMP PENDLETON	CA	LUST
92055	S102444630	9UT3298	AREA 14	BLDG 1482 MCB		CAMP PENDLETON	CA	LUST
92055	S102444631	9UT3294	AREA 14	BLDG 1491 MCB		CAMP PENDLETON	CA	LUST
92055	S102590493	9UT3421	AREA 15	BLDG 1536 MCB		CAMP PENDLETON	CA	LUST
92055	S102424530	9UT618	AREA 15 BLDG 44, 81, 82, 98	BLDG 1544 MCB		CAMP PENDLETON	CA	LUST
92055	S102590494	9UT3423	AREA 15	BLDG 1561 MCB		CAMP PENDLETON	CA	LUST
92055	S102590495	9UT3422	AREA 15	BLDG 1594 MCB		CAMP PENDLETON	CA	LUST
92055	S102590496	9UT3437	AREA 16	BLDG 16103 MCB		CAMP PENDLETON	CA	LUST
92055	S102590497	9UT3442	AREA 16	BLDG 16105 MCB		CAMP PENDLETON	CA	LUST
92055	S102590498	9UT3445	AREA 16	BLDG 16115 MCB		CAMP PENDLETON	CA	LUST
92055	S103472047	9UT3549	AREA 16	BLDG 1621 MCB	**	CAMP PENDLETON	CA	LUST
92055	S102444632	9UT3265	AREA 16	BLDG 1623 MCB		CAMP PENDLETON	CA	LUST
92055	S102532373	9UT3395	AREA 16	BLDG 1642 MCB		CAMP PENDLETON	CA	LUST
92055	S103472048	9UT643	AREA 16 COMM. SUPPRT WAREHOUSE	BLDG 1645 MCB	**	CAMP PENDLETON	CA	LUST
92055	S102590499	9UT3414	AREA 16	BLDG 1646 MCB		CAMP PENDLETON	CA	LUST
92055	S102532362	9UT3371	AREA 16	BLDG 1654 MCB		CAMP PENDLETON	CA	LUST
92055	S102532361	9UT3368	AREA 16	BLDG 1655 MCB		CAMP PENDLETON	CA	LUST
92055	S102444633	9UT3307	AREA 16	BLDG 1657 MCB		CAMP PENDLETON	CA	LUST
92055	S102424534	9UT626	AREA 16	BLDG 1661 MCB		CAMP PENDLETON	CA	LUST
92055	S102590500	9UT3430	AREA 16	BLDG 1671 MCB		CAMP PENDLETON	CA	LUST
92055	S102424535	9UT2921	AREA 16	BLDG 1674T MCB		CAMP PENDLETON	CA	LUST
92055	S102590501	9UT3429	AREA 16	BLDG 1684 MCB		CAMP PENDLETON	CA	LUST
92055	S102424533	9UT2920	AREA 16	BLDG 1685 MCB		CAMP PENDLETON	CA	LUST
92055	S102532372	9UT3394	AREA 16	BLDG 1687 MCB		CAMP PENDLETON	CA	LUST
92055	S102532363	9UT3373	AREA 16	BLDG 1692 MCB		CAMP PENDLETON	CA	LUST
92055	S102590502	9UT3425	AREA 17	BLDG 1781 MCB		CAMP PENDLETON	CA	LUST
92055	S103472049	9UT3565	AREA 18	BLDG 18415 MCB	**	CAMP PENDLETON	CA	LUST
92055	S102444634	9UT3308	AREA 21	BLDG 21415 MCB		CAMP PENDLETON	CA	LUST
92055	S102424538	9UT2916	AREA 21	BLDG 21426 MCB		CAMP PENDLETON	CA	LUST
92055	S103472050		AREA 21	BLDG 21433 MCB	**	CAMP PENDLETON	CA	LUST
92055	S102590503	9UT3427	AREA 21	BLDG 21441 MCB		CAMP PENDLETON	CA	LUST
92055	S102424539	9UT2912	AREA 21	BLDG 21443 MCB		CAMP PENDLETON	CA	LUST
92055	S102424541	9UT2914	AREA 21	BLDG 21478 MCB		CAMP PENDLETON	CA	LUST
92055	S102424542	9UT2832	AREA 21	BLDG 21503 MCB		CAMP PENDLETON	CA	LUST
92055	S102424543	9UT2822	AREA 21	BLDG 21513 MCB		CAMP PENDLETON	CA	LUST
92055	S103472051	9UT3669	AREA 210533	BLDG 21533 MCB	**	CAMP PENDLETON	CA	LUST
92055	S102590504	9UT661	AREA 21 OIL PT 5 BLDG 21561 &	BLDG 21559 MCB		CAMP PENDLETON	CA	LUST
92055	S102444636	9UT3316	AREA 21	BLDG 21563 MCB		CAMP PENDLETON	CA	LUST
92055	S102590505	9UT3426	AREA 21	BLDG 21565 MCB		CAMP PENDLETON	CA	LUST
92055	S102424544	9UT2817	AREA 21	BLDG 21578 MCB		CAMP PENDLETON	CA	LUST
92055	S102424545	9UT2797	AREA 21	BLDG 21580 MCB		CAMP PENDLETON	CA	LUST
92055	S103723430		AREA 21	BLDG 21601 MCB	**	CAMP PENDLETON	CA	LUST
92055	S102590507	9UT3443	AREA 21	BLDG 21620 MCB		CAMP PENDLETON	CA	LUST
92055	S102424547	9UT3024	AREA 21	BLDG 21668 MCB		CAMP PENDLETON	CA	LUST
92055	S102424548	9UT2820	AREA 21	BLDG 21671 MCB		CAMP PENDLETON	CA	LUST
92055	S102590508	9UT2818	AREA 21840	BLDG 21840 MCB		CAMP PENDLETON	CA	LUST
92055	S102424549	9UT1006	AREA 21	BLDG 21841 MCB		CAMP PENDLETON	CA	LUST
92055	S102424555	9UT2845	AREA 22	BLDG 22048 MCB		CAMP PENDLETON	CA	LUST
92055	S102424559	9UT1902	AREA 22 CHEVRON SS NR B. KING	BLDG 22124 MCB		CAMP PENDLETON	CA	LUST
92055	S102444637	9UT3267	AREA 22	BLDG 22131 MCB		CAMP PENDLETON	CA	LUST
92055	S102444638	9UT3272	AREA 22	BLDG 2214 MCB		CAMP PENDLETON	CA	LUST
92055	S102424553	9UT2821	AREA 22	BLDG 22150 MCB		CAMP PENDLETON	CA	LUST
92055	S100469978	9UT627	AREA 22	BLDG 22187 MCB		CAMP PENDLETON	CA	LUST
92055	S100833011	H53038	22 AREA MEDICAL CLINIC	BLDG 22190	**	CAMP PENDLETON	CA	HMMD

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
92055	S102424556	9UT2840	AREA 22	BLDG 2264 MCB		CAMP PENDLETON	CA	LUST
92055	91467691		BLDG 2276	BLDG 2276	**	CAMP PENDLETON	CA	ERNS
92055	91467692		BLDG 2276	BLDG 2276	**	CAMP PENDLETON	CA	ERNS
92055	S102424557	9UT2834	AREA 22	BLDG 22831 MCB		CAMP PENDLETON	CA	LUST
92055	S102424558	9UT2837	AREA 22	BLDG 2296 MCB		CAMP PENDLETON	CA	LUST
92055	S102556699		IR SITE 22 - UNLINED SURFACE I	BLDG 23-88,MUNN FIELD MC AIRST	**	CAMP PENDLETON	CA	WMUDS/SWAT
92055	S103818640	H81125	PUMP FARM	BLDG 23185	**	CAMP PENDLETON	CA	HMMD
92055	S102425455	9UT3072	AREA 23	BLDG 2397 MCB		CAMP PENDLETON	CA	LUST
92055	S102444639	9UT3336	AREA 24	BLDG 24100 MCB		CAMP PENDLETON	CA	LUST
92055	S102424563	9UT3006	AREA 24	BLDG 2459 MCB		CAMP PENDLETON	CA	LUST
92055	S102424564	9UT3005	AREA 24	BLDG 2481 MCB		CAMP PENDLETON	CA	LUST
92055	S102424570	9UT176	AREA 24 TANKS U2483E & U2482E	BLDG 2481 MCB		CAMP PENDLETON	CA	LUST
92055	S102424565	9UT2838	AREA 24	BLDG 2482 MCB		CAMP PENDLETON	CA	LUST
92055	S102424566	9UT2839	AREA 24	BLDG 2483 MCB		CAMP PENDLETON	CA	LUST
92055	S102424568	9UT2862	AREA 24	BLDG 2492 MCB		CAMP PENDLETON	CA	LUST
92055	S102424569	9UT2836	AREA 24	BLDG 2498 MCB		CAMP PENDLETON	CA	LUST
92055	1000344642	92055MRNCRPO	USMC CAMP PENDLETON	BLDG 2631		CAMP PENDLETON	CA	PADS, CERCLIS, FINDS, NPL, RCRIS/LQG, TRIS, RCRIS/TSDF, RAATS, CORRACTS, ROD
92055	S102424572	9UT2819	AREA 26	BLDG 2653 MCB		CAMP PENDLETON	CA	LUST
92055	S102590510	9UT3412	AREA 26	BLDG 2662 MCB		CAMP PENDLETON	CA	LUST
92055	S102425456	9UT3071	AREA 26	BLDG 2666 MCB		CAMP PENDLETON	CA	LUST
92055	S102590511	9UT3438	AREA 26	BLDG 2699 MCB		CAMP PENDLETON	CA	LUST
92055	S100833016	H53051	33 AREA MEDICAL CLINIC	BLDG 33305	**	CAMP PENDLETON	CA	HMMD
92055	S102444640	9UT3310	AREA 33	BLDG 33322 MCB		CAMP PENDLETON	CA	LUST
92055	S102444641	9UT3314	AREA 33	BLDG 33324 MCB		CAMP PENDLETON	CA	LUST
92055	S102444642	9UT3313	AREA 33	BLDG 33326 MCB		CAMP PENDLETON	CA	LUST
92055	S102444643	9UT3312	AREA 33	BLDG 33328 MCB		CAMP PENDLETON	CA	LUST
92055	S102532352	9UT3328	AREA 33	BLDG 33360 MCB		CAMP PENDLETON	CA	LUST
92055	S102424575	9UT2778	AREA 33	BLDG 33402 MCB		CAMP PENDLETON	CA	LUST
92055	S103241598	H81111	CAMP PENDLETON	BLDG 33421	**	CAMP PENDLETON	CA	HMMD
92055	S102424576	9UT3090	AREA 33	BLDG 33427 MCB		CAMP PENDLETON	CA	LUST
92055	S102444644	9UT3302	AREA 33	BLDG 33526 MCB		CAMP PENDLETON	CA	LUST
92055	S102590512	9UT3444	AREA 33	BLDG 33581 MCB		CAMP PENDLETON	CA	LUST
92055	S102590513	9UT3439	AREA 41	BLDG 41312 MCB		CAMP PENDLETON	CA	LUST
92055	S102424577	9UT2903	AREA 41	BLDG 41319 MCB		CAMP PENDLETON	CA	LUST
92055	S102424578	9UT2900	AREA 41	BLDG 41362 MCB		CAMP PENDLETON	CA	LUST
92055	92280441		BLDG 41404	BLDG 41404	**	CAMP PENDLETON	CA	ERNS
92055	S102424581	9UT2907	AREA 43	BLDG 43149 MCB		CAMP PENDLETON	CA	LUST
92055	S100273875	H80995	MCB	BLDG 432		CAMP PENDLETON	CA	HMMD
92055	S102424582	9UT2849	AREA 43	BLDG 43260 MCB		CAMP PENDLETON	CA	LUST
92055	S102424583	9UT2962	AREA 43	BLDG 43286 MCB		CAMP PENDLETON	CA	LUST
92055	S103723431		AREA 43 TANK U43302E	BLDG 43302 MCB	**	CAMP PENDLETON	CA	LUST
92055	S102424584	9UT2947	AREA 43	BLDG 43333 MCB		CAMP PENDLETON	CA	LUST
92055	S102424585	9UT2940	AREA 43	BLDG 43336 MCB		CAMP PENDLETON	CA	LUST
92055	S103296774	9UT3592	AREA 43	BLDG 43402 MCB		CAMP PENDLETON	CA	LUST
92055	S102424586	9UT2948	AREA 43	BLDG 43435 MCB		CAMP PENDLETON	CA	LUST
92055	S102424587	9UT2908	AREA 43	BLDG 43525 MCB		CAMP PENDLETON	CA	LUST
92055	S102424588	9UT2906	AREA 43	BLDG 43536 MCB		CAMP PENDLETON	CA	LUST
92055	S103472052		AREA 43 (BLDG 43574-3)	BLDG 43574 MCB	**	CAMP PENDLETON	CA	LUST
92055	S103472053	9UT2198	AREA 51 BCH CLUB OFF BASILONE	BLDG 51811 MCB	**	CAMP PENDLETON	CA	LUST
92055	S100740626	H80366	US MARINE CORP	BLDG 522 AREA 52 BLDG 291		CAMP PENDLETON	CA	HMMD
92055	S102532355	9UT3318	AREA 52	BLDG 52594 MCB		CAMP PENDLETON	CA	LUST
92055	S102424595	9UT2197	AREA 52	BLDG 52710 MCB		CAMP PENDLETON	CA	LUST
92055	S103296775	9UT177	AREA 53 TANK U53402E	BLDG 53 MCB		CAMP PENDLETON	CA	LUST
92055	S102444647	9UT3320	AREA 53	BLDG 53321 MCB		CAMP PENDLETON	CA	LUST
92055	S102444648	9UT3334	AREA 53	BLDG 53325 MCB		CAMP PENDLETON	CA	LUST
92055	S102444649	9UT3535	AREA 53	BLDG 53326 MCB		CAMP PENDLETON	CA	LUST
92055	S102444650	9UT3322	AREA 53	BLDG 53334 MCB		CAMP PENDLETON	CA	LUST
92055	S102444651	9UT3323	AREA 53	BLDG 53335 MCB		CAMP PENDLETON	CA	LUST
92055	S102424602	9UT1009	AREA 53 BLDG 420, 21, 33-36	BLDG 53401 MCB		CAMP PENDLETON	CA	LUST
92055	S102424598	9UT2899	AREA 53	BLDG 53415 MCB		CAMP PENDLETON	CA	LUST
92055	S102444652	9UT3309	AREA 53	BLDG 53421 MCB		CAMP PENDLETON	CA	LUST
92055	S102444653	9UT3335	AREA 53	BLDG 53426 MCB		CAMP PENDLETON	CA	LUST
92055	S102444654	9UT3331	AREA 53	BLDG 53427 MCB		CAMP PENDLETON	CA	LUST
92055	S102444655	9UT3329	AREA 53	BLDG 53433 MCB		CAMP PENDLETON	CA	LUST
92055	S102424599	9UT2847	AREA 53	BLDG 53471 MCB		CAMP PENDLETON	CA	LUST
92055	S102424600	9UT2904	AREA 53	BLDG 53502 MCB		CAMP PENDLETON	CA	LUST
92055	S102424603	9UT1012	AREA 53 CAMP HORNO 5TH ST	BLDG 53502 MCB		CAMP PENDLETON	CA	LUST
92055	S102424604	9UT617	AREA 53 UEPH BLDG 524-27 & 530	BLDG 53524 MCB		CAMP PENDLETON	CA	LUST

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
92055	S102424601	9UT2848	AREA 53	BLDG 53670 MCB		CAMP PENDLETON	CA	LUST
92055	S102424606	9UT3075	AREA 62	BLDG 62305 MCB		CAMP PENDLETON	CA	LUST
92055	S102424612	9UT2633	AREA 62	BLDG 62306 MCB		CAMP PENDLETON	CA	LUST
92055	S102424613	9UT2448	AREA 62	BLDG 62322 MCB		CAMP PENDLETON	CA	LUST
92055	S102444608	9UT3123	AREA 62	BLDG 62326 MCB		CAMP PENDLETON	CA	LUST
92055	S102444609	9UT3128	AREA 62	BLDG 62327 MCB		CAMP PENDLETON	CA	LUST
92055	S102444610	9UT3129	AREA 62	BLDG 62329 MCB		CAMP PENDLETON	CA	LUST
92055	S102444611	9UT3124	AREA 62	BLDG 62330 MCB		CAMP PENDLETON	CA	LUST
92055	S102424614	9UT2628	AREA 62	BLDG 62333 MCB		CAMP PENDLETON	CA	LUST
92055	S103723432		AREA 62	BLDG 62336 MCB	**	CAMP PENDLETON	CA	LUST
92055	S102424607	9UT2630	AREA 62	BLDG 62337 MCB		CAMP PENDLETON	CA	LUST
92055	S102444612	9UT3125	AREA 62	BLDG 62341 MCB		CAMP PENDLETON	CA	LUST
92055	S103723433		AREA 62	BLDG 62344 MCB	**	CAMP PENDLETON	CA	LUST
92055	S102444613	9UT3126	AREA 62	BLDG 62347 MCB		CAMP PENDLETON	CA	LUST
92055	S102424608	9UT3022	AREA 62	BLDG 62402 MCB		CAMP PENDLETON	CA	LUST
92055	S102424609	9UT2629	AREA 62	BLDG 62420 MCB		CAMP PENDLETON	CA	LUST
92055	S102424615	9UT2442	AREA 62	BLDG 62421 MCB		CAMP PENDLETON	CA	LUST
92055	S102444614	9UT3127	AREA 62	BLDG 62429 MCB		CAMP PENDLETON	CA	LUST
92055	S102424616	9UT2443	AREA 62	BLDG 62435 MCB		CAMP PENDLETON	CA	LUST
92055	S102424617	9UT2444	AREA 62	BLDG 62436 MCB		CAMP PENDLETON	CA	LUST
92055	S102424618	9UT2445	AREA 62	BLDG 62437 MCB		CAMP PENDLETON	CA	LUST
92055	S102424610	9UT3023	AREA 62	BLDG 62502 MCB		CAMP PENDLETON	CA	LUST
92055	S102590515	9UT3447	AREA 62	BLDG 62507 MCB		CAMP PENDLETON	CA	LUST
92055	S102444656	9UT3333	AREA 62	BLDG 62510 MCB		CAMP PENDLETON	CA	LUST
92055	S102424619	9UT2632	AREA 62	BLDG 62520 MCB		CAMP PENDLETON	CA	LUST
92055	S102444615	9UT3132	AREA 62	BLDG 62524 MCB		CAMP PENDLETON	CA	LUST
92055	S102444616	9UT3133	AREA 62	BLDG 62525 MCB		CAMP PENDLETON	CA	LUST
92055	S102444617	9UT3134	AREA 62	BLDG 62526 MCB		CAMP PENDLETON	CA	LUST
92055	S102444618	9UT3135	AREA 62	BLDG 62528 MCB		CAMP PENDLETON	CA	LUST
92055	S102444619	9UT3130	AREA 62	BLDG 62529 MCB		CAMP PENDLETON	CA	LUST
92055	S102424620	9UT2446	AREA 62	BLDG 62534 MCB		CAMP PENDLETON	CA	LUST
92055	S102424621	9UT2447	AREA 62	BLDG 62535 MCB		CAMP PENDLETON	CA	LUST
92055	S102424622	9UT2631	AREA 62	BLDG 62536 MCB		CAMP PENDLETON	CA	LUST
92055	S102444620	9UT3131	AREA 62	BLDG 62537 MCB		CAMP PENDLETON	CA	LUST
92055	S102424623	9UT2627	AREA 62	BLDG 62540 MCB		CAMP PENDLETON	CA	LUST
92055	S103472054	9UT2357	AREA 26 HOSP MAINTEN FACILITY	BLDG H-12 MCB	**	CAMP PENDLETON	CA	LUST
92055	S103472055	9UT2978	AREA 52 BLDG 520400-HOSP.	BLDG H-12 MCB	**	CAMP PENDLETON	CA	LUST
92055	S103472056	9UT2842	AREA 26 - HOSPITAL	BLDG H049 MCB	**	CAMP PENDLETON	CA	LUST
92055	S103472057	9UT2843	AREA 26 - HOSPITAL	BLDG H09 MCB	**	CAMP PENDLETON	CA	LUST
92055	S103472058	9UT2833	AREA 26 - HOSPITAL	BLDG H102 MCB	**	CAMP PENDLETON	CA	LUST
92055	94407439		BLDG NO.53423	BLDG NO.53423	**	CAMP PENDELTON	CA	ERNS
92055	S102769865	9UT3516	AREA 33	BLDG#33543 MCB	**	CAMP PENDLETON	CA	LUST
92055	1001407206	CA2170023533	USMC, CAMP PENDLETON	BLDG. 22165	**	CAMP PENDLETON	CA	FINDS
92055	U001572018	00000054631	CAMPBELL PENDLETON	BLDG. NO. 1143		CAMP PENDLETON	CA	UST
92055	U001572016	00000054628	CAMP PENDLETON	BLDG. NO. 1261		CAMP PENDLETON	CA	AST, UST
92055	U001572019	00000054632	CAMPPENDLETON	BLDG. NO. 1327		CAMP PENDLETON	CA	UST
92055	U001572017	00000054633	CAMP PENDLETON	BLDG. NO. 1545		CAMP PENDLETON	CA	UST
92055	U001572013	00000054634	CAMP PENDELTON	BLDG. NO. U2484E		CAMP PENDLETON	CA	UST
92055	S103472059	9UT3572	AREA 12	BLDG.12075 MCB	**	CAMP PENDLETON	CA	LUST
92055	S102424561	9UT3026	AREA 24	BLDG2404-1 MCB		CAMP PENDLETON	CA	LUST
92055	S102424589	9UT3047	AREA 43	BLDG435432 MCB		CAMP PENDLETON	CA	LUST
92055	S103342042	9 000000792	STP 10 & 11	BUILDING #2296	**	CAMP PENDLETON	CA	WDS
92055	S103617959	9 000000161	PLANT #01* HEADQUARTERS	BUILDING #2296	**	CAMP PENDLETON	CA	WDS
92055	S103617960	9 000000162	PLANT #02* SAN LUIS REY	BUILDING #2296	**	CAMP PENDLETON	CA	WDS
92055	S103617961	9 000000163	PLANT #03* CHAPPO	BUILDING #2296	**	CAMP PENDLETON	CA	WDS
92055	S103617962	9 000000164	PLANT #08* SANTA MARGARITA	BUILDING #2296	**	CAMP PENDLETON	CA	WDS
92055	S103617963	9 000000165	PLANT #09* LAS PULGAS	BUILDING #2296	**	CAMP PENDLETON	CA	WDS
92055	S103617964	9 000000168	PLANT #12* SAN MATEO	BUILDING #2296	**	CAMP PENDLETON	CA	WDS
92055	S103617965	9 000000169	PLANT #13* TWIN LAKES	BUILDING #2296	**	CAMP PENDLETON	CA	WDS
92055	S103617966	9 000000645	PLANT #2* SAN LUIS REY	BUILDING #2296	**	CAMP PENDLETON	CA	WDS
92055	1001134525	CA0108286	PLANT NO 12, SAN MATEO	BUILDING NO 2296	**	CAMP PENDLETON	CA	FINDS
92055	1000598471	CA0108251	PLANT NO 09, LAS PULGAS	BUILDING NO 2296	**	CAMP PENDLETON	CA	FINDS
92055	S100732194	H21474	OCEANSIDE VORTAC	CAMP PENDELTON		OCEANSIDE	CA	HMMD
92055	S103342027	9 000000868	BASILONG RD/SMRIV FLD CNTL DEW	CAMP PENDL. ADJ. TO MCAS	**	OCEANSIDE	CA	WDS
92055	S100833326		CAMP PENDLETON MARINE CORPS TRAII	CAMP PENDLETON		OCEANSIDE	CA	BEP
92055	S100727196	H05939	US MARINE CORP	CAMP PENDLETON		CAMP PENDLETON	CA	HMMD
92055	1001217435	CAR000034355	SOUTHBAY SANDBLASTING AND TANK CI	CAMP PENDLETON ACU 5	**	CAMP PENDLETON	CA	FINDS, RCRIS/LQG
92055	1000589864	I09#19920213	CAMP PENDLETON MARINE CORP BAS	CAMP PENDLETON MCB	**	CAMP PENDLETON	CA	FINDS
92055	1000598490	CA-170090545	USNAVY MC CHAPPO PLANT 3	CHAPPO PLT 3	**	CAMP PENDLETON	CA	FINDS
92055	94371867		CHRISTANITOS AVE EXIT OF I-5 NEAR EL	CHRISTANITOS AVE EXIT OF I-5 NEAR EL	**	CAMP PENDELTON	CA	ERNS
92055	S102864867	H37233	STUART MESA MAINTENANCE	1 COASTER WY	**	CAMP PENDLETON	CA	HMMD

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
92055	S103619392	CAL000138919	NORTH COUNTY TRANSIT COASTER SVC	1 COASTER WY	**	OCEANSIDE	CA	HAZNET
92055	S100278347	9119867		CRISTIANITOS ROAD		CAMP PENDELTON	CA	CHMIRS
92055	S103472060	9UT638	AREA 13 TANK U13113 E	U13113 E MCB	**	CAMP PENDLETON	CA	LUST
92055	S103472062	9UT640	AREA 14 TANK U14137 E	U14137 E MCB	**	CAMP PENDLETON	CA	LUST
92055	S103472065	9UT629	AREA 16 TANK U16124 E	U16124 E MCB	**	CAMP PENDLETON	CA	LUST
92055	S103472067	9UT632	AREA 21 TANK U21471 E	U21471 E MCB	**	CAMP PENDLETON	CA	LUST
92055	94386628		ENVIRONMENTAL OFFICE	ENVIRONMENTAL OFFICE	**	CAMP PENDELTON	CA	ERNS
92055	U001572024	00000014192	TRANSPORTATION, H-10	H-10		CAMP PENDLETON	CA	UST
92055	U001572020	00000014193	H-12 HEATING PLANT BUILDING	H-12		CAMP PENDLETON	CA	UST
92055	U001572021	00000014187	H-99 SERVICE BUILDING	H-99		CAMP PENDLETON	CA	UST
92055	S101669898	H35928	SDG & E SUBSTATION	HAYBARN RD	**	CAMP PENDLETON	CA	HMMD
92055	1000598504	CA-170090544	USNAVY MC HEADQUARTERS PLANT 1	HDQRTS PLT 1	**	CAMP PENDLETON	CA	FINDS
92055	1000282077	CAD981985963	7 ELEVEN #26190 SO PAC	1749 S HILL ST		OCEANSIDE	CA	RCRIS/SQG, FINDS
92055	S103636294	CAD981985963	7 ELEVEN STORE 26190	1749 S HILL ST	**	OCEANSIDE	CA	HAZNET
92055	S102017892	H35198	GTE MOBILNET	LAS PULGAS/I-5	**	CAMP PENDLETON	CA	HMMD
92055	S102363737	H80997	MCB CAMP PENDLETON LEMON GROVE	LEMON GROVE SITE	**	CAMP PENDLETON	CA	HMMD
92055	S103670111	CAC001245288	CHARLES MARINACK	7130 MALABAR ST		HUNTINGTON PARK	CA	HAZNET
92055	S103439209	9 000000671	PLANT #12	MARINE CORPS BASE	**	CAMP PENDLETON	CA	WDS
92055	S103439210	9 000000670	PLANT #9	MARINE CORPS BASE	**	CAMP PENDLETON	CA	WDS
92055	S100725928	H02502	US MARINE CORP	MARINE CORPS BASE		CAMP PENDLETON	CA	HMMD
92055	S103442802		SITE #6-DRMO SCRAP YARD	MARINE CORPS BASE, SITE 6	**	CAMP PENDLETON	CA	WMUDS/SWAT
92055	S103472041	9UT622	AREA 22 TANKS 22141-4, 22141-3	22141-4 MCB	**	CAMP PENDLETON	CA	LUST
92055	S102438419	9UT622	TANKS 22141-4 & 22141-3	221414 MCB		CAMP PENDLETON	CA	CORTESE
92055	S103472042	9UT64	AREA 26 TANK 2652-E2	2652 E-2 MCB	**	CAMP PENDLETON	CA	LUST
92055	S101301384	9UT64	TANK 2652-E2	2652 E2 MCB		CAMP PENDLETON	CA	CORTESE
92055	S103723428		AREA 11	B.1121-31 MCB	**	CAMP PENDLETON	CA	LUST
92055	S100739479	H52005	US MARINE CORP	MCB		CAMP PENDLETON	CA	HMMD
92055	S102438420	9UT620	TANKS U1133E, U1121E, U1395E	U1133E MCB		CAMP PENDLETON	CA	LUST
92055	S103472061	9UT650	AREA 13 TANK U1375E	U1375E MCB	**	CAMP PENDLETON	CA	LUST
92055	S103472063	9UT634	AREA 15 TANK U1523E-1	U1523E-1 MCB	**	CAMP PENDLETON	CA	LUST
92055	S102438421	9UT641	TANKS U1641E & U14137E	U1641E MCB		CAMP PENDLETON	CA	LUST
92055	S102267071	9 000000692	CAMP PENDLETON BIOREMED FACIL	NEAR BASILONE RD	**	CAMP PENDLETON	CA	WDS
92055	94393087		NEAR BLDG 31900 ON CONCRETE	NEAR BLDG 31900 ON CONCRETE	**	CAMP PENDELTON	CA	ERNS
92055	S102864580	H36059	GTE MOBILNET	5000 OLD EL CAMINO REAL	**	CAMP PENDLETON	CA	HMMD
92055	99622269		Camp Pendleton	Camp Pendleton	**	Camp Pendleton	CA	ERNS
92055	U001572023	00000037356	SAN CLEMENTE RANCH	SAN MATEO CANYON		CAMP PENDLETON	CA	HMMD, UST
92055	S103241601	H81114	MCBCP	SAN MATEO PT HOUSING	**	CAMP PENDLETON	CA	HMMD
92055	S101175702		LAS PULGAS VEHICLE WASH RACK	IR SITE 20, 43 AREA		CAMP PENDLETON	CA	WMUDS/SWAT
92055	1000148314	CA9170024286	USNAVY NAVY REGIONAL MEDICAL CENT	SITESTREET		CAMP PENDLETON	CA	RCRIS/SQG, FINDS
92055	S102444621	9UT3319	SAN CLEMENTE RANCH (AREA	(NO STREET NBR) AREA 61 MCB		CAMP PENDLETON	CA	CORTESE
92055	S102444622	9UT3062	AREA 11	(NO STREET NBR) BLDG 1106 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S103064877	9UT3306	AREA 11	(NO STREET NBR) BLDG 1133 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064878	9UT2922	AREA 11	(NO STREET NBR) BLDG 1142 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102424504	9UT3051	AREA 12	(NO STREET NBR) BLDG 12075 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S103064879	9UT3397	AREA 12	(NO STREET NBR) BLDG 1223 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064880	9UT2923	AREA 12	(NO STREET NBR) BLDG 1255 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064881	9UT3401	AREA 12	(NO STREET NBR) BLDG 1261 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064884	9UT2841	AREA 12	(NO STREET NBR) BLDG 1294 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102424511	9UT2924	AREA 13	(NO STREET NBR) BLDG 13 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S103064887	9UT3367	AREA 13	(NO STREET NBR) BLDG 13103 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064888	9UT1008	AREA 13	(NO STREET NBR) BLDG 13111 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102424509	9UT621	AREA 13 (BLDG 13115 E)	(NO STREET NBR) BLDG 13115 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S103064889	9UT3074	AREA 13	(NO STREET NBR) BLDG 13129 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064890	9UT3387	AREA 13	(NO STREET NBR) BLDG 13131 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064891	9UT3297	AREA 13	(NO STREET NBR) BLDG 13142 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064892	9UT3388	AREA 13	(NO STREET NBR) BLDG 13144 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064893	9UT3292	AREA 13	(NO STREET NBR) BLDG 13145 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102424519	9UT630	AREA 13BLDG 161, 162, 168,7	(NO STREET NBR) BLDG 13161 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S103064894	9UT3266	AREA 13	(NO STREET NBR) BLDG 13164 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102424515	9UT2975	AREA 13 BLDG 171 & 175	(NO STREET NBR) BLDG 13171 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S103064895	9UT2925	AREA 13	(NO STREET NBR) BLDG 1324 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102424517	9UT3004	AREA 13 USMC EXCHANGE SS	(NO STREET NBR) BLDG 1327 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S102424518	9UT624	AREA 13 USMC EXCHANGE TAN	(NO STREET NBR) BLDG 1327 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S103064896	9UT3004	AREA 13	(NO STREET NBR) BLDG 1327 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064898	9UT3296	AREA 13	(NO STREET NBR) BLDG 1344 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102424516	9UT68	AREA 13 TACTICAL VEH MAIN	(NO STREET NBR) BLDG 1352 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S103064899	9UT3295	AREA 13	(NO STREET NBR) BLDG 1363 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064900	9UT3389	AREA 13	(NO STREET NBR) BLDG 1364 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064901	9UT3390	AREA 13	(NO STREET NBR) BLDG 1376 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064904	9UT3413	AREA 13	(NO STREET NBR) BLDG 1395 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102444607	9UT3222	AREA 14	(NO STREET NBR) BLDG 14013 MCB		CAMP PENDLETON	CA	CORTESE, LUST

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
92055	S102424521	9UT954	AREA 14 16TH ST	(NO STREET NBR) BLDG 14107 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S103064906	9UT3293	AREA 14	(NO STREET NBR) BLDG 14121 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064907	9UT3357	AREA 14	(NO STREET NBR) BLDG 14125 MCB BULK	**	CAMP PENDLETON	CA	CORTESE
92055	S103064908	9UT623	AREA 14 BLDG 125, 184-197	(NO STREET NBR) BLDG 14125 MCB BULK	**	CAMP PENDLETON	CA	CORTESE
92055	S103064909	9UT3391	AREA 14	(NO STREET NBR) BLDG 14127 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102424525	9UT2911	AREA 14 (BLDG 131-57)	(NO STREET NBR) BLDG 14131 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S103064910	9UT2926	AREA 14	(NO STREET NBR) BLDG 14133 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102424527	9UT2844	AREA 14 BLDG 151-157	(NO STREET NBR) BLDG 14151 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S103064911	9UT628	AREA 14	(NO STREET NBR) BLDG 14156 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064912	9UT2300	AREA 14	(NO STREET NBR) BLDG 14170 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064913	9UT636	AREA 14	(NO STREET NBR) BLDG 14173 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064914	9UT3424	AREA 14	(NO STREET NBR) BLDG 1441 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064916	9UT3298	AREA 14	(NO STREET NBR) BLDG 1482 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064918	9UT3294	AREA 14	(NO STREET NBR) BLDG 1491 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102424529	9UT288	AREA 15 11TH ST	(NO STREET NBR) BLDG 1531 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S102424531	9UT616	AREA 15 BLDG 34,44,81,82,	(NO STREET NBR) BLDG 1534 MCB SERR/		CAMP PENDLETON	CA	CORTESE, LUST
92055	S103064919	9UT3421	AREA 15	(NO STREET NBR) BLDG 1536 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064922	9UT618	AREA 15 BLDG 44, 81, 82,	(NO STREET NBR) BLDG 1544 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064923	9UT3423	AREA 15	(NO STREET NBR) BLDG 1561 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064924	9UT3422	AREA 15	(NO STREET NBR) BLDG 1594 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064927	9UT3437	AREA 16	(NO STREET NBR) BLDG 16103 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102424532	9UT2932	AREA 16	(NO STREET NBR) BLDG 16104 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S103064928	9UT3442	AREA 16	(NO STREET NBR) BLDG 16105 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064929	9UT3445	AREA 16	(NO STREET NBR) BLDG 16115 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064930	9UT3265	AREA 16	(NO STREET NBR) BLDG 1623 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064931	9UT3395	AREA 16	(NO STREET NBR) BLDG 1642 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S101301393	9UT643	COMMUNICAT'NS SUPPRT WARE	(NO STREET NBR) BLDG 1645 MCB		CAMP PENDLETON	CA	CORTESE
92055	S103064932	9UT3414	AREA 16	(NO STREET NBR) BLDG 1646 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064934	9UT3371	AREA 16	(NO STREET NBR) BLDG 1654 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064935	9UT3368	AREA 16	(NO STREET NBR) BLDG 1655 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102424536	9UT63	AREA 16 BATTALION HEADQUA	(NO STREET NBR) BLDG 1656 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S103064936	9UT3307	AREA 16	(NO STREET NBR) BLDG 1657 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064937	9UT626	AREA 16	(NO STREET NBR) BLDG 1661 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064939	9UT3430	AREA 16	(NO STREET NBR) BLDG 1671 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064940	9UT2921	AREA 16	(NO STREET NBR) BLDG 1674T MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064941	9UT3429	AREA 16	(NO STREET NBR) BLDG 1684 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064942	9UT2920	AREA 16	(NO STREET NBR) BLDG 1685 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064943	9UT3394	AREA 16	(NO STREET NBR) BLDG 1687 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064944	9UT3373	AREA 16	(NO STREET NBR) BLDG 1692 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064948	9UT3425	AREA 17	(NO STREET NBR) BLDG 1781 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102424537	9UT2918	AREA 17	(NO STREET NBR) BLDG 1791 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S102424551	9UT661	AREA 21 OIL POINT 5	(NO STREET NBR) BLDG 21 BETWEEN BLI	**	CAMP PENDLETON	CA	CORTESE
92055	S103064954	9UT3308	AREA 21	(NO STREET NBR) BLDG 21415 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064955	9UT2916	AREA 21	(NO STREET NBR) BLDG 21426 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064956	9UT3427	AREA 21	(NO STREET NBR) BLDG 21441 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064957	9UT2912	AREA 21	(NO STREET NBR) BLDG 21443 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102444635	9UT3315	AREA 21 BLDGS 453 & 454	(NO STREET NBR) BLDG 21453 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S102424550	9UT1903	AREA 21 BLDG 471 & 473	(NO STREET NBR) BLDG 21471 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S103064958	9UT2913	AREA 21	(NO STREET NBR) BLDG 21471 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064959	9UT2914	AREA 21	(NO STREET NBR) BLDG 21478 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064960	9UT2832	AREA 21	(NO STREET NBR) BLDG 21503 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064961	9UT3316	AREA 21	(NO STREET NBR) BLDG 21563 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064962	9UT3426	AREA 21	(NO STREET NBR) BLDG 21565 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064963	9UT2817	AREA 21	(NO STREET NBR) BLDG 21578 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064964	9UT2797	AREA 21	(NO STREET NBR) BLDG 21580 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102590506	9UT1904	AREA 217 PX SERVICE STATI	(NO STREET NBR) BLDG 21587 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S103064965	9UT3443	AREA 21	(NO STREET NBR) BLDG 21620 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064966	9UT3024	AREA 21	(NO STREET NBR) BLDG 21668 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064967	9UT1006	AREA 21	(NO STREET NBR) BLDG 21841 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064968	9UT1902	AREA 22 CHEVRON SS NR B.	(NO STREET NBR) BLDG 22124 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064969	9UT3267	AREA 22	(NO STREET NBR) BLDG 22131 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064970	9UT3272	AREA 22	(NO STREET NBR) BLDG 2214 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064971	9UT2821	AREA 22	(NO STREET NBR) BLDG 22150 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102424554	9UT3025	AREA 22 (BLDG 151-1)	(NO STREET NBR) BLDG 22151 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S103064972	9UT627	AREA 22	(NO STREET NBR) BLDG 22187 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064973	9UT2840	AREA 22	(NO STREET NBR) BLDG 2264 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064974	9UT2834	AREA 22	(NO STREET NBR) BLDG 22831 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064975	9UT2837	AREA 22	(NO STREET NBR) BLDG 2296 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102425454	9UT3073	AREA 23	(NO STREET NBR) BLDG 2390 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S103064980	9UT3072	AREA 23	(NO STREET NBR) BLDG 2397 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102424562	9UT2859	AREA 24	(NO STREET NBR) BLDG 2406 MCB		CAMP PENDLETON	CA	CORTESE, LUST

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
92055	S103064981	9UT3336	AREA 24	(NO STREET NBR) BLDG 24100 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064983	9UT3006	AREA 24	(NO STREET NBR) BLDG 2459 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064984	9UT176	AREA 24 TANKS U2483E & U2	(NO STREET NBR) BLDG 2481 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064985	9UT3005	AREA 24	(NO STREET NBR) BLDG 2481 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064986	9UT2838	AREA 24	(NO STREET NBR) BLDG 2482 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064987	9UT2836	AREA 24	(NO STREET NBR) BLDG 2498 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102590509	9UT3446	AREA 25	(NO STREET NBR) BLDG 2581 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S100273888	9UT2021	AREA 26 NAVAL HOSPITAL	(NO STREET NBR) BLDG 26 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S102424571	9UT2819	AREA 26	(NO STREET NBR) BLDG 2652 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S103064993	9UT3412	AREA 26	(NO STREET NBR) BLDG 2662 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064994	9UT3071	AREA 26	(NO STREET NBR) BLDG 2666 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064995	9UT3438	AREA 26	(NO STREET NBR) BLDG 2699 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102424560	9UT2835	AREA 27	(NO STREET NBR) BLDG 27917 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S102424573	9UT3092	AREA 31	(NO STREET NBR) BLDG 31511 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S102424574	9UT2910	AREA 33	(NO STREET NBR) BLDG 33302 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S103065003	9UT3314	AREA 33	(NO STREET NBR) BLDG 33324 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065004	9UT3313	AREA 33	(NO STREET NBR) BLDG 33326 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065005	9UT3312	AREA 33	(NO STREET NBR) BLDG 33328 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065006	9UT3328	AREA 33	(NO STREET NBR) BLDG 33360 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065007	9UT2778	AREA 33	(NO STREET NBR) BLDG 33402 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065008	9UT3090	AREA 33	(NO STREET NBR) BLDG 33427 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065009	9UT3302	AREA 33	(NO STREET NBR) BLDG 33526 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065010	9UT3444	AREA 33	(NO STREET NBR) BLDG 33581 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102532374	9UT3396	AREA 41	(NO STREET NBR) BLDG 41311 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S103065021	9UT3439	AREA 41	(NO STREET NBR) BLDG 41312 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065022	9UT2903	AREA 41	(NO STREET NBR) BLDG 41319 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065023	9UT2900	AREA 41	(NO STREET NBR) BLDG 41362 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102424579	9UT1829	AREA 41 LAS FLORES	(NO STREET NBR) BLDG 41404 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S102424593	9UT22	AREA 43 TANK U43302E	(NO STREET NBR) BLDG 43 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S102424594	9UT177	AREA 43 TANK U43402E	(NO STREET NBR) BLDG 43 MCB		CAMP PENDLETON	CA	CORTESE
92055	S102424580	9UT2902	AREA 43	(NO STREET NBR) BLDG 4313 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S103065028	9UT2907	AREA 43	(NO STREET NBR) BLDG 43149 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102424592	9UT651	AREA 43 MILITARY GAS STAT	(NO STREET NBR) BLDG 43201 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S103065029	9UT2849	AREA 43	(NO STREET NBR) BLDG 43260 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065030	9UT2962	AREA 43	(NO STREET NBR) BLDG 43286 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065031	9UT2947	AREA 43	(NO STREET NBR) BLDG 43333 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065032	9UT2940	AREA 43	(NO STREET NBR) BLDG 43336 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065034	9UT2948	AREA 43	(NO STREET NBR) BLDG 43435 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065035	9UT2908	AREA 43	(NO STREET NBR) BLDG 43525 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065036	9UT2906	AREA 43	(NO STREET NBR) BLDG 43536 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102444645	9UT2901	AREA 43 (BLDG 43574-2)	(NO STREET NBR) BLDG 43574 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S103065037	9UT2901	AREA 43	(NO STREET NBR) BLDG 43574 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102590514	9UT3415	AREA 51	(NO STREET NBR) BLDG 51091 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S102424596	9UT2915	AREA 52 (BLDG 291-94)	(NO STREET NBR) BLDG 52291 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S102532354	9UT3317	AREA 52	(NO STREET NBR) BLDG 52448 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S103065051	9UT3318	AREA 52	(NO STREET NBR) BLDG 52594 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102444646	9UT3321	AREA 52 (BLDG 52651-2)	(NO STREET NBR) BLDG 52651 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S103065052	9UT2197	AREA 52	(NO STREET NBR) BLDG 52710 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102424597	9UT2905	AREA 53	(NO STREET NBR) BLDG 53302 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S103065053	9UT3320	AREA 53	(NO STREET NBR) BLDG 53321 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065054	9UT3334	AREA 53	(NO STREET NBR) BLDG 53325 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065055	9UT3327	AREA 53	(NO STREET NBR) BLDG 53326 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065056	9UT3322	AREA 53	(NO STREET NBR) BLDG 53334 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065057	9UT3323	AREA 53	(NO STREET NBR) BLDG 53335 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065058	9UT1009	AREA 53 BLDG 420, 21, 33-	(NO STREET NBR) BLDG 53401 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065059	9UT2899	AREA 53	(NO STREET NBR) BLDG 53415 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065060	9UT3309	AREA 53	(NO STREET NBR) BLDG 53421 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S101301390	9UT1891	AREA 53 CAMP HORNO	(NO STREET NBR) BLDG 53424 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S103065061	9UT3335	AREA 53	(NO STREET NBR) BLDG 53426 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065062	9UT3331	AREA 53	(NO STREET NBR) BLDG 53427 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065063	9UT3329	AREA 53	(NO STREET NBR) BLDG 53433 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065064	9UT2847	AREA 53	(NO STREET NBR) BLDG 53471 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065065	9UT2904	AREA 53	(NO STREET NBR) BLDG 53502 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065066	9UT617	AREA 53 UEPH BLDG 524-27	(NO STREET NBR) BLDG 53524 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065067	9UT2848	AREA 53	(NO STREET NBR) BLDG 53670 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102424605	9UT3020	AREA 61	(NO STREET NBR) BLDG 61514 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S102424611	9UT2651	AREA 62	(NO STREET NBR) BLDG 62302 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S103065073	9UT3075	AREA 62	(NO STREET NBR) BLDG 62305 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065074	9UT2633	AREA 62	(NO STREET NBR) BLDG 62306 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065075	9UT2448	AREA 62	(NO STREET NBR) BLDG 62322 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065076	9UT3123	AREA 62	(NO STREET NBR) BLDG 62326 MCB	**	CAMP PENDLETON	CA	CORTESE

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
92055	S103065077	9UT3128	AREA 62	(NO STREET NBR) BLDG 62327 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065078	9UT3129	AREA 62	(NO STREET NBR) BLDG 62329 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065079	9UT3124	AREA 62	(NO STREET NBR) BLDG 62330 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065080	9UT2628	AREA 62	(NO STREET NBR) BLDG 62333 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065081	9UT2630	AREA 62	(NO STREET NBR) BLDG 62337 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065082	9UT3125	AREA 62	(NO STREET NBR) BLDG 62341 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065083	9UT3126	AREA 62	(NO STREET NBR) BLDG 62347 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065084	9UT3022	AREA 62	(NO STREET NBR) BLDG 62402 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065085	9UT2629	AREA 62	(NO STREET NBR) BLDG 62420 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065086	9UT2442	AREA 62	(NO STREET NBR) BLDG 62421 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065087	9UT3127	AREA 62	(NO STREET NBR) BLDG 62429 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065088	9UT2443	AREA 62	(NO STREET NBR) BLDG 62435 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065089	9UT2444	AREA 62	(NO STREET NBR) BLDG 62436 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065090	9UT2445	AREA 62	(NO STREET NBR) BLDG 62437 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065091	9UT3023	AREA 62	(NO STREET NBR) BLDG 62502 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065092	9UT3447	AREA 62	(NO STREET NBR) BLDG 62507 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065093	9UT3333	AREA 62	(NO STREET NBR) BLDG 62510 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065094	9UT2632	AREA 62	(NO STREET NBR) BLDG 62520 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065095	9UT3132	AREA 62	(NO STREET NBR) BLDG 62524 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065096	9UT3133	AREA 62	(NO STREET NBR) BLDG 62525 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065097	9UT3134	AREA 62	(NO STREET NBR) BLDG 62526 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065098	9UT3135	AREA 62	(NO STREET NBR) BLDG 62528 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065099	9UT3130	AREA 62	(NO STREET NBR) BLDG 62529 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065100	9UT2446	AREA 62	(NO STREET NBR) BLDG 62534 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065101	9UT2447	AREA 62	(NO STREET NBR) BLDG 62535 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065102	9UT2631	AREA 62	(NO STREET NBR) BLDG 62536 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065103	9UT3131	AREA 62	(NO STREET NBR) BLDG 62537 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065104	9UT2627	AREA 62	(NO STREET NBR) BLDG 62540 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102424624	9UT3021	AREA 63	(NO STREET NBR) BLDG 63141 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S102424625	9UT3019	AREA 64	(NO STREET NBR) BLDG 64458 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S103065111	9UT2198	BEACH CLUB OFF BASILONE R	(NO STREET NBR) BLDG 811 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102424626	9UT2842	AREA HOSPITAL	(NO STREET NBR) BLDG H049 MCB		CAMP PENDLETON	CA	CORTESE
92055	S103064869	9UT2833	AREA HOSPITAL	(NO STREET NBR) BLDG H102 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103064870	9UT2357	HOSPITAL MAINTEN FAC	(NO STREET NBR) BLDG H12 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102425450	9UT2978	BLDG H-12	(NO STREET NBR) BLDG H12 MCB		CAMP PENDLETON	CA	CORTESE
92055	S102590516	9UT3428	AREA H-94	(NO STREET NBR) BLDG H94 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S102424591	9UT2909	AREA 43 (FIRE STATION)	(NO STREET NBR) BLDG10407 MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S103065116	9UT3046	AREA 14	(NO STREET NBR) BLDG140008 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065117	9UT3026	AREA 24	(NO STREET NBR) BLDG24041 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S103065118	9UT3047	AREA 43	(NO STREET NBR) BLDG435432 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S100232128	9UT619	CAMP HORNO UEPH 903 (NORT	(NO STREET NBR) CAMP HORNO UEPH 9(		CAMP PENDLETON	CA	CORTESE
92055	S103066074	9UT620	TANKS U1133E, U1121E, U13	(NO STREET NBR) U1133E MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102438410	9UT638	TANK U13113 E	(NO STREET NBR) U13113 E. MCB		CAMP PENDLETON	CA	CORTESE
92055	S102438411	9UT650	TANK U1375E	(NO STREET NBR) U1375E MCB		CAMP PENDLETON	CA	CORTESE
92055	S102424528	9UT639	AREA 14 TANK U14131 E	(NO STREET NBR) U14131 E. MCB		CAMP PENDLETON	CA	CORTESE, LUST
92055	S101301428	9UT640	TANK U14137 E	(NO STREET NBR) U14137 E. MCB		CAMP PENDLETON	CA	CORTESE
92055	S102438413	9UT634	TANK U1523E-1	(NO STREET NBR) U1523E 1 MCB		CAMP PENDLETON	CA	CORTESE
92055	S102438414	9UT631	TANK U16114E #1	(NO STREET NBR) U16114E #1 MCB		CAMP PENDLETON	CA	CORTESE
92055	S102438415	9UT629	TANK U16124 E	(NO STREET NBR) U16124 E. MCB		CAMP PENDLETON	CA	CORTESE
92055	S102438416	9UT633	TANK U16144-E #2	(NO STREET NBR) U16144E 2 MCB		CAMP PENDLETON	CA	CORTESE
92055	S103066075	9UT641	TANKS U1641E & U14137E	(NO STREET NBR) U1641E MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S102438417	9UT632	TANK U21471 E	(NO STREET NBR) U21471 E. MCB		CAMP PENDLETON	CA	CORTESE
92055	S103066073	9UT2652	UST 23102-2	(NO STREET NBR) UST 23102 MCB	**	CAMP PENDLETON	CA	CORTESE
92055	S101102096	H34726	HARRY SINGH AND SONS	STUART MESA FARM	**	CAMP PENDLETON	CA	HMMD
92055	S103241618	H99600	SAN CLEMENTE RANCH	STUART MESA MARINE B	**	C PENDLETON	CA	HMMD
92055	1000598371	CA-170064495	MARCORPSMWTC BRIDGEPORT CA	TRAINING CENTER	**	BRIDGEPORT	CA	FINDS
92055	1000598447	CA-170090547	USNAVY MC TWIN LAKES PLANT 13	TWIN LAKES PLT 13	**	CAMP PENDLETON	CA	FINDS
92055	S103472068	9UT619	AREA 53 CAMP HORNO UEPH 903	UEPH 903 MCB	**	CAMP PENDLETON	CA	LUST
92055	94379588		USMC - CAMP PENDLETON	USMC - CAMP PENDLETON	**	OCEANSIDE	CA	ERNS
92055	98454951		USMC BASE CAMP PENDLETON	USMC BASE CAMP PENDLETON	**	CAMP PENDLETON	CA	ERNS
92055	99608228		USMC BASE CAMP PENDLETON	USMC BASE CAMP PENDLETON	**	CAMP PENDLETON	CA	ERNS
92055	98445831		USMC BASE CAMP PENDLETON	USMC BASE CAMP PENDLETON	**	CAMP PENDLETON	CA	ERNS
92055	98464702		USMC BASE CAMP PENDLETON	USMC BASE CAMP PENDLETON	**	CAMP PENDLETON	CA	ERNS
92055	99606829		USMC BASE CAMP PENDLETON	USMC BASE CAMP PENDLETON	**	CAMP PENDLETON	CA	ERNS
92055	98434267		USMC BASE CAMP PENDLETON	USMC BASE CAMP PENDLETON	**	CAMP PENDLETON	CA	ERNS
92055	98442001		USMC BASE CAMP PENDLETON	USMC BASE CAMP PENDLETON	**	CAMP PENDLETON	CA	ERNS
92055	98468025		USMC BASE CAMP PENDLETON BUILDING	USMC BASE CAMP PENDLETON BUILDING	**	CAMP PENDLETON	CA	ERNS
92055	98443239		USMC BASE CAMP PENDLETON EL CAMI	USMC BASE CAMP PENDLETON EL CAMI	**	CAMP PENDLETON	CA	ERNS
92055	98438115		USMC BASE CAMP PENDLETON FLIGHT L	USMC BASE CAMP PENDLETON FLIGHT L	**	CAMP PENDLETON	CA	ERNS
92055	98469122		USMC BASE CAMP PENDLETON LEMON (	USMC BASE CAMP PENDLETON LEMON (	**	CAMP PENDLETON	CA	ERNS
92055	98451529		USMC BASE CAMP PENDLETON LOS POG	USMC BASE CAMP PENDLETON LOS POG	**	CAMP PENDLETON	CA	ERNS

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
92055	S103472069	9UT2652	AREA 23 UST 23102-2 *	UST 23102 MCB	**	CAMP PENDLETON	CA	LUST
92055	U001572022	00000057246	PACIFIC BELL (DB-132)	O VANDERGRIFT & 11TH		CAMP PENDLETON	CA	HAZNET, UST
92055	S102017625	H21403	PACIFIC BELL CMPDCA91/DB132	VANDERGRIFT / 11TH	**	CAMP PENDLETON	CA	HMMD
92055	S100838451	9 000000011	BOX CANYON SANITARY LANDFILL	VANDERGRIFT BLVD		CAMP PENDLETON	CA	WDS
92055	99622287		Near the Mount Facility, 4 mi fron Los Pulgus	Near the Mount Facility, 4 mi fron Los Pulgus	**	Unincorporated county area	CA	ERNS
92055	99622504		at the Stewart Mesa Housing	at the Stewart Mesa Housing	**	Camp Pendleton	CA	ERNS
92672	1001267601	CA0796728	SO CAL EDISON CO	HY 101-NUCLEAR GEN STN	**	SAN DIEGO	CA	FINDS
92672	S103547770	H38311	SAN ONOFRE INSP FACILITY-651	I5 13 MI N HY 5	**	SAN CLEMENTE	CA	HMMD
92672	S100943921	CAC001020112	RYDER TRUCK RENTAL	ROUTE 5 / CRISPANITOS RD		SAN CLEMENTE	CA	HAZNET
92672	U001577780	00000022258	SAN ONOFRE NUCLEAR GEN STATION	ADJ. HWAY 5, S.E. BASILONE RD.		SAN CLEMENTE	CA	UST
92672	S103654558	CAL000170010	MOBIL MIRACLES DBA COLORS ON PARA	35 ALBERGAR		SAN CLEMENTE	CA	HAZNET
92672	S103620551	CAC001311680	CITY OF SAN CLEMENTE	102 ANENEDA CABA LLEROS	**	SAN CLEMENTE	CA	HAZNET
92672	1000247674	CAD982406076	RAPID PHOTO FINISHING	144 AVE DEL MAR		SAN CLEMENTE	CA	RCRIS/SQG, FINDS, HAZNET
92672	S102809765	CAL000010977	JAYS CAR REPAIR	1504 AVE DE LA ESTRELLA		SAN CLEMENTE	CA	HAZNET
92672	1000225187	CAD981167455	FREEWAY AUTO RESTORATION & PAI	1508 AVE DE LA ESTRELLA		SAN CLEMENTE	CA	RCRIS/SQG, FINDS, HAZNET
92672	S103632409	CAL000077940	RON DWINNELL TRUCKING	1523 AVE DE LA ESTRELLA		SAN CLEMENTE	CA	HAZNET
92672	S102428062		CITY OF SAN CLEMENTE	1801 AVE ESTACION		SAN CLEMENTE	CA	LUST
92672	1000190214	CAD981381064	PENDLETON COAST DST PARKS & REC	3030 AVE DEL PRESIDENTE		SAN CLEMENTE	CA	HAZNET
92672	S103651855	CAL000168263	PASKOWITZ GRAPHIC IMAGING	312 N AVE DE LA ESTRELLA		SAN CLEMENTE	CA	HAZNET
92672	S101629430		FLAGG STATION	422 AVE DE LA ESTRELLA		SAN CLEMENTE	CA	FID
92672	U001559727	30001863	EXXON #7-7140	504 AVE DE LA ESTRELLA		SAN CLEMENTE	CA	FID
92672	S100873036	CAL000058313	SAN CLEMENTE EXXON	504 N AVE DE LA ESTRELLA		SAN CLEMENTE	CA	HAZNET
92672	U001577761	00000024011	EXXON SERVICE STATION	101 AVE. CALAFIA		SAN CLEMENTE	CA	UST
92672	U001577763	00000024084	EXXON SERVICE STATION	151 AVE. VAQUERO	**	SAN CLEMENTE	CA	UST
92672	U001577778	00000040780	SAN CLEMENTE STATE BEACH	3030 AVE. DEL PRESIDENTE		SAN CLEMENTE	CA	LUST, UST
92672	1000596568	CAD983605429	STANLEYS MUFFLER SHOP	145 AVEINDA NAVARRO		SAN CLEMENTE	CA	RCRIS/SQG, FINDS
92672	1000596786	CAD983607664	BILL BREWSTER	1510 B AVENDA DA LA ESTRELLA	**	SAN CLEMENTE	CA	RCRIS/SQG, FINDS
92672	1000250173	CAD981687585	PACIFIC COAST GM BODYSHOP	1510 N AVENDIA ESTRELLA		SAN CLEMENTE	CA	RCRIS/SQG, FINDS, HAZNET
92672	S102429324		EXXON	101 AVENIDA CALIFIA		SAN CLEMENTE	CA	LUST
92672	S102430220	9UT1165	FORMER EXXON STATION #7-3887	101 AVENIDA CALIFIA		SAN CLEMENTE	CA	LUST
92672	S103620175	CLU960010743	RICHARD PIERCE, TAMARA TUBBS	101 AVENIDA DE LA GRULLA		SAN CLEMENTE	CA	HAZNET
92672	S102826061	CAL920796280	NICHOLAS C SALVATI DMD	130 AVENIDA CABRILLO		SAN CLEMENTE	CA	HAZNET
92672	S103630664		RAPID PHOTO FINISHING	144 AVENIDA DEL MAR	**	SAN CLEMENTE	CA	HAZNET
92672	S103631633	CAL000120293	BRIAN RICE DDS	150 AVENIDA DEL MAR	**	SAN CLEMENTE	CA	HAZNET
92672	S103632047		FREEWAY AUTO RESTORATION & SALES	1508 N AVENIDA DE LA ESTRELLA		SAN CLEMENTE	CA	HAZNET
92672	S101589130	30001436	EXXON #7-0973	151 AVENIDA VAQUERO		SAN CLEMENTE	CA	FID
92672	1000107790	CAD981997489	SAN CLEMENTE AUTO	151 AVENIDA NAVARRO		SAN CLEMENTE	CA	RCRIS/SQG, FINDS, HAZNET
92672	S101299934	9UT1538	EXXON STATION #7-0973	151 AVENIDA VAQUERO		SAN CLEMENTE	CA	CORTESE, LUST
92672	S102429334		EXXON	151 AVENIDA VAQUERO		SAN CLEMENTE	CA	LUST
92672	1001122799	CAR000016378	COLLISION CAR CARE	1510 AVENIDA DE LA ESTRELLA E		SAN CLEMENTE	CA	RCRIS/SQG, FINDS
92672	1001134911	CAR000016378	COLLISION CAR CARE	1510 AVENIDA DE LA ESTRELLA E		SAN CLEMENTE	CA	HAZNET
92672	S103637580	CAL000064133	CHRISTIAN AUTO REPAIR	184 AVENIDA NAVARRO		SAN CLEMENTE	CA	HAZNET
92672	S101609593		PACIFIC GOLF CLUB	200 AVENIDA LA PATA		SAN CLEMENTE	CA	FID
92672	S102819367	CAL000112969	DEL MAR CHIROPRACTIC	210 AVENIDA DEL MAR		SAN CLEMENTE	CA	HAZNET
92672	S101619709		SAN CLEMENTE STATE BEACH PARK	3030 AVENIDA DEL PRESIDEN		SAN CLEMENTE	CA	FID
92672	1000332365	CAD981417595	ST OF CAL DEPT OF PKS & REC	3030 AVENIDA DEL PRESIDENTE		SAN CLEMENTE	CA	RCRIS/SQG, FINDS
92672	S100942065		SAN CLEMENTE STATE BEACH	3030 AVENIDA DEL PRESIDENTE		SAN CLEMENTE	CA	LUST
92672	S103651135		PENDLETON COAST DST PARKS & REC	3030 AVENIDA DEL PRESIDENTE		SAN CLEMENTE	CA	HAZNET
92672	1000159921	00000001137	U HAUL CENTER	310 AVENIDA PICO		SAN CLEMENTE	CA	FID, UST
92672	S103651602	CAD981574833	U-HAUL CO OF CALIFORNIA	310 AVENIDA PICO		SAN CLEMENTE	CA	HAZNET
92672	S100876601		U HAUL CENTER #717-21	310 E AVENIDA PICO		SAN CLEMENTE	CA	LUST
92672	S102444605	9UT3232	U-HAUL CENTER 717-21	310 E AVENIDA PICO		SAN CLEMENTE	CA	LUST
92672	S103651610		U-HAUL CO OF CALIFORNIA	310 E AVENIDA PICO		SAN CLEMENTE	CA	HAZNET
92672	U002096357	30017450	T R W CAPISTRANO TEST SITE	33000 AVENIDA PICO	**	SAN CLEMENTE	CA	FID
92672	S102005271	9 000000034	TRW SPACE TECHNOLOGY LABS	33000 AVENIDA PICO	**	SAN CLEMENTE	CA	WDS
92672	U001577787	00000037708	TRW - CAPISTRANO TEST SITE	33000 AVENIDA PICO		SAN CLEMENTE	CA	UST
92672	U002096011	30003890	CITY OF SAN CLEMENTE-WATER TRE	380 AVENIDA PICO		SAN CLEMENTE	CA	FID
92672	S103617643	9 0000175S2	SAN CLEMENTE* CITY OF* WRP	380 E AVENIDA PICO		SAN CLEMENTE	CA	WDS
92672	S103341720	9 000000758	SEWAGE COLLECTION SYSTEM	380 E AVENIDA PICO BLDG J	**	SAN CLEMENTE	CA	WDS
92672	S102005204	9 000000290	SAN CLEMENTE WRP	380 E AVENIDA PICO BLDG N		SAN CLEMENTE	CA	WDS
92672	U002096304	30017565	SAN CLEMENTE CORPORATION YARD	390 AVENIDA PICO		SAN CLEMENTE	CA	FID
92672	S103656749	CAL000116301	RYDER MANAGED LOGISTICS SYSTEM	390 AVENIDA PICO		SAN CLEMENTE	CA	HAZNET
92672	U001577775	00000065852	REEVES RUBBER DIVISION	415 AVENIDA PICO		SAN CLEMENTE	CA	UST
92672	S102810800	CAL000025259	FANCY 1 HOUR CLEANERS	415 AVENIDA PICO #D		SAN CLEMENTE	CA	HAZNET
92672	1000341742	CAD981454812	FLUOROCARBON	415 E AVENIDA PICO		SAN CLEMENTE	CA	RCRIS/SQG, FINDS, LUST
92672	S102955670		FLUORCARBON	415 E AVENIDA PICO		SAN CLEMENTE	CA	LUST
92672	S103658391		FANCY 1 HOUR CLEANERS	415 E AVENIDA PICO STE D	**	SAN CLEMENTE	CA	HAZNET
92672	S102429361		EXXON	504 N AVENIDA DE LA ESTRELLA		SAN CLEMENTE	CA	LUST
92672	S103662624		SAN CLEMENTE EXXON	504 N AVENIDA DE LA ESTRELLA		SAN CLEMENTE	CA	HAZNET
92672	S101609513		CHEVRON	515 AVENIDA PICO		SAN CLEMENTE	CA	FID
92672	S103663107	CAL000175339	CHEVRON 99944	515 AVENIDA PICO		SAN CLEMENTE	CA	HAZNET

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
92672	1000857403	CAD983668351	CHEVRON STATION 98151	525 AVENIDA PICO		SAN CLEMENTE	CA	RCRIS/SQG, FINDS
92672	U001577755	00000063074	98151	525 AVENIDA PICO		SAN CLEMENTE	CA	UST
92672	S103064805	9UT93	CHEVRON SERVICE STATION	525 E AVENIDA PICO		SAN CLEMENTE	CA	CORTESE
92672	S103472037	9UT93	CHEVRON SERVICE STATION#9-8151	525 E AVENIDA PICO		SAN CLEMENTE	CA	LUST
92672	U003148339		TEXACO	530 E AVENIDA PICO		SAN CLEMENTE	CA	LUST
92672	S101631442		VAQUERO SEWAGE PUMP STATION	608 AVENIDA VAQUERO		SAN CLEMENTE	CA	FID
92672	S103723425		VAQUERO PUMP STATION	608 AVENIDA VAQUERO		SAN CLEMENTE	CA	LUST
92672	S101589157	30001881	SAN CLEMENTE HIGH SCHOOL	700 AVENIDA PICO		SAN CLEMENTE	CA	FID
92672	S103625594	CLU970016903	DAVID BRENT TAMBLYN	121 AVENITA SERRA	**	SAN CLEMENTE	CA	HAZNET
92672	S102428063	9UT1350	CITY OF SAN CLEMENTE	1801 AVENUE ESTACION		SAN CLEMENTE	CA	LUST
92672	1000905480	CA0000753343	MOBIL OIL CORP HH1	600 AVENUE PICO		SAN CLEMENTE	CA	FID, LUST, RCRIS/SQG, FINDS
92672	U001577766	00000030065	GOLF COURSE MAINTENANCE YARD	340 BAHIA		SAN CLEMENTE	CA	UST
92672	1000409128	CAD981967383	SOUTHERN CAL EDISON	1 5 BASELINE	**	SAN CLEMENTE	CA	RCRIS/SQG, FINDS
92672	U001577776	00000066595	SA ONOFRE NUCLEAR GENERATING S	S.E. BASILONE ROAD	**	SAN CLEMENTE	CA	UST
92672	U001577781	00000066342	SAN ONOFRE NUCLEAR GENERATING	S.E. BASILONE ROAD	**	SAN CLEMENTE	CA	UST
92672	A100109833		SAN ONOFRE NUCLEAR GEN. STA.	SE BASILONE RD.	**	SAN CLEMENTE	CA	AST
92672	S101541381		CAPISTRANO TEST SITE	PO BOX 10	**	SAN CLEMENTE	CA	WMUDS/SWAT
92672	S101541377		SAN ONOFRE NUCLEAR GEN STATION	PO BOX 128	**	SAN CLEMENTE	CA	WMUDS/SWAT
92672	S103627610	CAL000177486	DONALD B. CROW DDS	130 CABRILLO AVE	**	SAN CLEMENTE	CA	HAZNET
92672	S100942458	CAL923183327	PICO CAMERA	67 CALE DE INDUSTRIAS		SAN CLEMENTE	CA	HAZNET
92672	1000819233	CAD983652066	DADEN ASSOCIATES INC	1001 CALLE AMANCER		SAN CLEMENTE	CA	RCRIS/SQG, FINDS, HAZNET
92672	S103619909		DADEN ASSOCIATES INC	1001 CALLE AMANECER		SAN CLEMENTE	CA	HAZNET
92672	S102822589	CAL000128229	CAPISTRANO LABS	1010 CALLE RICHARDO, STE B	**	SAN CLEMENTE	CA	HAZNET
92672	S103620354	CAL000094812	DIMENSIONS	1011 CALLE RECODO		SAN CLEMENTE	CA	HAZNET
92672	S103620640	CAL000058319	TALON GRAPHICS	1021 CALLE SOMBRA		SAN CLEMENTE	CA	HAZNET
92672	1000819424	CAD983654062	JUNO TOOL AND PLASTIC	1041 CALLE TREPADORA		SAN CLEMENTE	CA	RCRIS/SQG, FINDS, HAZNET
92672	S102424804		AVERY RENTALS INC	125 CALLE DE LOS MOLINOS		SAN CLEMENTE	CA	LUST
92672	S102424805	9UT363	AVERY RENTALS, INC.	127 CALLE DE LOS MOLINOS		SAN CLEMENTE	CA	LUST
92672	1000926188	047278CA 001	CROWN SERVICES	1321 CALLE VALLE		SAN CLEMENTE	CA	FINDS
92672	S100874582	CAD981460553	SOUTH BAY SILVER	1321 CALLE VALLE #I		SAN CLEMENTE	CA	HAZNET
92672	S103628249		SOUTH BAY SILVER	1321 CALLE VALLE STE I	**	SAN CLEMENTE	CA	HAZNET
92672	S102822565	CAL000128123	WHITE COYOTE ENTERPRISES	146 CALLE DE MOLINOS		SAN CLEMENTE	CA	HAZNET
92672	1000266489	CAD981624380	MARK GARCIA TRUCKING	1516 CALLE VALLE		SAN CLEMENTE	CA	RCRIS/SQG, FINDS
92672	S102793593	CAC000738216	ANNA MCNIELL	201 CALLE DEL JUEGO		SAN CLEMENTE	CA	HAZNET
92672	1000820589	CAD983666538	SPARKY'S TRANSMISSIONS	216 CALLE DE LOS MOLINOS STE A		SAN CLEMENTE	CA	RCRIS/SQG, FINDS
92672	S103642772	CAL912943577	MILLIPORE CORP	221 CALLE PINTORESCO		SAN CLEMENTE	CA	HAZNET
92672	S102826375	CAL921494600	AUTO CARE	231 CALLE PINTORESCO		SAN CLEMENTE	CA	HAZNET
92672	1000597820	CAD983618513	SUN AG INC	236 CALLE PINTORESCO		SAN CLEMENTE	CA	RCRIS/SQG, FINDS
92672	S103644673	CAD983618513	SUN AG INC (TRANSPORTER)	236 CALLE PINTORESCO		SAN CLEMENTE	CA	HAZNET
92672	S102814808	CAL000070384	STAR TECH	247 CALLE PINTO RESCO	**	SAN CLEMENTE	CA	HAZNET
92672	S103645848		STAR TECH	247 CALLE PINTORESCO		SAN CLEMENTE	CA	HAZNET
92672	S101609535		FRONTERA SEWAGE PUMP STATION	2901 CALLE FRONTERA		SAN CLEMENTE	CA	FID
92672	S103654587	CAC001354456	PICO PLAZA ASSOCIATES	35-109 CALLE DE INDUSTRIAS		SAN CLEMENTE	CA	HAZNET
92672	1000131809	CAD981650666	SAM SHUPE TRUCKING	3911 CALLE MAYO		SAN CLEMENTE	CA	RCRIS/SQG, FINDS
92672	1000250365	CAT080025059	PACIFIC BELL	401 CALLE DE LOS MOLINAS		SAN CLEMENTE	CA	FID, HAZNET, RCRIS/SQG, FINDS, UST
92672	U001559739	30017566	SAN CLEMENTE SOUTH YARD	404 CALLE BAHIA		SAN CLEMENTE	CA	FID
92672	S102444606	9UT3234	PUBLIC WORKS	404 CALLE BAHIA		SAN CLEMENTE	CA	LUST
92672	S102825131	CAL000173565	PICO PHOTO	63 CALLE DE INDUSTRIAS		SAN CLEMENTE	CA	HAZNET
92672	S103668674		PICO CAMERA	67 CALLE DE INDUSTRIAS		SAN CLEMENTE	CA	HAZNET
92672	S103676214		EOT	920 CALLE NEGOCIO STE C	**	SAN CLEMENTE	CA	HAZNET
92672	S100630239	CAL000097651	EOT	920-C CALLE NEGOCIO		SAN CLEMENTE	CA	HAZNET
92672	1000151451	CAD982521411	ADVANCED SURGICAL INERVENTION	920A CALLE NEGOCI0	**	SAN CLEMENTE	CA	RCRIS/SQG, FINDS
92672	S103676442		MINUTE MAN PRESS	927 CALLE NEGOCIO STE B	**	SAN CLEMENTE	CA	HAZNET
92672	1000596240	I09#19901001	BIO-CURE, INC	927 CALLE NEGOCLO		SAN CLEMENTE	CA	FINDS
92672	S100940137	CAL923035804	MINUTE MAN PRESS	927-B CALLE NEGOCIO		SAN CLEMENTE	CA	HAZNET
92672	S103676562	CAL000078683	FULL TILT OFF-ROAD EQUIPMENT	931 CALLE NEGOCIO STE N	**	SAN CLEMENTE	CA	HAZNET
92672	1000595909	CAD983598673	FULL TILT OFF ROAD EQUIPTMENT	931 N CALLE MEGOCIO	**	SAN CLEMENTE	CA	RCRIS/SQG, FINDS
92672	1000819009	CAD983649559	NAME GAME THE	934 CALLE NEGOCIO UNIT A		SAN CLEMENTE	CA	RCRIS/SQG, FINDS
92672	S103676776	CAL000092647	DIANE'S QUALITY PRINTING	940 CALLE AMANECER, #N		SAN CLEMENTE	CA	HAZNET
92672	S100573506	CAC000590416	1X DOLPHIN CYLINDERS	946 CALLE AMANECER_UNIT G	**	SAN CLEMENTE	CA	HAZNET
92672	1000324713	CAD982026452	PICO CLEANERS	95 CALLE INDUSTRIAS	**	SAN CLEMENTE	CA	RCRIS/SQG, FINDS
92672	1000151446	CAD982487316	ADVANCED SURGICAL INTERVENTION	951 CALLE AMENECER		SAN CLEMENTE	CA	RCRIS/SQG, FINDS
92672	S102813504	CAL000051703	SOUTH COUNTY PRINTING	99 CALLE DE INDUSTRIAS		SAN CLEMENTE	CA	HAZNET
92672	1000904990	CA0000237180	CARRILLO INDUSTRIES	990 CALLE AMANECER		SAN CLEMENTE	CA	RCRIS/SQG, FINDS
92672	S102439021		THRIFTY OIL	1010 EL CAMINO REAL		SAN CLEMENTE	CA	LUST
92672	S102439080	9UT594	THRIFTY SERVICE STATION #392	1010 EL CAMINO REAL		SAN CLEMENTE	CA	LUST
92672	S101299936	9UT577	THRIFTY SERVICE STATION #	1201 EL CAMINO REAL		SAN CLEMENTE	CA	CORTESE, LUST
92672	U001577786	00000004689	THRIFTY OIL STN. #125	1401 EL CAMINO REAL	**	SAN CLEMENTE	CA	UST
92672	S102433750		MOBIL SERVICE STATION	1430 EL CAMINO REAL		SAN CLEMENTE	CA	LUST

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
92672	S102433818	9UT278	MOBIL SERVICE STATION #18-HHF	1430 EL CAMINO REAL		SAN CLEMENTE	CA	LUST
92672	1000818815	CAD983647280	CHEVRON	1729 EL CAMINO REAL		SAN CLEMENTE	CA	RCRIS/SQG, FINDS, LUST
92672	S102436306	9UT3233	SAN CLEMENTE CAR WASH	1731 EL CAMINO REAL		SAN CLEMENTE	CA	CORTESE, LUST
92672	S103444610		HOME INVESTMENT & LOANS/MIRA MAR	1736 EL CAMINO REAL		SAN CLEMENTE	CA	LUST
92672	S100931979	CAL000074594	CARRS AUTO PARTS	1908 EL CAMINO	**	SAN CLEMENTE	CA	HAZNET
92672	1000250063	CAD980891600	PACIFIC BELL	27472 CAMINO CAPISTRANO		LAGUNA NIGUEL	CA	HAZNET
92672	S103648733	CAL923576363	ARCO PRODUCTS COMPANY	2749 EL CAMINO REAL		SAN CLEMENTE	CA	HAZNET
92672	S103651039	CAL000124620	MARK'S SIGN COMPANY	302 EL CAMINO ROAD, NORTH	**	SAN CLEMENTE	CA	HAZNET
92672	S102439799		UNOCAL	305 EL CAMINO REAL		SAN CLEMENTE	CA	LUST
92672	1000985051	CAR000001602	GRANT PLAZA CLEANERS	410 CAMINO DE ESTRELLA		SAN CLEMENTE	CA	RCRIS/SQG, FINDS, HAZNET
92672	S102433439	9UT1348	MISSION VALLEY BANK	501 EL CAMINO REAL		SAN CLEMENTE	CA	LUST
92672	U001577765	00000015487	FRANK'S FOREIGN CARS	509 EL CAMINO REAL		SAN CLEMENTE	CA	CORTESE, LUST, UST
92672	S102436518		SCALZO BROTHERS	512 EL CAMINO REAL		SAN CLEMENTE	CA	LUST
92672	S102436519	9UT462	SCALZO BROTHERS AUTOMOTIVE	512 EL CAMINO REAL		SAN CLEMENTE	CA	LUST
92672	1000904978	CA0000233627	HACIENDA FORD	535 EL CAMINO REAL		SAN CLEMENTE	CA	RCRIS/SQG, FINDS, LUST, INDUSTRIAL SITE, HAZNET
92672	S102432068	9UT800	K-MART	550 CAMINO DE ESTRELLA		SAN CLEMENTE	CA	LUST
92672	U001577771	00000014376	KMART ENTERPRISES	550 CAMINO DE ESTRELLA		SAN CLEMENTE	CA	UST
92672	U002096376	30001408	THRIFTY OIL #391	590 CAMINO DE ESTRELLA		SAN CLEMENTE	CA	FID
92672	S100946635	CAL920825678	THRIFTY OIL CO #391	590 CAMINO DE ESTRELLA		SAN CLEMENTE	CA	HAZNET
92672	S101307832	9UT559	THRIFTY SERVICE STATION #391	590 CAMINO DE ESTRELLA		SAN CLEMENTE	CA	LUST
92672	U001577773	00000001901	MOBIL OIL STN. #391	590 CAMINO DE ESTRELLA		SAN CLEMENTE	CA	UST
92672	S102834170		THRIFTY OIL	590 CAMINO ESTRELLA		SAN CLEMENTE	CA	LUST
92672	U001743182	30001464	UNOCAL #6007	606 CAMINO DE LOS MARES		SAN CLEMENTE	CA	FID
92672	U001577783	00000043792	STATION # 6007	606 CAMINO DE LAS MARES		SAN CLEMENTE	CA	UST
92672	U001577791	00000013543	UNION OIL SERVICE STATION #600	606 CAMINO DE LAS MARES		SAN CLEMENTE	CA	UST
92672	S101299935	9UT2114	UNOCAL SERVICE STATION #6	606 CAMINO DE LOS MARES		SAN CLEMENTE	CA	CORTESE, LUST, HAZNET
92672	U003148495		UNOCAL	606 CAMINO DE LOS MARES		SAN CLEMENTE	CA	LUST
92672	1000273524	CAD982402216	LUCKYS CLEANERS	622 CAMINO DE LOS MARES		SAN CLEMENTE	CA	RCRIS/SQG, FINDS, HAZNET
92672	S103667435	CAL000077394	AHRENS CHIROPRACTIC	629 CAMINO DE LOS MARES STE 10	**	SAN CLEMENTE	CA	HAZNET
92672	1000597747	CAD983617739	CELEBRITY CLEANERS	638 CAMINO DE LOS MARES		SAN CLEMENTE	CA	RCRIS/SQG, FINDS
92672	S100942429	CAL921002914	PHOTO-TECH	638 CAMINO DE LOS MARES		SAN CLEMENTE	CA	HAZNET
92672	S101589267	30004837	SAMARITAN MEDICAL CENTER	654 CAMINO DE LOS MARES		SAN CLEMENTE	CA	FID
92672	S103668300	CAC000643040	1X SAMARITAN HOSPITAL MED CENTER	654 CAMINO DE LOS MARES		SAN CLEMENTIA	CA	HAZNET
92672	U003148218	9UT2040	SAMARITAN MEDICAL CENTER	654 CAMINO DE LOS MARES		SAN CLEMENTE	CA	LUST
92672	S100875882	CAL922623209	THOMAS RISBRUDT DDS	655 CAMINO DE LOS MARES		SAN CLEMENTE	CA	HAZNET
92672	S102814745	CAL000069280	SAMUEL W OGLESBY DDS INC	665 CAMINO DE LOS MARES #204		SAN CLEMENTE	CA	HAZNET
92672	S102818688	CAL000110122	DR JOE WONG, MD	665 CAMINO DE LOS MARES,#301		SAN CLEMENTE	CA	HAZNET
92672	U001559742	30005803	SAN DIEGO GAS & ELECTRIC	674 CAMINO DE LOS MARES		SAN CLEMENTE	CA	FID
92672	1000315116	CAD981168651	ORANGE COUNTY DISTRICT OPERATI	674 CAMINO DE LOS MARES		SAN CLEMENTE	CA	RCRIS/SQG, FINDS, UST
92672	S100609403	CAD981168651	ORANGE COUNTY C&O	674 CAMINO DE LOS MARES		SAN CLEMENTE	CA	HAZNET
92672	S103668812	CAL920074563	OCEAN VIEW DIAGNOSTIC IMAGING	675 CAMINO DE LOS MARES #101		SAN CLEMENTE	CA	HAZNET
92672	S103668813	CAL000077243	HERITAGE HEALTH FOUNDATION	675 CAMINO DE LOS MARES STE 20	**	SAN CLEMENTE	CA	HAZNET
92672	1000401479	CAD981673445	NELSONS CONTINENTAL CLEANERS	810 EL CAMINO REAL	**	SAN CLEMENTE	CA	RCRIS/SQG, FINDS
92672	S102436307	9UT1216	SAN CLEMENTE MOTORS	824 EL CAMINO REAL		SAN CLEMENTE	CA	LUST
92672	S102436308		SAN CLEMENTE MOTORS	842 EL CAMINO REAL		SAN CLEMENTE	CA	LUST
92672	U001577770	00000038965	KEN CARROLL AUTOMOTIVE	902 EL CAMINO REAL		SAN CLEMENTE	CA	CORTESE, LUST, UST
92672	S102431008	9UT2503	GRUBSTAKE SERVICE STATION	908 EL CAMINO REAL		SAN CLEMENTE	CA	LUST
92672	S101609633		UNOCAL # 7486	1201 S EL CAMINO REAL		SAN CLEMENTE	CA	FID
92672	1000596159	CAD983601220	CAPO VALLEY JEEP EAGLE	1212 S EL CAMINO REAL		SAN CLEMENTE	CA	FID, HAZNET, RCRIS/SQG, FINDS
92672	U001577772	00000043846	MISSION MOTORS	1212 S. EL CAMINO REAL		SAN CLEMENTE	CA	UST
92672	1000185859	CAD981963390	BONDED CLEANERS AND LAUNDRY	1221 N EL CAMINO REAL		SAN CLEMENTE	CA	HAZNET
92672	S103626089	CAL000074610	BEACH TOWN AUTOMOTIVE	1225 N EL CAMINO REAL		SAN CLEMENTE	CA	HAZNET
92672	U001742937	30002730	MOBIL STATION (18-HHF)	1430 S EL CAMINO REAL		SAN CLEMENTE	CA	FID
92672	U001577769	00000039300	JAMES MESSERSMITH	1430 S. EL CAMINO REAL		SAN CLEMENTE	CA	UST
92672	S100863884	CAL000081728	HENDRIX QUIK-PRINT SERVICE	1444 NO EL CAMINO REAL		SAN CLEMENTE	CA	HAZNET
92672	S101631441		TOP TUNE #29	1502 S EL CAMINO REAL		SAN CLEMENTE	CA	FID
92672	1000293531	CAD982499048	DAILY SUN POST	1542 N EL CAMINO REAL		SAN CLEMENTE	CA	RCRIS/SQG, FINDS, HAZNET
92672	S102432997	9UT2491	MARINA AUTO REPAIR	1606 N EL CAMINO REAL		SAN CLEMENTE	CA	LUST
92672	S102432998		MARINA AUTOMOTIVE REPAIR	1606 N EL CAMINO REAL		SAN CLEMENTE	CA	LUST
92672	S103633903	CAL000106625	DISCOUNT TIRE CENTERS #134	1606 N EL CAMINO REAL		SAN CLEMENTE	CA	HAZNET
92672	S103634280	CAL000128993	WORLD OCEANS MEDIA	1625 NORTH EL CAMINO REAL		SAN CLEMENTE	CA	HAZNET
92672	1000905527	CA0000836833	SHADETREE AUTOMOTIVE	1635 N EL CAMINO REAL		SAN CLEMENTE	CA	RCRIS/SQG, FINDS, HAZNET
92672	S101631438		CHEVRON STATION #99476	1729 S EL CAMINO REAL		SAN CLEMENTE	CA	FID
92672	S103636023	CAD983647280	CHEVRON 99476	1729 S EL CAMINO REAL		SAN CLEMENTE	CA	HAZNET
92672	U001577756	00000063208	99476	1729 S EL CAMINO REAL		SAN CLEMENTE	CA	UST
92672	S101619708		SAN CLEMENTE CAR WASH	1731 N EL CAMINO REAL		SAN CLEMENTE	CA	FID
92672	U001577777	00000006127	SAN CLEMENTE CAR WASH	1731 N. EL CAMINO REAL		SAN CLEMENTE	CA	UST
92672	S103296764	9UT3623	HOME INVESTMENT & LOAN PROP.	1736 N EL CAMINO REAL		SAN CLEMENTE	CA	LUST
92672	1000316727	CAD981657539	FRANK'S COACHWERKS AUTOBODY	2101 S EL CAMINO REAL		SAN CLEMENTE	CA	RCRIS/SQG, FINDS, HAZNET

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
92672	S103643066	CAL000065025	4 IN SERVICE AND REPAIR	2229 S EL CAMINO REAL		SAN CLEMENTE	CA	HAZNET
92672	S103643109		C&R RADIATOR & AIR CONDITIONING	2231 S EL CAMINO REAL		SAN CLEMENTE	CA	HAZNET
92672	1000129380	00000020387	C & R RADIATOR & AIR CONDITION	2231 SOUTH EL CAMINO REAL		SAN CLEMENTE	CA	HAZNET, UST
92672	1000857693	CAD983671389	EL CAMINO CLEANERS	2241 S EL CAMINO REAL		SAN CLEMENTE	CA	RCRIS/SQG, FINDS, HAZNET
92672	1000389728	CAL000015427	WINSTON TIRE COMPANY #69	2310 S EL CAMINO REAL		SAN CLEMENTE	CA	HAZNET
92672	1000978267	CA0000996330	DICK WATSON AUTO CENTER	2345 S EL CAMINO REAL		SAN CLEMENTE	CA	FID, LUST, HAZNET, RCRIS/SQG, FINDS, UST
92672	S103644642	CAL000007702	DICK WATSON AUTO CTR	2355 S EL CAMINO REAL		SAN CLEMENTE	CA	HAZNET
92672	S101299938	9UT444	UNOCAL SERVICE STATION #5058	2360 S EL CAMINO REAL		SAN CLEMENTE	CA	LUST
92672	S102440226		UNOCAL S S #5058	2360 S EL CAMINO REAL		SAN CLEMENTE	CA	LUST
92672	S103065299	9UT444	UNOCAL SERVICE STATION #5	2360 S EL CAMINO REAL		SAN CLEMENTE	CA	CORTESE
92672	U002096412	30001410	UNOCAL #5058	2360 S EL CAMINO REAL		SAN CLEMENTE	CA	FID
92672	U001577790	00000002330	UNION OIL SERVICE STATION #505	2360 S. EL CAMINO REAL		SAN CLEMENTE	CA	UST
92672	S102811741	CAL000034859	SAN CLEMENTE UNION 76	2360 SO EL CAMINO REAL		SAN CLEMENTE	CA	HAZNET
92672	U001577785	00000043725	STATION #5058	2360 SOUTH EL CAMINO REAL		SAN CLEMENTE	CA	UST
92672	S101631440		SHELL (6762-0207)	2400 S EL CAMINO REAL		SAN CLEMENTE	CA	FID
92672	S103296765	9UT3637	SHELL STATION	2400 S EL CAMINO REAL		SAN CLEMENTE	CA	LUST
92672	U003148269		SHELL	2400 S EL CAMINO REAL		SAN CLEMENTE	CA	LUST
92672	U001577792	00000020055	VARISH H. ANTABLIAN	2400 S. EL CAMINO REAL		SAN CLEMENTE	CA	UST
92672	S103648734	CAL000003718	SAN CLEMENTE ARCO	2749 N EL CAMINO REAL		SAN CLEMENTE	CA	HAZNET
92672	U001577768	00000026789	HAIG AROUSIA-ARTIN	2749 N EL CAMINO REAL		SAN CLEMENTE	CA	UST
92672	U002095905	30001521	ARCO #5111	2749 N EL CAMINO REAL		SAN CLEMENTE	CA	FID, INDUSTRIAL SITE
92672	U001577788	00000017901	UNION OIL SERVICE STATION #051	305 S EL CAMINO REAL		SAN CLEMENTE	CA	UST
92672	U001577784	00000040570	STATION #0517	305 SOUTH EL CAMINO REAL		SAN CLEMENTE	CA	UST
92672	1000595910	CAD983598681	FRANKS FOREIGN CAR SVC	509 S EL CAMINO REAL		SAN CLEMENTE	CA	RCRIS/SQG, FINDS, LUST
92672	U001577767	00000063691	HACIENDA FORD	535 N. EL CAMINO REAL		SAN CLEMENTE	CA	UST
92672	S100276834	9100604		706 NORTH EL CAMINO REAL		SAN CLEMENTE	CA	CHMIRS
92672	U001577759	00000020121	DENAULT'S HAREWARE-HOME CENTER	717 N. EL CAMINO		SAN CLEMENTE	CA	LUST, UST
92672	S103673464	CAL000159461	SAN CLEMENTE AUTO SERVICE	822 N EL CAMINO REAL		SAN CLEMENTE	CA	HAZNET
92672	S102809558	CAL000007135	KENS TEXACO	902 N EL CAMINO REAL		SAN CLEMENTE	CA	HAZNET
92672	S103675880	CAL000094056	1HR MOTO PHOTO	909 S EL CAMINO REAL		SAN CLEMENTE	CA	HAZNET
92672	S102806262	CAD010684629	SAN CLEMENTE DRY CLEANER	913 S EL CAMINO REAL		SAN CLEMENTE	CA	HAZNET
92672	1000125315	CAD981668007	BIG O TIRES	927 N EL CAMINO REAL		SAN CLEMENTE	CA	RCRIS/SQG, FINDS
92672	S102810166	CAL000016486	CSB PARTNERSHIP DBA BIG O TIRES	927 N EL CAMINO REAL		SAN CLEMENTE	CA	HAZNET
92672	S103630676	CAC000715656	COAST PROPERTY MANAGEMENT	144 W ESCALONES		SAN CLEMENTE	CA	HAZNET
92672	1000312232	CAD094723574	KENNEDY'S BODYSHOP	1527 ESTRELLA	**	SAN CLEMENTE	CA	HAZNET
92672	S100278405	9120126		S.B I-5 100' SOUTH OF PALIZADA AVENUE	**	SAN CLEMENTE	CA	CHMIRS
92672	1000309634	CAD030586309	B AND M AUTO BODY SHOP	1520 DE LA ESTRELLA	**	SAN CLEMENTE	CA	HAZNET
92672	1000596278	CAD983602434	RAYS AUTO REPAIR	1520 DE LA ESTRELLA A	**	SAN CLEMENTE	CA	RCRIS/SQG, FINDS
92672	1000391667	CAD982499287	WEST COAST RADIATOR	1520 DE LA ESTRELLA D		SAN CLEMENTE	CA	RCRIS/SQG, FINDS
92672	U001577764	00000044026	FLAGG STATION	422 DE LA ESTRELLA		SAN CLEMENTE	CA	CORTESE, LUST, UST
92672	U001577762	00000024012	EXXON SERVICE STATION	504 DE LA ESTRELLA	**	SAN CLEMENTE	CA	UST
92672	U001577789	00000017863	UNION OIL SERVICE STATION #505	105 W. LINCOLN		ORANGE	CA	UST
92672	S100933468	CAL000041628	CUSTOM CRAFT	124 LOS MOLINOS		SAN CLEMENTE	CA	HAZNET
92672	1000400189	CAD982023178	FRATELLI MELLONI BODY SHOP	127 LOS MOLINOS AVE		SAN CLEMENTE	CA	RCRIS/SQG, FINDS
92672	S102809653	CAL000008865	MIKES AUTO REPAIR	136 LOS MOLINAS		SAN CLEMENTE	CA	HAZNET
92672	S102825315	CAL000177087	MIKE'S AUTO REPAIR	136 LOS MOLINOS	**	SAN CLEMENTE	CA	HAZNET
92672	U001577782	00000027258	SOAUTH COAST DIST. CO.	309 LOS MOLINOS		SAN CLEMENTE	CA	UST
92672	1000594834	CAD983587189	SAN CLEMENTE TRANSMISSION	215 LOSMOLINOS	**	SAN CLEMENTE	CA	RCRIS/SQG, FINDS
92672	1000360682	CAD980887111	AMERICAN BIOGENETICS CORP	19732 MACARTHUR BLVD, STE 130		IRVINE	CA	FINDS, RCRIS/LQG
92672	S100277823	9117778		135 WEST MARQUITE		SAN CLEMENTE	CA	CHMIRS
92672	S103628942	CAC000613048	1X SAN CLEMENTE COMM INC	135 W MARUITA AVENITA	**	SAN CLEMENTE	CA	HAZNET
92672	1000685999	CAD983629650	SOUTHERN CAL EDISON SONGS MESA	14300 MESA RD	**	SAN CLEMENTE	CA	FINDS, RCRIS/LQG
92672	S102809321	CAL000003503	STANLEY'S MUFFLER SHOP	145 NAVARRO AVE	**	SAN CLEMENTE	CA	HAZNET
92672	S103636459	CAL000070230	DAVE WERT AUTOMOTIVE REPAIR	176 NAVARRO	**	SAN CLEMENTE	CA	HAZNET
92672	1000107792	CAD982003048	SAN CLEMENTE AUTO REPAIR	184 NAVARRO ST		SAN CLEMENTE	CA	RCRIS/SQG, FINDS
92672	U001577774	00000061036	NAVAL AUXILIARY LANDING FIELD	U.S. NAVY	**	SAN CLEMENTE	CA	UST
92672	1000351948	CAT080012230	AMER TELE & TELE CO SAN CLEMEN	2 MI NE OF	**	SAN CLEMENTE	CA	RCRIS/SQG, FINDS
92672	U001577779	00000065910	SAN MATEO POINT	NEXT TO THE NIXON WESTERN WHIT	**	SAN CLEMENTE	CA	UST
92672	S103631682	CAL000125822	MFG NETWORK	150 OBREROS_LN SUITE I	**	SAN CLEMENTE	CA	HAZNET
92672	1000119222	CAD000629402	TRW INC	ONE VIA ESPASCIO	**	SAN CLEMENTE	CA	FINDS, RCRIS/LQG, HAZNET
92672	S102440443	9UT1694	UNOCAL STATION SS#5434	32842 PACIFIC COAST HWY		DANA POINT	CA	CORTESE, LUST
92672	1000921580	CAD000630921	SAN ONOFRE NUCLEAR G S SONGS	5000 PACIFIC COAST HWY		SAN CLEMENTE	CA	FINDS, RCRIS/LQG
92672	S102436400	9UT509	SAN ONOFRE NUCLEAR GEN.STATION	5000 PACIFIC COAST HWY		SAN ONOFRE	CA	LUST
92672	S102436399	9UT2559	SAN ONOFRE NUCLEAR GEN STATION	5000 PACIFIC COAST HWY S		SAN ONOFRE	CA	LUST
92672	S102017394	H04692	SAN ONOFRE NUC GENERATING STA	5000 S PACIFIC COAST HY	**	SAN ONOFRE	CA	HMMD
92672	1000167565	CAD000630863	SO CALIF EDISON SAN ONOFRE NUC GEI	PACIFIC COAST HWY UNIT 1		SAN CLEMENTE	CA	RCRIS/SQG, FINDS, HAZNET
92672	U001577758	00000008455	CTS	33000 PICO AVENUE	**	SAN CLEMENTE	CA	UST
92672	S100932689	CAL000013607	CITY OF SAN CLEMENTE	390 PICO	**	SAN CLEMENTE	CA	HAZNET
92672	U001577757	00000030052	CORPORATION YARD	390 PICO	**	SAN CLEMENTE	CA	UST
92672	S102827652	CLU950001480	DARRELL GENE HUFF JR.	117 EL PORTAL AVE APT A	**	SAN CLEMENTE	CA	HAZNET

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
92672	1000107793	CAD982005910	SAN CLEMENTE COMMERCIAL	108 RIN CON COURT		SAN CLEMENTE	CA	RCRIS/SQG, FINDS, LUST, UST
92672	S102807550	CAD981673445	PORTER RANCH CLEANERS	19450 RINALDI	**	SAN CLEMENTE	CA	HAZNET
92672	1000150914	CAD981391451	LYMAN'S READY MIXED CONCRETE,	116 N. RINCON COURT		SAN CLEMENTE	CA	FID, LUST, HAZNET, RCRIS/SQG, FINDS, UST
92672	1000250442	CAT080027402	PACIFIC BELL	SBB&M T8S R7W S26	**	SAN CLEMENTE	CA	FINDS, RCRIS/LQG
92672	S102792429	CAC000718400	BEATRICE BECKETT	100 SHELL DR		SAN CLEMENTE	CA	HAZNET
92672	S101481076	19970009	NAVAL AUXILIARY LANDING F	(NO STREET NBR) SOUTHERN MOST ISLA		SAN CLEMENTE	CA	CORTESE, CAL-SITES (ASPIS)
92672	1000404973	CAD981460553	SOUTH BAY SILVER	1321 UNIT 1 CALLE VALLE		SAN CLEMENTE	CA	RCRIS/SQG, FINDS
92672	S103648566	CAD983582537	DRY CLEAN CALIFORNIA	2727 VIA CASCADITA # G / H	**	SAN CLEMENTE	CA	HAZNET
92672	1000594423	CAD983582537	DRY CLEAN CALIFORNIA	2727 VIA CASCADITA #G&H		SAN CLEMENTE	CA	RCRIS/SQG, FINDS
92675	S100931995	CAC000950024	CASA DE CAPISTRANO	32041 / 32043 PASEO CAROLINA		SAN JUAN CAPISTRANO	CA	HAZNET
92675	U001577811	00000048163	KINOSHITA FARMS, INC	32701 ALI PAZ		SAN JUAN CAPISTRANO	CA	UST
92675	1000921650	CAD983599580	MOBIL OIL CORP ADR	23002 ALICIA PKWY		MISSION VIEJO	CA	RCRIS/SQG, FINDS
92675	U001577819	00000026756	PRESTIGE STATIONS INC #574	23931 ALICIA PARKWAY		MISSION VIEJO	CA	UST
92675	S100463140	9UT24	ARCO SERVICE STATION #310	23931 ALICIA PKWY		MISSION VIEJO	CA	CORTESE, LUST
92675	U001577818	00000067223	PARNELLI JONES INC	24510 ALICIA PARKWAY		MISSION VIEJO	CA	UST
92675	S102433429	9UT1906	MISSION PIPE & SUPPLY COMPANY	32107 ALIPAZ ST		SAN JUAN CAPISTRANO	CA	LUST
92675	S102433430		MISSION PIPE AND SUPPLY CO	32107 ALIPAZ ST		SAN JUAN CAPISTRANO	CA	LUST
92675	S102817239	CAL000092887	COLOR CRAFT PRESS	32141 ALIPAZ, #I		SAN JUAN CAPISTRANO	CA	HAZNET
92675	1001195477	CAR000020578	JIFFY LUBE NO 1598	23401 ANTONIO	**	RANCHO SANTA MARGARITA		RCRIS/SQG, FINDS
92675	1000119229	CAD048761530	AMF INC POTTER & BRUMFIELD DIV	26181 AVENIDA AEROPUORTO		SAN JUAN CAPIST	CA	FINDS, RCRIS/LQG
92675	U001577812	00000037673	LOS CERRITOS RANCH	31642 AVENIDA LOS CERRITOS		SAN JUAN CAPISTRANO	CA	LUST, HAZNET, UST
92675	S103651558	CAC001264408	INTOWN PROPERTIES	30962 AVENUIDA DE LA VISTA	**	SAN JUAN CAPISTRANO	CA	HAZNET
92675	U001577825	00000021444	SAN JUAN CAPISTRANO H.M.A. PLA	26772 AVERY PARKWAY		INCORPORATED	CA	UST
92675	1001265496	CA0078019	BLUE DIAMOND MATLS	26772 AVERY PKWY SJC	**	SAN JUAN CP	CA	FINDS
92675	S103640539	CAC001264232	INTOWN PROPERTIES	20400 CALLE SAN FRANCISCO	**	SAN JUAN CAPISTRANO	CA	HAZNET
92675	S102807695	CAD981968951	CAPISTRANO USD	26126 CALLE PERFECTO	**	SAN JUAN CAPISTRANO	CA	HAZNET
92675	S102811605	CAL000033479	MICRO PRECISION SWISS INC	26401 CALLE ROLANDO		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S103647901	CAC001342136	HUD INTOWN PROPERTIES	26544 CALLE SAN FRANCISCO		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S103647903	CAC001311504	H.U.D.	26546 CALLE SANTA BARBARA		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S103648644	CAP600928943	APPLIED ENVIRONMENTAL SERVICES	27362 CALLE ARROYO		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S102809550	CAL000006976	ROBERT J PATTERSON PAINTING CO	27901 CALLE BELMONTE		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S103651563	CAC001226672	HUD	30976 CALLE SAN DEIGO	**	SAN JUAN CAPISTRANO	CA	HAZNET
92675	S103651754	CAC001334216	INTOWN PROP/HUD	31098 CALLE SAN DIEGO		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S101631447		U S RENTALS	32821 CALLE PERFECTO		SAN JUAN CAPISTRA	CA	FID
92675	S103653081	CAD982013260	US RENTALS INC	32821 CALLE PERFECTO		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S100931874	CAL000038439	CAPO COACHWORKS	32841 CALLE PERFECTO		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S102793606	CAC000738376	DAL-TILE	32891 CALLE PERFECTO		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S102811529	CAL000032680	PROFESSIONAL/MOTORCAR PERFORMA	32901 CALLE PERFECTO		SAN JUAN CAPISTRANO	CA	HAZNET
92675	1000312789	CAD982021479	TRONEMED INC	32921 CALLE PERFECTO		SAN JUAN CAPISTRANO	CA	HAZNET
92675	1000243504	CAD982508566	NICHOLS INSTITUTE REFERENCE LA	32961 CALLE PREFECTO		SAN JUAN CAPIST	CA	RCRIS/SQG, FINDS
92675	U002096028	30001878	CUSD MAINTENANCE CENTER	32972 CALLE PERFECTO		SAN JUAN CAPISTRA	CA	FID
92675	U001577803	00000023659	CAPISTRANO UNIFIED SCHOOL DIST	32972 CALLE PERFECTO		SAN JUAN CAPISTRANO	CA	UST
92675	S100933456	CAL000014207	CUSD/EDUCATION CENTER	32972 CALLE PERFECTO		SAN JUAN CAPISTRANO	CA	HAZNET
92675	U001577813	00000063468	MAINTENANCE DEPT.	32972 CALLE PERFECTO		SAN JUAN CAPISTRANO	CA	UST
92675	1000596571	CAD983605452	AUTO ART	32991 CALLE AVIADOR NO A		SAN JUAN CAPIST	CA	RCRIS/SQG, FINDS
92675	S103653151	CAD983605452	AUTO ART	32991 CALLE AVIADOR STE A		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S102795335	CAC000877672	ORANGE COUNTY REGISTER	32992 CALLE PERFECTO		SAN JUAN CAPISTRANO	CA	HAZNET
92675	U001577805	00000019549	COAST CATAMARAN CORP. DBA HOBI	33001 CALLE PERFECTO		SAN JUAN CAPISTRANO	CA	UST
92675	S100928957	CAL000036761	ADVANCED AUTO REFINISHING	33011 CALLE AVIADOR STE C		SAN JUAN CAPISTRANO	CA	HAZNET
92675	1000387129	CAD072529811	COAST CATAMARAN CORP	33012 CALLE PERFECTO		SAN JUAN CAPIST	CA	RCRIS/SQG, FINDS, HAZNET, UST
92675	S101589132	30001468	RAYNE SOFT WATER	33021 CALLE PERFECTO		SAN JUAN CAPISTRA	CA	FID
92675	S101299942	9UT2196	RAYNE WATER	33021 CALLE PERFECTO		SAN JUAN CAPISTRANO	CA	CORTESE, LUST
92675	S103653319	CAL000148515	CAPITOL VALLEY AUTO SERVICE	33032 CALLE AVIADOR		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S100876526	CAL000083084	TUNA AUTO BODY	33041 CALLE AVIADOR		SAN JUAN CAPISTRANO	CA	HAZNET
92675	1000271462	CAD981394208	LAAKMANN ELECTRO-OPTICS, INC	3305 CALLE AVIADOR	**	SAN JUAN CAPIST	CA	RCRIS/SQG, FINDS
92675	1000686620	CAD983639592	BOSCH SCREENPRINT	33051 CALLE AVIADOR E		SAN JUAN CAPIST	CA	RCRIS/SQG, FINDS
92675	1000243503	CAD982508558	NICHOLS INSTITUTE DIAGNOSTIC	33061 CALLE AVIADOR		SAN JUAN CAPISTRANO	CA	RCRIS/SQG, FINDS, HAZNET
92675	U001577817	00000057720	PACIFIC BELL (LE-312)	25762 CAM DEL AVION		SAN JUAN CAPISTRANO	CA	UST
92675	S102823919	CAL000142811	SAN JUAN TIRE	22171 CAMINO CAPISTRANO	**	SAN JUAN CAPISTRANO	CA	HAZNET
92675	1000250379	CAT080025190	PACIFIC BELL	25762 CAMINO DEL AVION		SAN JUAN CAPIST	CA	FID, HAZNET, RCRIS/SQG, FINDS
92675	S101609498		AVERY SHELL (2046846-0256)	28662 CAMINO CAPISTRANO		SAN JUAN CAPISTRA	CA	FID
92675	S101299852	9UT1353	SHELL STATION	28662 CAMINO CAPISTRANO		MISSION VIEJO	CA	CORTESE, LUST, HAZNET
92675	S101589133	30001475	EXXON #7-3732	28692 CAMINO CAPISTRANO		SAN JUAN CAPISTRA	CA	FID
92675	S100934996	CAL000002621	EXXON CO USA #73732	28692 CAMINO CAPISTRANO		SAN JUAN CAPISTRANO	CA	HAZNET
92675	U001577807	00000024066	EXXON SERVICE STATION	28692 CAMINO CPAISTRANO		SAN JUAN CAPISTRANO	CA	UST
92675	S102820863	CAL000120239	THE SOUTH ORANGE COUNTY VET EMEF	28832 CAMINO CAPISTRANO		SAN JUAN CAPISTRANO	CA	HAZNET
92675	U001577821	00000011848	RANCHO CAPISTRANO	29251 CAMINO CAPISTRANO		SAN JUAN CAPISTRANO	CA	LUST, UST

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
92675	S103651743	CAL000152953	LAWSON'S LANDSCAPE	31050 CAMINO CAPISTRANO		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S103652159	CAC000758920	THE CAPISTRANO LAGUNA BEACH R O P	31522 EL CAMINO REAL		SAN JUAN CAPISTRANO	CA	HAZNET
92675	1000250409	CAT080025497	PACIFIC BELL	31776 EL CAMINO REAL		SAN JUAN CAPIST	CA	RCRIS/SQG, FINDS, UST
92675	S103652353	CAC001112504	ROMAN CATHOLIC DIOCESE OF ORANGE	31871 CAMINO CAPISTRANO		SAN JUAN CAPISTRANO	CA	HAZNET
92675	1000289617	CAD981641459	SWALLONS CLEANERS	31921 CAMINO CAPISTRANO		SAN JUAN CAPIST	CA	RCRIS/SQG, FINDS, HAZNET
92675	U001742684	30001429	CHEVRON STATION #93417	32001 CAMINO CAPISTRANO		SAN JUAN CAPISTRA	CA	FID
92675	U003432883		CHEVRON STATION	32001 CAMINO CAPISTRANO		SAN JUAN CAPISTRANO	CA	LUST, UST
92675	U001577797	00000062437	93417	32001 CAMINO CAPISTRANO		SAN JUAN CAPISTRANO	CA	UST
92675	S102426823		CHEVRON	32009 CAMINO CAPISTRANO		SAN JUAN CAPISTRANO	CA	LUST
92675	S101307836	9UT1728	SUPER 7	32022 CAMINO CAPISTRANO		SAN JUAN CAPISTRANO	CA	LUST
92675	U001577834	00000012846	SUPER-7 #18901	32022 CAMINO CAPISTRANO		SAN JUAN CAPISTRANO	CA	UST
92675	S102423481		7 ELEVEN STORE #18901	32022 CAMINO CAPISTRANO		SAN JUAN CAPISTRANO	CA	LUST
92675	S102438255	9UT832	SUPER-7 SS #18901	32022 CAMINO CAPISTRANO		SAN JUAN CAPISTRANO	CA	LUST
92675	S103652674		SIR SPEEDY	32150 CAMINO CAPISTRANO # 103	**	SAN JUAN CAPISTRANO	CA	HAZNET
92675	S100945136	CAL913185380	SIR SPEEDY	32150 CAMINO CAPISTRANO #103		SAN JUAN CAPISTRANO	CA	HAZNET
92675	1000382461	CAD982038937	MISSION VILLAGE CLEANERS	32191 CAMINO CAPISTRANO		SAN JUAN CAPISTRANO	CA	HAZNET
92675	1001217502	CAR000035832	MISSION VILLAGE CLEANERS	32191 CAMINO CAPISTRANO		SAN JUAN CAPISTRANO	CA	RCRIS/SQG, FINDS
92675	1001126724	CAR000018077	CAPISTRANO TIRE AND BRAKE	32201 CAMINO CAPISTRANO		SAN JUAN CAPISTRANO	CA	RCRIS/SQG, FINDS
92675	S103652758	CAL000178469	CAROL L. DADERIAN, D.D.S.	32272 CAMINO CAPISTRANO		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S100941157	CAL000028898	CROWN CLEANERS	32301 CAMINO CAPISTRANO		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S103652783	CAL000094694	ONE HOUR MOTO PHOTO	32301 CAMINO CAPISTRANO #A		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S103652784		ONE HOUR MOTO PHOTO	32301 CAMINO CAPISTRANO STE A	**	SAN JUAN CAPISTRANO	CA	HAZNET
92675	S102825373	CAL000177479	CENTER FOR PREVENTIVE HEALTH	32302 CAMINO CAPISTRANO		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S101609507		CAPISTRANO CAR WASH (UNOCAL)	32841 CAMINO CAPISTRANO		SAN JUAN CAPISTRA	CA	FID
92675	U002095917	30011304	ASHIK BUILDING	32861 CAMINO CAPISTRANO		SAN JUAN CAPISTRA	CA	FID
92675	S102810771	CAL000024932	AL'S AUTO REPAIR SHOP	32861 CAMINO CAPISTRANO		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S103653090	CAL000009144	CAMINO IMPORTS AUTO SERVICE	32861 CAMINO CAPISTRANO #2		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S102809627	CAL000008434	DAUGHTERS HONDA CAR	32861 CAMINO CAPISTRANO #5		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S103653091		CAMINO IMPORTS AUTO SERVICE	32861 CAMINO CAPISTRANO STE 2	**	SAN JUAN CAPISTRANO	CA	HAZNET
92675	S103653092		DAUGHTERS HONDA CAR	32861 CAMINO CAPISTRANO STE 5	**	SAN JUAN CAPISTRANO	CA	HAZNET
92675	S101589571	30017608	JIM SLEMONS HONDA	32881 CAMINO CAPISTRANO		SAN JUAN CAPISTRA	CA	FID
92675	1000904885	CA0000149229	WESELOH HONDA	32881 CAMINO CAPISTRANO		SAN JUAN CAPIST	CA	RCRIS/SQG, FINDS, LUST, HAZNET
92675	S103296766	9UT3598	WELEOH HONDA	32881 CAMINO CAPISTRANO		SAN JUAN CAPISTRANO	CA	LUST
92675	1000134648	CAD982520686	CAL TRANS DISTRICT 12	32941 CAMINO CAPISTRANO		SAN JUAN CAPISTRA	CA	FID, RCRIS/SQG, FINDS
92675	S100931431	9UT3574	CAL TRANS MAINTENANCE YARD	32941 CAMINO CAPISTRANO		SAN JUAN CAPISTRANO	CA	LUST
92675	U001577801	00000068080	CAPISTRANO	32941 CAMINO CAPISTRANO		SAN JUAN PISTRANO,	CA	UST
92675	S103444611		CAL TRANSMAINTENANCE YARD	32941 CAMINO CAPISTRANO		SAN JUAN CAPISTRANO	CA	LUST
92675	S103653133	CAD982520686	CALTRANS-DIST 12	32941 CAMINO CAPISTRANO		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S101629973		CALIFORNIA HIGHWAY PATROL	32951 CAMINO CAPISTRANO		SAN JUAN CAPISTRA	CA	FID
92675	U001830185	00000017990	CALIFORNIA HIGHWAY PATROL	32951 CAMINO CAPISTRANO		SAN JUAN CAPISTRANO	CA	UST
92675	1000820221	CAD983662537	SATURN OF SAN JUAN CAPISTRANO	33033 CAMINO CAPISTRANO		SAN JUAN CAPIST	CA	RCRIS/SQG, FINDS, HAZNET
92675	S100942824	CAL920215071	PRINTING COMPANY, THE	33155 CAMINO CAPISTRANO		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S102793626	CAC000738616	THE ESPANADE	33157 CAMINO CAPISTRANO		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S100940184	CAL000111415	MISSION CHIROPRACTIC	33161 CAMINO CAPISTRANO		SAN JUAN CAPISTRANO	CA	HAZNET
92675	1000598001	CAD983620386	BARWICK JEEP EAGLE INC	33301 CAMINO CAPISTRANO		SAN JAUN CAPIST	CA	RCRIS/SQG, FINDS, HAZNET
92675	1000436877	CAD981383318	BARWICK IMPORTS INC	33375 CAMINO CAPISTRANO		SAN JUAN CAPISTRA	CA	FID, HAZNET, RCRIS/SQG, FINDS, UST
92675	S103653641	CAL000139258	FAMILY TOYOTA	33395 CAMINO CAPISTRANO		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S102815004	CAL000073341	SIR SPEEDY	32158 CMINO CAPISTRANO #103		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S103677684	CAL923535559	ARCO PRODUCTS COMPANY	980 N COAST HWY		LAGUNA BEACH	CA	HAZNET
92675	U001577838	00000013565	UNION OIL SERVICE STATION #644	26411 CROWN VALLEY PARKWAY		MISSION VIEJO	CA	UST
92675	U001577808	00000026729	GARY WAYNE ROBERTS	27682 CROWN VALLEY PKW		MISSION VIEJO	CA	UST
92675	U001577795	00000061778	90297	27742 CROWN VALLEY PKWY		MISSION VIEJO	CA	UST
92675	S103636076	CAC000139277	1X LOYD'S ENTERPRISES	17305 DAIMLER ST		IRVINE	CA	HAZNET
92675	S101589550	30017521	OR COUNTY FIRE STATION #7	31865 DEL OBISPO		SAN JUAN CAPISTRA	CA	FID
92675	U001577831	00000027190	STAION #7	31865 DEL OBISPO		SAN JUAN CAPISTRANO	CA	UST
92675	S102434711		ORANGE COUNTY FIRE STATION #7	31865 DEL OBISPO ST		SAN JUAN CAPISTRANO	CA	LUST
92675	S102429966	9UT2803	FIRE STATION #7	31865 DEL OBISPO ST		SAN JUAN CAPISTRANO	CA	LUST, HAZNET
92675	1000597818	CAD983618497	PARK CLEANERS	31878 DEL OBISPO NO 123		SAN JUAN CAPIST	CA	RCRIS/SQG, FINDS
92675	S102822307	CAL000127262	RONALD BERMAN DC	31899 DEL OBISPO ST # 150		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S102823224	CAL000138015	GALAXY CLEANERS	31952 DEL OBISPO ST		SAN JUAN CAPISTRANO	CA	HAZNET
92675	1000263529	CAD982328262	GALAXY CLEANER	31952 DEL OBISPO ST		SAN JUAN CAPIST	CA	RCRIS/SQG, FINDS
92675	S103652590	CAC000735352	CAPISTRANO VALLEY BAPTIST CHURCH	32032 DEL OBISPO		SAN JUAN CAPISTRANO	CA	HAZNET
92675	U001577802	00000042211	CAPISTRANO RANCH	32285 DEL OBISPO		SAN JUAN CAPISTRANO	CA	UST
92675	1000323591	CAD982501165	SUNNY CLEANERS	32382 DEL OBISPO ST		SAN JUAN CAPIST	CA	RCRIS/SQG, FINDS, HAZNET
92675	1000978239	CA0000981969	CAPISTRANO FORD	33949 DOHENY PARK RD		SAN JUAN CAPIST	CA	RCRIS/SQG, FINDS, HAZNET
92675	S102824989	CAL000162899	MAXIM CLEANERS	33951 DOHENY PARK DR #D		SAN JUAN CAPISTRANO	CA	HAZNET
92675	1001023202	CAR000005603	PRICE CLUB NO 429	33961 DOHENY PARK RD		SAN JUAN CAPISTRANO	CA	RCRIS/SQG, FINDS
92675	S100942780	CAL000055267	PRICE CLUB # 129	33961 DOHENY PARK RD		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S103650133	CLU960011975	URIZE & MITANEZ DRUG LAB	29345 EDGEWOOD DR		SAN JUAN CAPISTRANO	CA	HAZNET

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
92675	S101612640	9 000000261	PRIMA DESCHECHA SANIT LANDFILL	END OF LA PATA RD		SAN JUAN CAPISTRANO	CA	WDS
92675	S102814613	CAL000068004	SAME DAY PHOTO	27601 FORBES ROAD		LAGUNA NIGUEL	CA	HAZNET
92675	U001559767	30013247	MARBELLA GOLF & COUNTRY CLUB	30650 GOLF CLUB DR		SAN JUAN CAPISTRA	CA	FID
92675	U003147945	CAL000060988	MARBELLA GOLF AND COUNTRY CLUB	30650 GOLF CLUB DR		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S100278096	9118845		S/B I-5 900' NORTH OF EL HORN CREEK		SAN JUAN CAPISTRANO	CA	CHMIRS
92675	1000144813	00000007277	TEXACO	25561 JERANIMO & LOS ALISOS		MISSION VIEJO	CA	UST
92675	U001577829	00000039207	SMI	25502 JERONIMO		MISSION VIEJO	CA	UST
92675	S103646948	CAD981379480	TEXACO REFINING AND MARKETING INC	25561 JERONIMO	**	MISSION VIEJO	CA	HAZNET
92675	S103646949		TEXACO REFINING AND MARKETING INC	25561 JERONIMO RD		MISSION VIEJO	CA	HAZNET
92675	U001577798	00000028576	BERNARD N. BOZEMAN	06571 JUNIPER STA.	**	SAN JUAN CAPISTRANO	CA	UST
92675	U001559779	30001425	SAN JUAN SHELL (6846-0306)	26571 JUNIPERO SERRA RD		SAN JUAN CAPISTRA	CA	FID
92675	S103647933	CAD981458508	EQUILON ENTERPRISES LLC	26571 JUNIPERO SERRA		SAN JUAN CAPISTRANO	CA	HAZNET
92675	1000288482	CAD981458508	SHELL	26571 JUNIPERO SERRA RD		SAN JUAN CAPISTRANO	CA	RCRIS/SQG, FINDS, LUST
92675	S101609604		SAN JUAN EXXON #7-3050	26572 JUNIPERO SERRA RD		SAN JUAN CAPISTRA	CA	FID
92675	S103647937	CAL000074064	SAN JAUN CAPISTRANO EXXON	26572 JUNIPERO	**	SAN JUAN CAPISTRANO	CA	HAZNET
92675	U001577806	00000024021	EXXON	26572 JUNIPERO SERRA RD		SAN JUAN CAPISTRANO	CA	LUST, UST
92675	S103444612		ULTRAMAR / SAN JUAN SERVICE	26572 JUNIPERO SERRA RD		SAN JUAN CAPISTRANO	CA	LUST
92675	S103296767	9UT3636	ULTRAMAR/SAN JUAN SERVICE	26572 JUNIPERO SERRA RD		SAN JUAN CAPISTRANO	CA	LUST
92675	1000857508	CAD983669458	RE ED RESERVOIR	LATITUDE 33-29-33N	**	SAN JUAN CAPIST	CA	RCRIS/SQG, FINDS
92675	S102802175	CAC001021000	LOMAS MORTGAGE INC	9686 LIVE OAK AVE		TEMPLE CITY	CA	HAZNET
92675	S102827761	CLU950002480	DAVID KOBZI	31496 LOS RIOS		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S103652216	CAC001263696	INTOWN PROPERTIES	31604 LOS RIOS ST		SAN JUAN CAPISTRANO	CA	HAZNET
92675	1000145951	CAD981966724	SOLAG DISPOSAL	31731 LOS RIOS		SAN JUAN CAPIST	CA	RCRIS/SQG, FINDS, HAZNET, UST
92675	1000388918	CAT000618926	PRESTIGE STATIONS INC	25122 MARGUERITE PARKWAY		MISSION VIEJO	CA	RCRIS/SQG, FINDS, UST
92675	S103646655	CAL000111352	SAV ON DRUG STORE #3199	25272 MARGUERITE PKWY		MISSION VIEJO	CA	HAZNET
92675	S103646809		BONDED CLEANERS AND LAUNDRY	25482 MARGUERITE PKWY		MISSION VIEJO	CA	HAZNET
92675	U001577814	00000007496	MISSION VIEJO	28242 MARGUERITE PARKWAY		MISSION VIEJO	CA	UST
92675	S100874453	CAD981422645	SOUTHERN CALIFORNIA GAS CO	28242 MARGUERITE PKWY		MISSION VIEJO	CA	HAZNET
92675	1000167585	CAD981422645	SO CALIF GAS CO/MISSION VIEJO	28242 MARGUERITE PKWY		MISSION VIEJO	CA	RCRIS/SQG, FINDS
92675	1000144814	00000007278	TEXACO	28681 MARGUERITE & AVERY		MISSION VIEJO	CA	LUST, UST
92675	1000370093	CAD981651748	COURTESY CLEANERS	25270 MARGURITE PKWY		MISSION VIEJO	CA	RCRIS/SQG, FINDS, HAZNET
92675	1000185857	CAD981696339	BONDED CLEANERS	25482 MARGURITE PKWY		MISSION VIEJO	CA	RCRIS/SQG, FINDS
92675	S102807654	CAD981696339	BONDED CLEANERS AND LAUNDRY	25482 MARGURITE PKWY		MISSION VIEJO	CA	HAZNET
92675	1000442862	CAD981984677	PLAZA CLEANERS	2510 MARGURTIE PKWY	**	MISSION VIEJO	CA	RCRIS/SQG, FINDS, HAZNET
92675	S103647695	CAC000971424	HECTOR GABIRA	26301 MARINA RD		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S103653287	CAC001110208	COUNTY ORANGE/EMA	3301 ORETAGA HWY	**	SAN JUAN CAPISTRANO	CA	HAZNET
92675	U002096195	30001454	MISSION ARCO #1706	26851 ORTEGA HWY		SAN JUAN CAPISTRA	CA	FID
92675	S103648113	CAL000044232	ARCO PRODUCTS COMPANY	26851 ORTEGA HWY		SAN JUAN CAPISTRANO	CA	HAZNET
92675	U001577809	00000026611	ARCO	26851 ORTEGA HWY		SAN JUAN CAPISTRANO	CA	LUST, UST
92675	U002096362	30017425	TEXACO (61-106-334)	26874 ORTEGA HWY		SAN JUAN CAPISTRA	CA	FID
92675	U001577835	00000007284	TEXACO	26874 ORTEGA & EL CAMINO		SAN JUAN CAPISTRANO	CA	CORTESE, LUST, UST
92675	S101631445		CHEVRON STATION #98719	26988 ORTEGA HWY		SAN JUAN CAPISTRA	CA	FID
92675	S102427560	9UT826	CHEVRON SERVICE STATION #8719	26988 ORTEGA HWY		SAN JUAN CAPISTRANO	CA	LUST
92675	S102427408		CHEVRON #9-8719	26988 ORTEGA HWY		SAN JUAN CAPISTRANO	CA	LUST
92675	S103648187	CAD981373400	CHEVRON 98719	26988 ORTEGA HWY		SAN JUAN CAPISTRANO	CA	HAZNET
92675	U002096329	30001406	SHELL (6846-0108)	27101 ORTEGA HWY		SAN JUAN CAPISTRA	CA	FID
92675	U001577828	00000031774	SHELL STA.	27101 ORTEGA		SAN JUAN CAPISTRANO	CA	UST
92675	U003148270		SHELL	27101 ORTEGA HWY		SAN JUAN CAPISTRANO	CA	LUST
92675	S102437361	9UT490	SHELL SERVICE STATION *	27101 ORTEGA HWY		SAN JUAN CAPISTRANO	CA	CORTESE, LUST
92675	S101631444		CHEVRON STATION #93160	27112 ORTEGA HWY		SAN JUAN CAPISTRA	CA	FID
92675	S103648418	CAL000049843	CHEVRON 93160	27112 ORTEGA HIGHWAY		SAN JUAN CAPISTRANO	CA	HAZNET
92675	U001577796	00000062398	93160	27112 ORTEGA HWY		SAN JUAN CAPISTRANO	CA	LUST, UST
92675	S102427772	9UT2030	CHEVRON STATION #9-3160	27112 ORTEGA HWY		SAN JUAN CAPISTRANO	CA	LUST
92675	S103648419		CHEVRON 93160	27112 ORTEGA HWY		SAN JUAN CAPISTRANO	CA	HAZNET
92675	U002096419	30001411	UNOCAL #5425	27164 ORTEGA HWY		SAN JUAN CAPISTRA	CA	FID
92675	U001577836	00000019979	UNION OIL SERVICE STATION #542	27164 ORTEGA HIGHWAY		SAN JUAN CAPISTRANO	CA	UST
92675	S100231061	9UT448	UNOCAL SERVICE STATION #5425	27164 ORTEGA HWY		SAN JUAN CAPISTRANO	CA	LUST, HAZNET
92675	S102440230		UNOCAL S S #5425	27164 ORTEGA HWY		SAN JUAN CAPISTRANO	CA	LUST
92675	S103301380		TOSCO/76 PRODUCTS STATION #5425	27164 ORTEGA HWY		SAN JUAN CAPISTRANO	CA	LUST
92675	U001577832	00000043722	STATION #5425	27164 ORTEGA HWY.		SAN JUAN CAPISTRANO	CA	UST
92675	S101619710		RANCHO MISSION VIEJO	28672 ORTEGA HWY		SAN JUAN CAPISTRA	CA	FID
92675	U001577822	00000043488	RANCHO MISSION VIEJO	28672 ORTEGA HWY		SAN JUAN CAPISTRANO	CA	CORTESE, LUST, HAZNET, UST
92675	S102435686		RANCHO MISSION VIEJO	28675 ORTEGA HWY		SAN JUAN CAPISTRANO	CA	LUST
92675	U002096005	30012936	CHIQUITA WATER RECLAMATION PL	28793 ORTEGA HWY		SAN JUAN CAPISTRA	CA	FID
92675	S102005219	9 0000175S4	SANTA MARG WD CHIQUITA WRP	28793 ORTEGA HWY		SAN JUAN CAPISTRANO	CA	WDS
92675	U003147616	9 000000457	CHIQUITA WWTP	28793 ORTEGA HWY		SAN JUAN CAPISTRANO	CA	WDS
92675	U001577816	00000046061	OKUMA BROS.	28909 ORTEGA HWY.		SAN JUAN CAPISTRANO	CA	UST
92675	U002095969	30017392	CAPISTRANO WHOLESALE NURSERY	29812 ORTEGA HWY		SAN JUAN CAPISTRA	CA	FID
92675	1000252195	CAD040522351	CALIFORNIA SILICA PROD CO	31302 ORTEGA HIGHWAY		SAN JUAN CAPISTRANO	CA	RCRIS/SQG, FINDS, CORTESE,

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
								LUST
92675	S100941339	CAD040522351	OGLEBAY NORTON INDUSTRIAL SANDS II	31302 ORTEGA HIGHWAY		SAN JUAN CAPISTRANO	CA	HAZNET
92675	U001577815	00000016621	MISSION VIEJO SAND PLANT	31302 ORTEGA HIGHWAY		SAN JUAN CAPISTRANO	CA	UST, WDS
92675	S102426011	9UT1752	CA SILICA PRODUCTS CO.	31302 ORTEGA HWY		SAN JUAN CAPISTRANO	CA	LUST
92675	S103651956		OGLEBAY NORTON INDUSTRIAL SANDS II	31302 ORTEGA HWY		SAN JUAN CAPISTRANO	CA	HAZNET
92675	U003147785	9UT3523	OGLEBAY NORTON INDUSTRIAL SAND	31302 ORTEGA HWY		SAN JUAN CAPISTRANO	CA	LUST
92675	U003433274		OGLEBAY NORTON INDUSTRIAL SAND	31302 ORTEGA HWY		SAN JUAN CAPISTRANO	CA	LUST, UST
92675	1000595915	CAD983598731	RANCHO MISSION VIEJO	31471 ORTEGA HWY		SAN JUAN CAPISTRA	CA	FID, HAZNET, RCRIS/SQG, FINDS
92675	1000123778	CAD981571227	CATALINA PACIFIC CONCRETE	31511 ORTEGA HWY		SAN JUAN CAPISTRA	CA	FID, RCRIS/SQG, FINDS
92675	U001577824	00000005689	SAN JUAN	31511 ORTEGA HWY		SAN JUAN CAPISTRANO	CA	UST
92675	S100931411	9UT1699	CAL MAT	31511 ORTEGA HWY		SAN JUAN CAPISTRANO	CA	LUST
92675	S101541328	CAD981571227	CALIFORNIA PORTLAND CEMENT CO	31511 ORTEGA HWY		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S103653573	CAC001188240	RANCHO DEL RIO GIRL SCOUTS COUNCIL	33300 ORTEGA HWY		SAN JUAN CAPISTRANO	CA	HAZNET
92675	U002095971	30017629	CASPER REGIONAL PARK	33401 ORTEGA HWY		SAN JUAN CAPISTRA	CA	FID
92675	S103653672	CAC000771808	COUNTY OF ORANGE/HARBORS BEACHE	33401 ORTEGA HWY/CASPERS PARK	**	SAN JUAN CAPISTRANO	CA	HAZNET
92675	S102430105	9UT1747	FORD AEROSPACE CORPORATION	33600 ORTEGA HWY		SAN JUAN CAPISTRANO	CA	LUST
92675	S102430104		FORD AEROSPACE CORP	33600 ORTEGA HWY		SAN JUAN CAPISTRANO	CA	LUST
92675	S103653782	CAD980893333	LORAL AEROSPACE CORPORATION	33600 ORTEGA HWY		SAN JUAN CAPISTRANO	CA	HAZNET
92675	1000182595	CAD980893333	LORAL AERONUTRONIC	33600 ORTEGA HWY NON TSD		SAN JUAN CAPISTRANO	CA	PADS, RCRIS/SQG, FINDS
92675	1000978070	CAD981393085	FORD MOTOR CO	33600 ORTEGA HWY TSD SITE		SAN JUAN CAPISTRANO	CA	RCRIS/SQG, FINDS
92675	S102005210	9 000000502	NICHOLS RESEACH INSTITUTE WRF	33608 ORTEGA HWY		SAN JUAN CAPISTRANO	CA	WDS
92675	1000594883	CAD983587676	ORTEGA ROCK QUARRY	33977 ORTEGA HWY		SAN JUAN CAPISTRA	CA	FID, HAZNET, RCRIS/SQG, FINDS
92675	S102432759	9UT2481	LOS PINOS FORESTRY CAMP	39251 ORTEGA		UNINCORPORATED ORANG	CA	CORTESE, LUST
92675	S100926569	CAC000749384	1X FORD MOTOR LAND DEVELOPMENT C	3360 ORTIGA HIGHWAY	**	SAN JUAN CAPISTRANO	CA	HAZNET
92675	U001577837	00000013558	UNION OIL SERVICE STATION #639	26282 OSO PARKWAY		MISSION VIEJO	CA	UST
92675	93306647		OSO ST	OSO ST	**	SAN JUAN CAPISTRANO	CA	ERNS
92675	1001264821	CA0948431	PRIMA DESCHECHA LANDFILL	32250 LA PACTA ROAD	**	SAN JUAN CAPIST	CA	FINDS
92675	S100944261	CAL000000746	SAN JUAN RENT-IT SERVICE	32202 PASCO ADELANTO		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S103647904	CAC001303824	HUD	26547 PASEO SANTA CLARA		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S103648435	CAC001223888	CAPISTRANO BUSNESS CENTER	27130 B PASEO ESTADA #501	**	SAN JUAN CAPISTRANO	CA	HAZNET
92675	S100929464	CAL000111798	AMERICAN SPEEDY PRINTING	27134 B PASEO ESPADA_STE 203	**	SAN JUAN CAPISTRANO	CA	HAZNET
92675	S103648437	CAL912944722	AMERICAN SPEEDY PRINTING	27134A PASEO ESPADA	**	SAN JUAN CAPISTRANO	CA	HAZNET
92675	U002096338	30017624	SOLAG	31731 PASEO ADELANTO		SAN JUAN CAPISTRA	CA	FID
92675	S102955672	9UT3568	SOLAG DISPOSAL	31731 PASEO ADELANTO		SAN JUAN CAPISTRANO	CA	LUST
92675	S102809810	CAL000011764	CALIFORNIA DESERT ENGINES	32122 PASEO ADELANTO		SAN JUAN CAPISTRANO	CA	HAZNET
92675	U001577810	00000066436	J. W. NOVAKOFF & CO., INC.	32192 PASEO ADELANTO		SAN JUAN CAPISTRANO	CA	UST
92675	U001559778	30001487	SAN JUAN RENT IT SERVICE	32202 PASEO ADELANTO		SAN JUAN CAPISTRA	CA	FID
92675	S103652714		SAN JUAN RENT-IT SERVICE	32202 PASEO ADELANTO		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S103652742	CAD983653528	HIGH END AUTO COLLISION	32242 PASEO ADELANTO		SAN JUAN CAPISTRANO	CA	HAZNET
92675	1000819371	CAD983653528	HIGH END AUTO COLLISION	32242 PASEO ADELANTRO		SAN JUAN CAPIST	CA	RCRIS/SQG, FINDS
92675	S102406151	9 000000760	SEWAGE COLLECTION SYSTEM	3240 PASEO ADELANTO	**	SAN JUAN CAPISTRANO	CA	WDS
92675	S101631446		CITY OF SAN JUAN CAPISTRANO	32400 PASEO ADELANTO		SAN JUAN CAPISTRA	CA	FID
92675	S103617637	9 0000511S7	ORANGE CO* MSW	32400 PASEO ADELANTO		SAN JUAN CAPISTRANO	CA	WDS
92675	U001577804	00000033526	CITY HALL/SERVICE YARD	32400 PASEO ADELANTO		SAN JUAN CAPISTRANO	CA	LUST, UST
92675	1001433058	CA0107956	SAN JUAN GRNDWTR IMPRVMNT PRJT	32450 PASEO ADELANTO	**	SAN JUAN CAPIST	CA	FINDS
92675	S102005206	9 000000251	SAN JUAN GRNDWTR IMPRVMNT PRJT	32450 PASEO ADELANTO		SAN JUAN CAPISTRANO	CA	WDS
92675	S103652288	CAC001134864	BROWNING FERROUS INDUSTRIES - LA F	31748 LA PATA	**	SAN JUAN CAPISTRANO	CA	HAZNET
92675	S103652752	CAL000096020	PRIMA REPAIR FACILITY STA 26	32250 LA PATA	**	SAN JUAN CAPISTRAN	CA	HAZNET
92675	1001247760	CA0963267	ORANGE CO INTEGRATED- WASTE MA	32250 LA PATA AVE	**	SAN JUAN CAPIST	CA	FINDS
92675	S103652753	CAD981679145	CTY OF ORANGE PRIMA DESHECHA LANI	32250 LA PATA AVENUE	**	SAN JUAN CAPISTRANO	CA	HAZNET
92675	U001577820	00000026679	PRESTIGE STATIONS INC #699	26001 LA PAZ RD		MISSION VIEJO	CA	LUST, UST
92675	S103647363	CAL000016665	ARCO PRODUCTS COMPANY	26001 LA PAZ RD		MISSION VIEJO	CA	HAZNET
92675	S103647364		ARCO PRODUCTS COMPANY	26001 LA PAZ ROAD		MISSION VIEJO	CA	HAZNET
92675	S100463152	9UT824	MOBIL SERVICE STATION #18	26051 LA PAZ RD		MISSION VIEJO	CA	CORTESE, LUST, HAZNET
92675	U001577823	00000039376	ROBERT K. BIRKINSHAW	26051 LA PAZ RD.		MISSION VIEJO	CA	UST
92675	S103647451	CAL000020362	BOB'S MOBIL	26051 LA PAZ ROAD		MISSION VIEJO	CA	HAZNET
92675	S103620843	CAC001014768	WES NORTON	10295 QUAIL SPRINGS ROAD	**	MURRIETA	CA	HAZNET
92675	S102824141	CAL000148517	COMPREHENSIVE CHIROPRACTIC	30210 RANCHO VIEJO		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S103651066	CAL000111993	BRADFUL OF STAPH DDS APC	30210 RANCHO VIEJO RD		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S102005221	9 000000175	SERRA OCEAN OUTFALL	30290 RANCHO VIEJO RD		SAN JUAN CAPISTRANO	CA	WDS
92675	S102005000	9 000000117	ALISO OCEAN OUTFALL	30290 RANCHO VIEJO RD		SAN JUAN CAPISTRANO	CA	WDS
92675	1000591967	CA0107611	ALISO OCEAN OUTFALL	30290 RANCHO VIEJO ROAD		SAN JUAN CAPIST	CA	FINDS
92675	1000589882	CA0107417	SERRA OCEAN OUTFALL	30290 RANCHO VIEJO ROAD		SAN JUAN CAPIST	CA	FINDS, LUST
92675	S103651157	CAL000117284	HERITAGE HEALTH FOUNDATION	30300 RANCHO VIEJO RD		SAN JUAN CAPISTRANO	CA	HAZNET
92675	1000886353	CA0000146068	ENDEVCO	30700 RANCHO VIEJO RD		SAN JUAN CAPISTRANO	CA	INDUSTRIAL SITE, HAZNET, RCRIS/SQG, FINDS
92675	1000818235	CAD983639840	POLO CLEANERS	31105 RANCHO VIEJO RD		SAN JUAN CAPIST	CA	RCRIS/SQG, FINDS, HAZNET
92675	1000202353	CAD982029530	ORTEGA CLEANERS	31654 RANCHO VIEJO RD STE F		SAN JUAN CAPIST	CA	RCRIS/SQG, FINDS, HAZNET
92675	1000595914	CAD983598723	A ALIGNMENT BRAKE SPECIALIST	3284 SALLE PERFECTO		SAN JUAN CAPIST	CA	RCRIS/SQG, FINDS

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
92675	S101609603		SAN JUAN HILLS GOLF CLUBHOUSE	32120 SAN JUAN CREEK RD		SAN JUAN CAPISTRA	CA	FID
92675	U001577827	00000066117	SAN JUAN HILLS COUNTRY CLUB	32120 SAN JUAN CREEK		SAN JUAN CAPISTRANO	CA	HAZNET, UST
92675	S103652827	CAL000156586	SAN JUAN ANIMAL HOSPITAL, INC	32391 SAN JUAN CREEK RD		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S103653045	CAC001346832	RESCO	32731 SAN JUAN CREEK RD		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S103648993	CAC001020992	LOMAS MORTGAGE INC	27836 SOMERSET LN		SAN JUAN CAPISTRANO	CA	HAZNET
92675	S100278520	9120678		S/B SR 1	**	SAN JUAN CAPISTRANO	CA	CHMIRS
92675	U001577830	00000039211	SMI	26811 TRABUCO RD.		MISSION VIEJO	CA	UST
92675	U002096197	30003894	MISSION VIEJO MATERIALS	29261 TRABUCO CREEK RD		SAN JUAN CAPISTRA	CA	FID
92675	S103650083	CAC000522736	1X MISSION VIEJO MATERIALS, INC.	29261 TRABUCO CREEK RD		SAN JUAN CAPISTRANO	CA	HAZNET
92675	U003147981	9UT1753	MISSION VIEJO MATERIALS INC	29261 TRABUCO CREEK RD		SAN JUAN CAPISTRANO	CA	LUST
92675	U003433192		MISSION VIEJO MATERIALS	29261 TRABUCO CREEK RD		SAN JUAN CAPISTRANO	CA	LUST, UST
92675	U001577826	00000041806	SAN JUAN CAPISTRANO ROCK AND G	29261 TRABUCO CREEK ROAD		SAN JUAN CAPISTRANO	CA	UST
92675	S102430810		GLEN FED DEVELOPMENT CO	TRACT 10139	**	SAN JUAN CAPISTRANO	CA	LUST
92675	S102432719	9UT197	LOMAS SAN JUAN MODEL HOME SITE	TRACT 10139	**	SAN JUAN CAPISTRANO	CA	LUST
92675	S101299943	9UT1169	SHELL OIL STATION	26571 UNIPERO SERRA		SAN JUAN CAPISTRANO	CA	CORTESE, LUST
92675	S103442732		PROVINCIAL PROPERTIES DUMP	UNKNOWN	**	SAN JUAN CAPISTRANO	CA	WMUDS/SWAT
92675	1001134912	CAR000006437	SAN JUAN LINCOLN MERCURY	32592 VALLE RD		SAN JUAN CAPISTRANO	CA	HAZNET
92675	1000905518	CA0000808303	CAPISTRANO VOLKSWAGEN	32852 VALLE RD		SAN JUAN CAPIST	CA	RCRIS/SQG, FINDS
92675	U001577799	00000011414	BILL YATES, INC.	32852 VALLE RD.		SAN JUAN CAPISTRANO	CA	UST
92675	1001075555	CAR000006437	CAPISTRANO LINCOLN MERCURY	32592 VALLEY RD		SAN JUAN CAPISTRANO	CA	RCRIS/SQG, FINDS
92675	1000234980	CAD982497224	WRIGHT TRANS INC	25581 VIA SOLIS		SAN JUAN CAPIST	CA	RCRIS/SQG, FINDS
92675	U001577833	00000027188	STATION #9	26312 VIA CUROCION		MISSION VIEJO	CA	UST
92675	S103647733	CAL000114336	ORANGE COAST COLLISION	26361 VIA DE ANZA		SAN JUAN CAPISTRANO	CA	HAZNET
92675	U002095919	30012853	AUTOMOTIVE INTERNATIONAL	26362 VIA DE ANZA		SAN JUAN CAPISTRA	CA	FID
92675	S100855821	CAL000040577	AUTOMOTIVE INTERNATIONAL BODY REF	26362 VIA DE ANZA		SAN JUAN CAPISTRANO	CA	HAZNET
92675	1000297887	CAD981629249	CARMER AUTO BODY SOUTH INC	26371 VIA DE ANZA		SAN JUAN CAPISTRANO	CA	HAZNET
92675	1000229127	CAD981986409	SURFGLAS SURF PRODUCTS	26382 VIA DE ANZA		SAN JUAN CAPIST	CA	RCRIS/SQG, FINDS
92675	S103647743	CAL000005428	BECKS AUTO SVC INC	26382 VIA DE ANZA		SAN JUAN CAPISTRANO	CA	HAZNET
92675	1001231373	CAR000044115	CALIBER COLLISION CENTER	26442 VIA DE ANZA		SAN JUAN CAPISTRANO	CA	RCRIS/SQG, FINDS
92675	S103647930	CAC001300992	HUD	26565 LA ZANJA ST		SAN JUAN CAPISTRANO	CA	HAZNET

GEOCHECK VERSION 2.1 ADDENDUM
STATE DATABASE WELL INFORMATION

Water Wells:

Well Within >2 Miles of Target Property (Southern Quadrant)

Water System Information:

Prime Station Code:	09S/07W-01F01 S	User ID:	WAT
FRDS Number Number:	3710700025	County:	San Diego
District Number:	14	Station Type:	WELL/AMBNT/MUN/INTAKE
Water Type:	Well/Groundwater	Well Status:	Monitoring Well
Source Lat/Long:	332513.0 1173356.0	Precision:	1,000 Feet (10 Seconds)
Source Name:	WELL 62605 (Y) - MONITORING WELL		
System Number:	3710700		
System Name:	Camp Pendleton (North)		
Organization That Operates System:			
	P.O. Box 555008		
	MCB, Camp Pendleton, CA 92055		
Pop Served:	12000	Connections:	2500
Area Served:	Not Reported		

Well Within 1 - 2 Miles of Target Property (Western Quadrant)

Water System Information:

Prime Station Code:	08S/07W-24M01 S	User ID:	TEE
FRDS Number Number:	3000803001	County:	Orange
District Number:	08	Station Type:	WELL/AMBNT/MUN/INTAKE
Water Type:	Well/Groundwater	Well Status:	Active Untreated
Source Lat/Long:	332734.6 1173409.5	Precision:	100 Feet (one Second)
Source Name:	WELL 01		
System Number:	3000803		
System Name:	TRW Systems, Capistrano Test Site		
Organization That Operates System:			
	P.O. Box 10		
	San Clemente, CA 92673		
Pop Served:	60	Connections:	17
Area Served:	Not Reported		

Sample Information: * Only Findings Above Detection Level Are Listed

Sample Collected:	12/06/1995	Findings:	.440 MG/L
Chemical:	FLUORIDE (TEMPERATURE DEPENDENT)		

GEOCHECK VERSION 2.1
PUBLIC WATER SUPPLY SYSTEM INFORMATION

Searched by Nearest PWS.

PWS SUMMARY:

PWS ID:	CA3010036	PWS Status:	Active	Distance from TP:	>2 Miles
Date Initiated:	June / 1977	Date Deactivated:	Not Reported	Dir relative to TP:	West
PWS Name:	CITY OF SAN CLEMENTE 100 AVENIDA PRESIDIO SAN CLEMENTE, CA 92672				
Addressee / Facility:	Not Reported				
Facility Latitude:	33 25 36		Facility Longitude:	117 36 39	
City Served:	SAN CLEMENTE				
Treatment Class:	Mixed (treated and untreated)		Population Served:	10,001 - 50,000 Persons	

PWS currently has or has had major violation(s) or enforcement: No

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Elapsed ASTM days: Provides confirmation that this EDR report meets or exceeds the 90-day updating requirement of the ASTM standard.

FEDERAL ASTM RECORDS:

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System
Source: EPA
Telephone: 703-413-0223
CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 04/21/99
Date Made Active at EDR: 06/09/99
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 05/14/99
Elapsed ASTM days: 26
Date of Last EDR Contact: 05/14/99

ERNS: Emergency Response Notification System
Source: EPA/NTIS
Telephone: 202-260-2342
Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 12/31/98
Date Made Active at EDR: 01/18/99
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 01/13/99
Elapsed ASTM days: 5
Date of Last EDR Contact: 05/12/99

NPL: National Priority List
Source: EPA
Telephone: N/A
National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC).

Date of Government Version: 05/10/99
Date Made Active at EDR: 06/09/99
Database Release Frequency: Semi-Annually
Date of Data Arrival at EDR: 05/12/99
Elapsed ASTM days: 28
Date of Last EDR Contact: 05/12/99

RCRIS: Resource Conservation and Recovery Information System
Source: EPA/NTIS
Telephone: 800-424-9346
Resource Conservation and Recovery Information System. RCRIS includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA).

Date of Government Version: 04/26/99
Date Made Active at EDR: 06/09/99
Database Release Frequency: Semi-Annually
Date of Data Arrival at EDR: 05/14/99
Elapsed ASTM days: 26
Date of Last EDR Contact: 05/14/99

CORRACTS: Corrective Action Report
Source: EPA
Telephone: 800-424-9346
CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 03/01/99
Date Made Active at EDR: 04/16/99
Database Release Frequency: Semi-Annually
Date of Data Arrival at EDR: 03/17/99
Elapsed ASTM days: 30
Date of Last EDR Contact: 06/21/99

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

FEDERAL NON-ASTM RECORDS:

BRS: Biennial Reporting System
Source: EPA/NTIS
Telephone: 800-424-9346
The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/95
Database Release Frequency: Biennially
Date of Last EDR Contact: 03/25/99
Date of Next Scheduled EDR Contact: 06/21/99

CONSENT: Superfund (CERCLA) Consent Decrees
Source: EPA Regional Offices
Telephone: Varies
Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: Varies
Database Release Frequency: Varies
Date of Last EDR Contact: Varies
Date of Next Scheduled EDR Contact: N/A

FINDS: Facility Index System/Facility Identification Initiative Program Summary Report
Source: EPA
Telephone: N/A
Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 04/01/99
Database Release Frequency: Quarterly
Date of Last EDR Contact: 04/16/99
Date of Next Scheduled EDR Contact: 07/12/99

HMIRS: Hazardous Materials Information Reporting System
Source: U.S. Department of Transportation
Telephone: 202-366-4526
Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 12/31/97
Database Release Frequency: Annually
Date of Last EDR Contact: 03/24/99
Date of Next Scheduled EDR Contact: 07/26/99

MLTS: Material Licensing Tracking System
Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 12/08/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 04/13/99
Date of Next Scheduled EDR Contact: 07/12/99

NPL LIENS: Federal Superfund Liens
Source: EPA
Telephone: 205-564-4267
Federal Superfund Liens. Under the authority granted the USEPA by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner receives notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/91
Database Release Frequency: No Update Planned
Date of Last EDR Contact: 05/28/98
Date of Next Scheduled EDR Contact: 08/23/99

PADS: PCB Activity Database System
Source: EPA
Telephone: 202-260-3936
PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 09/22/97
Database Release Frequency: No Update Planned
Date of Last EDR Contact: 05/27/99
Date of Next Scheduled EDR Contact: 08/16/99

RAATS: RCRA Administrative Action Tracking System
Source: EPA
Telephone: 202-564-4104
RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/95
Database Release Frequency: No Update Planned
Date of Last EDR Contact: 06/14/99
Date of Next Scheduled EDR Contact: 09/13/99

ROD: Records Of Decision
Source: NTIS
Telephone: 703-416-0223
Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 01/31/99
Database Release Frequency: Annually
Date of Last EDR Contact: 05/25/99
Date of Next Scheduled EDR Contact: 07/19/99

TRIS: Toxic Chemical Release Inventory System
Source: EPA
Telephone: 202-260-1531
Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/97
Database Release Frequency: Annually
Date of Last EDR Contact: 05/07/99
Date of Next Scheduled EDR Contact: 06/28/99

TSCA: Toxic Substances Control Act
Source: EPA
Telephone: 202-260-1444
Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/94
Database Release Frequency: Every 4 Years
Date of Last EDR Contact: 04/26/99
Date of Next Scheduled EDR Contact: 07/26/99

MINES: Mines Master Index File
Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959

Date of Government Version: 08/01/98
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 04/08/99
Date of Next Scheduled EDR Contact: 07/05/99

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

STATE OF CALIFORNIA ASTM RECORDS:

BEP: Bond Expenditure Plan
Source: Department of Health Services
Telephone: 916-255-2118
Department of Health Services developed a site-specific expenditure plan as the basis for an appropriation of Hazardous Substance Cleanup Bond Act funds. It is not updated.

Date of Government Version: 01/01/89
Date Made Active at EDR: 08/02/94
Database Release Frequency: No Update Planned
Date of Data Arrival at EDR: 07/27/94
Elapsed ASTM days: 6
Date of Last EDR Contact: 05/31/94

CAL-SITES (AWP): Annual Workplan
Source: California Environmental Protection Agency
Telephone: 916-323-3400
Known Hazardous Waste Sites. California DTSC's Annual Workplan (AWP), formerly BEP, identifies known hazardous substance sites targeted for cleanup.

Date of Government Version: 03/02/99
Date Made Active at EDR: 06/29/99
Database Release Frequency: Annually
Date of Data Arrival at EDR: 06/01/99
Elapsed ASTM days: 28
Date of Last EDR Contact: 05/04/99

CAL-SITES (ASPIS): Calsites
Source: Department of Toxic Substance Control
Telephone: 916-323-3400
The Calsites database contains potential or confirmed hazardous substance release properties. In 1996, California EPA reevaluated and significantly reduced the number of sites in the Calsites database.

Date of Government Version: 04/01/99
Date Made Active at EDR: 06/03/99
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 05/04/99
Elapsed ASTM days: 30
Date of Last EDR Contact: 03/08/98

CHMIRS: California Hazardous Material Incident Report System
Source: Office of Emergency Services
Telephone: 916-464-3277
California Hazardous Material Incident Reporting System. CHMIRS contains information on reported hazardous material incidents (accidental releases or spills).

Date of Government Version: 12/31/94
Date Made Active at EDR: 04/24/95
Database Release Frequency: No Update Planned
Date of Data Arrival at EDR: 03/13/95
Elapsed ASTM days: 42
Date of Last EDR Contact: 06/01/99

CORTESE: Cortese
Source: CAL EPA/Office of Emergency Information
Telephone: 916-327-1848
The sites for the list are designated by the State Water Resource Control Board (LUST), the Integrated Waste Board (SWF/LS), and the Department of Toxic Substances Control (Cal-Sites).

Date of Government Version: 04/01/98
Date Made Active at EDR: 09/23/98
Database Release Frequency: Annually
Date of Data Arrival at EDR: 08/26/98
Elapsed ASTM days: 28
Date of Last EDR Contact: 05/03/99

LUST: Leaking Underground Storage Tank Information System
Source: State Water Resources Control Board
Telephone: 916-445-6532
Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 01/31/99
Date Made Active at EDR: 04/02/99
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 03/05/99
Elapsed ASTM days: 28
Date of Last EDR Contact: 05/10/99

NOTIFY 65: Proposition 65
Source: State Water Resources Control Board
Telephone: 916-657-0696
Proposition 65 Notification Records. NOTIFY 65 contains facility notifications about any release which could impact drinking water and thereby expose the public to a potential health risk.

Date of Government Version: 10/21/93
Date Made Active at EDR: 11/19/93
Database Release Frequency: No Update Planned
Date of Data Arrival at EDR: 11/01/93
Elapsed ASTM days: 18
Date of Last EDR Contact: 04/26/99

SWF/LF (SWIS): Solid Waste Information System
Source: Integrated Waste Management Board
Telephone: 916-255-4035
Active, Closed and Inactive Landfills. SWF/LF records typically contain an inventory of solid waste disposal facilities or landfills. These may be active or inactive facilities or open dumps that failed to meet RCRA Section 2004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 03/08/99
Date Made Active at EDR: 04/07/99
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 03/08/99
Elapsed ASTM days: 30
Date of Last EDR Contact: 06/07/99

TOXIC PITS: Toxic Pits
Source: State Water Resources Control Board
Telephone: 916-227-4364
Toxic PITS Cleanup Act Sites. TOXIC PITS identifies sites suspected of containing hazardous substances where cleanup has not yet been completed.

Date of Government Version: 07/01/95
Date Made Active at EDR: 09/26/95
Database Release Frequency: No Update Planned
Date of Data Arrival at EDR: 08/30/95
Elapsed ASTM days: 27
Date of Last EDR Contact: 05/10/99

CA UST:

UST: Hazardous Substance Storage Container Database
Source: State Water Resources Control Board
Telephone: 916-227-4408
The Hazardous Substance Storage Container Database is a historical listing of UST sites. Refer to local/county source for current data.

Date of Government Version: 10/15/90
Date Made Active at EDR: 02/12/91
Database Release Frequency: No Update Planned
Date of Data Arrival at EDR: 01/25/91
Elapsed ASTM days: 18
Date of Last EDR Contact: 04/19/99

FID: Facility Inventory Database
Source: California Environmental Protection Agency
Telephone: 916-445-6532
The Facility Inventory Database (FID) contains a historical listing of active and inactive underground storage tank locations from the State Water Resource Control Board. Refer to local/county source for current data.

Date of Government Version: 10/31/94
Date Made Active at EDR: 09/29/95
Database Release Frequency: No Update Planned
Date of Data Arrival at EDR: 09/05/95
Elapsed ASTM days: 24
Date of Last EDR Contact: 12/28/98

WMUDS/SWAT: Waste Management Unit Database
Source: State Water Resources Control Board
Telephone: 916-227-4448
Waste Management Unit Database System. WMUDS is used by the State Water Resources Control Board staff and the Regional Water Quality Control Boards for program tracking and inventory of waste management units. WMUDS is composed of the following databases: Facility Information, Scheduled Inspections Information, Waste Management Unit Information, SWAT Program Information, SWAT Report Summary Information, SWAT Report Summary Data, Chapter 15 (formerly Subchapter 15) Information, Chapter 15 Monitoring Parameters, TPCA Program Information, RCRA Program Information, Closure Information, and Interested Parties Information.

Date of Government Version: 03/01/99
Date Made Active at EDR: 04/30/99
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 04/02/99
Elapsed ASTM days: 28
Date of Last EDR Contact: 06/15/99

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

STATE OF CALIFORNIA NON-ASTM RECORDS:

AST: Aboveground Petroleum Storage Tank Facilities
Source: State Water Resources Control Board
Telephone: 916-227-4382
Registered Aboveground Storage Tanks.

Date of Government Version: 02/22/99
Database Release Frequency: Quarterly
Date of Last EDR Contact: 05/10/99
Date of Next Scheduled EDR Contact: 08/09/99

HAZNET: Hazardous Waste Information System
Source: California Environmental Protection Agency
Telephone: 916-324-1781
Facility and Manifest Data. The data is extracted from the copies of hazardous waste manifests received each year by the DTSC. The annual volume of manifests is typically 700,000 - 1,000,000 annually, representing approximately 350,000 - 500,000 shipments. Data are from the manifests submitted without correction, and therefore many contain some invalid values for data elements such as generator ID, TSD ID, waste category, and disposal method.

Date of Government Version: 12/31/97
Database Release Frequency: Annually
Date of Last EDR Contact: 04/19/99
Date of Next Scheduled EDR Contact: 07/19/99

SOUTH BAY: South Bay Site Management System
Source: California Regional Water Quality Control Board San Francisco Bay Region (2)
Telephone: 510-286-0457
Groundwater pollution cases in the Santa Clara Valley where the regulatory lead is the San Francisco Bay Regional Water Quality Control Board.

Date of Government Version: 09/01/96
Database Release Frequency: Annually
Date of Last EDR Contact: 05/19/99
Date of Next Scheduled EDR Contact: 08/16/99

WDS: Waste Discharge System
Source: State Water Resources Control Board
Telephone: 916-657-1571
Sites which have been issued waste discharge requirements.

Date of Government Version: 03/01/99
Database Release Frequency: Quarterly
Date of Last EDR Contact: 05/24/99
Date of Next Scheduled EDR Contact: 08/23/99

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

CALIFORNIA COUNTY RECORDS

ALAMEDA COUNTY:

Underground Tanks
Source: Alameda County Environmental Health Services
Telephone: 510-567-6700

Date of Government Version: 01/04/99
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 05/03/99
Date of Next Scheduled EDR Contact: 08/02/99

Local Oversight Program Listing of UGT Cleanup Sites
Source: Alameda County Environmental Health Services
Telephone: 510-567-6700

Date of Government Version: 01/04/99
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 05/03/69
Date of Next Scheduled EDR Contact: 08/02/99

CONTRA COSTA COUNTY:

SL: Site List
Source: Contra Costa Health Services Department
Telephone: 925-646-2286
List includes sites from the underground tank, hazardous waste generator and business plan/2185 programs.

Date of Government Version: 01/04/99
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 06/07/99
Date of Next Scheduled EDR Contact: 09/06/99

KERN COUNTY:

UST: Sites & Tanks Listing
Source: Kern County Environment Health Services Department
Telephone: 805-862-8700
Kern County Sites and Tanks Listing.

Date of Government Version: 03/04/99
Database Release Frequency: Quarterly
Date of Last EDR Contact: 06/21/99
Date of Next Scheduled EDR Contact: 09/06/99

LOS ANGELES COUNTY:

HMS: Street Number List
Source: Department of Public Works
Telephone: 626-458-3517
Industrial Waste and Underground Storage Tank Sites.

Date of Government Version: 03/31/99
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 04/12/99
Date of Next Scheduled EDR Contact: 07/12/99

SWF/LF: List of Solid Waste Facilities
Source: La County Department of Public Works
Telephone: 818-458-5185

Date of Government Version: 09/16/98
Database Release Frequency: Annually
Date of Last EDR Contact: 05/24/99
Date of Next Scheduled EDR Contact: 08/23/99

Site Mitigation List
Source: Community Health Services
Telephone: 213-890-7806
Industrial sites that have had some sort of spill or complaint.

Date of Government Version: 03/23/99
Database Release Frequency: Annually
Date of Last EDR Contact: 05/24/99
Date of Next Scheduled EDR Contact: 08/23/99

MARIN COUNTY:

UST Sites
Source: Public Works Department Waste Management
Telephone: 415-499-6647
Currently permitted USTs in Marin County.

Date of Government Version: 03/01/99
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 05/10/99
Date of Next Scheduled EDR Contact: 08/09/99

SAN JOSE COUNTY:

Hazmat Facilities
Source: City of San Jose Fire Department
Telephone: 408-277-4659

Date of Government Version: 04/27/99
Database Release Frequency: Quarterly
Date of Last EDR Contact: 05/24/99
Date of Next Scheduled EDR Contact: 08/23/99

NAPA COUNTY:

LUST: Sites With Reported Contamination
Source: Napa County Department of Environmental Management
Telephone: 707-253-4269

Date of Government Version: 10/27/97
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 06/21/99
Date of Next Scheduled EDR Contact: 09/20/99

UST: Closed and Operating Underground Storage Tank Sites
Source: Napa County Department of Environmental Management
Telephone: 707-253-4269

Date of Government Version: 02/17/98
Database Release Frequency: Annually
Date of Last EDR Contact: 06/21/99
Date of Next Scheduled EDR Contact: 09/20/99

ORANGE COUNTY:

List of Industrial Site Cleanups
Source: Health Care Agency
Telephone: 714-834-3446
Petroleum and non-petroleum spills.

Date of Government Version: 01/19/99
Database Release Frequency: Quarterly
Date of Last EDR Contact: 06/14/99
Date of Next Scheduled EDR Contact: 09/13/99

LUST: List of Underground Storage Tank Cleanups
Source: Health Care Agency
Telephone: 714-834-3446
Orange County Underground Storage Tank Cleanups (LUST).

Date of Government Version: 01/04/99
Database Release Frequency: Quarterly
Date of Last EDR Contact: 06/14/99
Date of Next Scheduled EDR Contact: 09/13/99

UST: List of Underground Storage Tank Facilities
Source: Health Care Agency
Telephone: 714-834-3446
Orange County Underground Storage Tank Facilities (UST).

Date of Government Version: 02/24/99
Database Release Frequency: Quarterly
Date of Last EDR Contact: 06/14/99
Date of Next Scheduled EDR Contact: 09/13/99

PLACER COUNTY:

MS: Master List of Facilities
Source: Placer County Health and Human Services
Telephone: 530-889-7335
List includes aboveground tanks, underground tanks and cleanup sites.

Date of Government Version: 04/13/99
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 06/28/99
Date of Next Scheduled EDR Contact: 09/27/99

RIVERSIDE COUNTY:

LUST: Listing of Underground Tank Cleanup Sites
Source: Department of Public Health
Telephone: 909-358-5055
Riverside County Underground Storage Tank Cleanup Sites (LUST).

Date of Government Version: 04/02/99
Database Release Frequency: Quarterly
Date of Last EDR Contact: 04/26/99
Date of Next Scheduled EDR Contact: 07/26/99

UST: Tank List
Source: Health Services Agency
Telephone: 909-358-5055

Date of Government Version: 04/02/99
Database Release Frequency: Quarterly
Date of Last EDR Contact: 04/26/99
Date of Next Scheduled EDR Contact: 07/26/99

SACRAMENTO COUNTY:

Toxisite List
Source: Sacramento County Environmental Management
Telephone: 916-875-8450

Date of Government Version: 12/01/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 06/04/98
Date of Next Scheduled EDR Contact: 08/09/99

ML: Regulatory Compliance Master List
Source: Sacramento County Environmental Management
Telephone: 916-875-8450
Any business that has hazardous materials on site - hazardous material storage sites, underground storage tanks, waste generators.

Date of Government Version: 04/01/99
Database Release Frequency: Quarterly
Date of Last EDR Contact: 04/08/99
Date of Next Scheduled EDR Contact: 08/09/99

SAN BERNARDINO COUNTY:

DEHS Permit System Print-Out By Location
Source: San Bernardino County Fire Department Hazardous Materials Division
Telephone: 909-387-3041
This listing includes underground storage tanks, medical waste handlers/generators, hazardous materials handlers, hazardous waste generators, and waste oil generators/handlers.

Date of Government Version: 04/01/99
Database Release Frequency: Quarterly
Date of Last EDR Contact: 06/14/99
Date of Next Scheduled EDR Contact: 09/13/99

SAN DIEGO COUNTY:

SWF/LF: Solid Waste Facilities
Source: Department of Health Services
Telephone: 619-338-2209
San Diego County Solid Waste Facilities.

Date of Government Version: 07/01/98
Database Release Frequency: Annually
Date of Last EDR Contact: 06/01/99
Date of Next Scheduled EDR Contact: 08/30/99

HMMD: Hazardous Materials Management Division Database
Source: Hazardous Materials Management Division
Telephone: 619-338-2268
The database includes: HE58 - This report contains the business name, site address, business phone number, establishment 'H' permit number, type of permit, and the business status. HE17 - In addition to providing the same information provided in the HE58 listing, HE17 provides inspection dates, violations received by the establishment, hazardous waste generated, the quantity, method of storage, treatment/disposal of waste and the hauler, and information on underground storage tanks. Unauthorized Release List - Includes a summary of environmental contamination cases in San Diego County (underground tank cases, non-tank cases, groundwater contamination, and soil contamination are included.)

Date of Government Version: 05/03/99
Database Release Frequency: Quarterly
Date of Last EDR Contact: 04/12/99
Date of Next Scheduled EDR Contact: 07/12/99

SAN FRANCISCO COUNTY:

LUST: Local Oversite Facilities
Source: Department Of Public Health San Francisco County
Telephone: 415-252-3920

Date of Government Version: 01/05/99
Database Release Frequency: Quarterly
Date of Last EDR Contact: 04/20/99
Date of Next Scheduled EDR Contact: 07/19/99

Underground Storage Tank Information
Source: Department of Public Health
Telephone: 415-252-3920

Date of Government Version: 02/01/99
Database Release Frequency: Quarterly
Date of Last EDR Contact: 05/18/99
Date of Next Scheduled EDR Contact: 08/16/99

SAN MATEO COUNTY:

Business Inventory
Source: San Mateo County Environmental Health Services Division
Telephone: 650-363-1921
List includes Hazardous Materials Business Plan, hazardous waste generators, and underground storage tanks.

Date of Government Version: 04/01/98
Database Release Frequency: Annually
Date of Last EDR Contact: 06/25/99
Date of Next Scheduled EDR Contact: 07/19/99

LUST: Fuel Leak List
Source: San Mateo County Environmental Health Services Division
Telephone: 650-363-1921

Date of Government Version: 04/02/99
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 05/03/99
Date of Next Scheduled EDR Contact: 08/02/99

SANTA CLARA COUNTY:

LUST: Fuel Leak Site Activity Report
Source: Santa Clara Valley Water District
Telephone: 408-927-0710

Date of Government Version: 12/01/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 04/12/99
Date of Next Scheduled EDR Contact: 07/12/99

SOLANO COUNTY:

LUST: Leaking Undergroung Storage Tanks
Source: Solano County Department of Environmental Management
Telephone: 707-421-6770

Date of Government Version: 02/25/99
Database Release Frequency: Quarterly
Date of Last EDR Contact: 06/25/99
Date of Next Scheduled EDR Contact: 06/21/99

UST: Underground Storage Tanks
Source: Solano County Department of Environmental Management
Telephone: 707-421-6770

Date of Government Version: 02/17/99
Database Release Frequency: Quarterly
Date of Last EDR Contact: 06/25/99
Date of Next Scheduled EDR Contact: 06/21/99

SONOMA COUNTY:

LUST Sites
Source: Department of Health Services
Telephone: 707-525-6565

Date of Government Version: 04/26/99
Database Release Frequency: Quarterly
Date of Last EDR Contact: 05/03/99
Date of Next Scheduled EDR Contact: 08/02/99

SUTTER COUNTY:

UST: Underground Storage Tanks
Source: Sutter County Department of Agriculture
Telephone: 530-741-7504

Date of Government Version: 04/01/99
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 04/12/99
Date of Next Scheduled EDR Contact: 07/12/99

VENTURA COUNTY:

BWT: Business Plan, Hazardous Waste Producers, and Operating Underground Tanks
Source: Ventura County Environmental Health Division
Telephone: 805-654-2813
The BWT list indicates by site address whether the Environmental Health Division has Business Plan (B), Waste Producer (W), and/or Underground Tank (T) information.

Date of Government Version: 02/25/99
Database Release Frequency: Quarterly
Date of Last EDR Contact: 06/21/99
Date of Next Scheduled EDR Contact: 09/21/99

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

LUST: Listing of Underground Tank Cleanup Sites
Source: Environmental Health Division
Telephone: 805-654-2813
Ventura County Underground Storage Tank Cleanup Sites (LUST).

Date of Government Version: 02/25/99
Database Release Frequency: Quarterly
Date of Last EDR Contact: 06/21/99
Date of Next Scheduled EDR Contact: 09/20/99

UST: Underground Tank Closed Sites List
Source: Environmental Health Division
Telephone: 805-654-2813
Ventura County Operating Underground Storage Tank Sites (UST)/Underground Tank Closed Sites List.

Date of Government Version: 03/29/99
Database Release Frequency: Quarterly
Date of Last EDR Contact: 06/21/99
Date of Next Scheduled EDR Contact: 09/20/99

SWF/LF: Inventory of Illegal Abandoned and Inactive Sites
Source: Environmental Health Division
Telephone: 805-654-2813
Ventura County Inventory of Closed, Illegal Abandoned, and Inactive Sites.

Date of Government Version: 06/01/97
Database Release Frequency: Annually
Date of Last EDR Contact: 06/07/99
Date of Next Scheduled EDR Contact: 08/30/99

California Regional Water Quality Control Board (RWQCB) LUST Records

LUST REG 1: Active Toxic Site Investigation
Source: California Regional Water Quality Control Board North Coast (1)
Telephone: 707-576-2220

Date of Government Version: 10/14/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 06/01/99
Date of Next Scheduled EDR Contact: 08/30/99

LUST REG 2: Fuel Leak List
Source: California Regional Water Quality Control Board San Francisco Bay Region (2)
Telephone: 510-286-0457

Date of Government Version: 04/01/99
Database Release Frequency: Quarterly
Date of Last EDR Contact: 04/20/99
Date of Next Scheduled EDR Contact: 07/19/99

LUST REG 3: LUSTIS Database
Source: California Regional Water Quality Control Board Central Coast Region (3)
Telephone: 805-549-3147

Date of Government Version: 05/22/99
Database Release Frequency: Quarterly
Date of Last EDR Contact: 05/24/99
Date of Next Scheduled EDR Contact: 08/23/99

LUST REG 4: Underground Storage Tank Leak List
Source: California Regional Water Quality Control Board Los Angeles Region (4)
Telephone: 213-266-7544

Date of Government Version: 02/26/99
Database Release Frequency: Quarterly
Date of Last EDR Contact: 06/14/99
Date of Next Scheduled EDR Contact: 08/30/99

LUST REG 5: Leaking Underground Storage Tank Database
Source: California Regional Water Quality Control Board Central Valley Region (5)
Telephone: 916-255-3125

Date of Government Version: 04/27/99
Database Release Frequency: Quarterly
Date of Last EDR Contact: 04/12/99
Date of Next Scheduled EDR Contact: 07/12/99

LUST REG 6L: Leaking Underground Storage Tank Case Listing
Source: California Regional Water Quality Control Board Lahontan Region (6)
Telephone: 916-542-5424

Date of Government Version: 03/31/99
Database Release Frequency: Quarterly
Date of Last EDR Contact: 04/23/99
Date of Next Scheduled EDR Contact: 07/12/99

LUST REG 6V: Leaking Underground Storage Tank Case Listing
Source: California Regional Water Quality Control Board Victorville Branch Office (6)
Telephone: 760-346-7491

Date of Government Version: 04/01/99
Database Release Frequency: Quarterly
Date of Last EDR Contact: 04/12/99
Date of Next Scheduled EDR Contact: 07/12/99

LUST REG 7: Leaking Underground Storage Tank Case Listing
Source: California Regional Water Quality Control Board Colorado River Basin Region (7)
Telephone: 760-346-7491

Date of Government Version: 03/02/99
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 06/03/99
Date of Next Scheduled EDR Contact: 08/30/99

LUST REG 8: (LUSTIS) Leaking Underground Storage Tanks
Source: California Regional Water Quality Control Board Santa Ana Region (8)
Telephone: 909-782-4498

Date of Government Version: 04/19/99
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 04/12/99
Date of Next Scheduled EDR Contact: 07/12/99

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

LUST REG 9: Leaking Underground Storage Tank Report
Source: California Regional Water Quality Control Board San Diego Region (9)
Telephone: 619-467-2952

Date of Government Version: 03/03/99
Database Release Frequency: Quarterly

Date of Last EDR Contact: 04/26/99
Date of Next Scheduled EDR Contact: 07/26/99

California Regional Water Quality Control Board (RWQCB) SLIC Records

SLIC REG 1: Active Toxic Site Investigations
Source: California Regional Water Quality Control Board, North Coast Region (1)
Telephone: 707-576-2220

Date of Government Version: 10/14/98
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 06/01/99
Date of Next Scheduled EDR Contact: 05/31/99

SLIC REG 2: North and South Bay Slic Report
Source: Regional Water Quality Control Board San Francisco Bay Region (2)
Telephone: 510-286-0457
Any contaminated site that impacts groundwater or has the potential to impact groundwater.

Date of Government Version: 04/01/99
Database Release Frequency: Quarterly
Date of Last EDR Contact: 04/20/99
Date of Next Scheduled EDR Contact: 07/19/99

SLIC REG 3: SLIC Data
Source: California Regional Water Quality Control Board Central Coast Region (3)
Telephone: 805-549-3147
Any contaminated site that impacts groundwater or has the potential to impact groundwater.

Date of Government Version: 02/01/99
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 06/01/99
Date of Next Scheduled EDR Contact: 08/23/99

SLIC REG 4: SLIC Sites
Source: Region Water Quality Control Board Los Angeles Region (4)
Telephone: 213-576-6600
Any contaminated site that impacts groundwater or has the potential to impact groundwater.

Date of Government Version: 04/01/99
Database Release Frequency: Quarterly
Date of Last EDR Contact: 05/04/99
Date of Next Scheduled EDR Contact: 08/02/99

SLIC REG 5: SLIC List
Source: Regional Water Quality Control Board Central Valley Region (5)
Telephone: 916-855-3075
Unregulated sites that impact groundwater or have the potential to impact groundwater.

Date of Government Version: 10/01/98
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 05/13/99
Date of Next Scheduled EDR Contact: 07/12/99

SLIC REG 6V: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing
Source: Regional Water Quality Control Board, Victorville Branch
Telephone: 619-241-6583

Date of Government Version: 12/01/98
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 04/12/99
Date of Next Scheduled EDR Contact: 07/12/99

SLIC REG 8: SLIC List
Source: California Region Water Quality Control Board Santa Ana Region (8)
Telephone: 909-782-3298

Date of Government Version: 10/31/97
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 04/15/99
Date of Next Scheduled EDR Contact: 07/12/99

SLIC REG 9: WDS NURD List
Source: California Regional Water Quality Control Board San Diego Region (9)
Telephone: 619-467-2980

Date of Government Version: 03/12/99
Database Release Frequency: Annually
Date of Last EDR Contact: 06/09/99
Date of Next Scheduled EDR Contact: 09/06/99

Historical and Other Database(s)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

Former Manufactured Gas (Coal Gas) Sites: The existence and location of Coal Gas sites is provided exclusively to EDR by Real Property Scan, Inc. ©Copyright 1993 Real Property Scan, Inc. For a technical description of the types of hazards which may be found at such sites, contact your EDR customer service representative.

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DELISTED NPL: NPL Deletions
Source: EPA
Telephone: N/A
The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 04/23/99
Date Made Active at EDR: 06/09/99
Database Release Frequency: Semi-Annually
Date of Data Arrival at EDR: 05/12/99
Elapsed ASTM days: 28
Date of Last EDR Contact: 02/08/99

NFRAP: No Further Remedial Action Planned
Source: EPA
Telephone: 703-413-0223
As of February 1995, CERCLIS sites designated "No Further Remedial Action Planned" (NFRAP) have been removed from CERCLIS. NFRAP sites may be sites where, following an initial investigation, no contamination was found, contamination was removed quickly without the need for the site to be placed on the NPL, or the contamination was not serious enough to require Federal Superfund action or NPL consideration. EPA has removed approximately 25,000 NFRAP sites to lift the unintended barriers to the redevelopment of these properties and has archived them as historical records so EPA does not needlessly repeat the investigations in the future. This policy change is part of the EPA's Brownfields Redevelopment Program to help cities, states, private investors and affected citizens to promote economic redevelopment of unproductive urban sites.

Date of Government Version: 04/21/99
Date Made Active at EDR: 06/09/99
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 05/14/99
Elapsed ASTM days: 26
Date of Last EDR Contact: 05/14/99

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-260-2805
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-260-2805
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SWDIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Area Radon Information: The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones: Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

Oil/Gas Pipelines/Electrical Transmission Lines: This data was obtained by EDR from the USGS in 1994. It is referred to by USGS as GeoData Digital Line Graphs from 1:100,000-Scale Maps. It was extracted from the transportation category including some oil, but primarily gas pipelines and electrical transmission lines.

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

USGS Water Wells: In November 1971 the United States Geological Survey (USGS) implemented a national water resource information tracking system. This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on more than 900,000 wells, springs, and other sources of groundwater.

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 1999 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in March 1997 from the U.S. Fish and Wildlife Service.

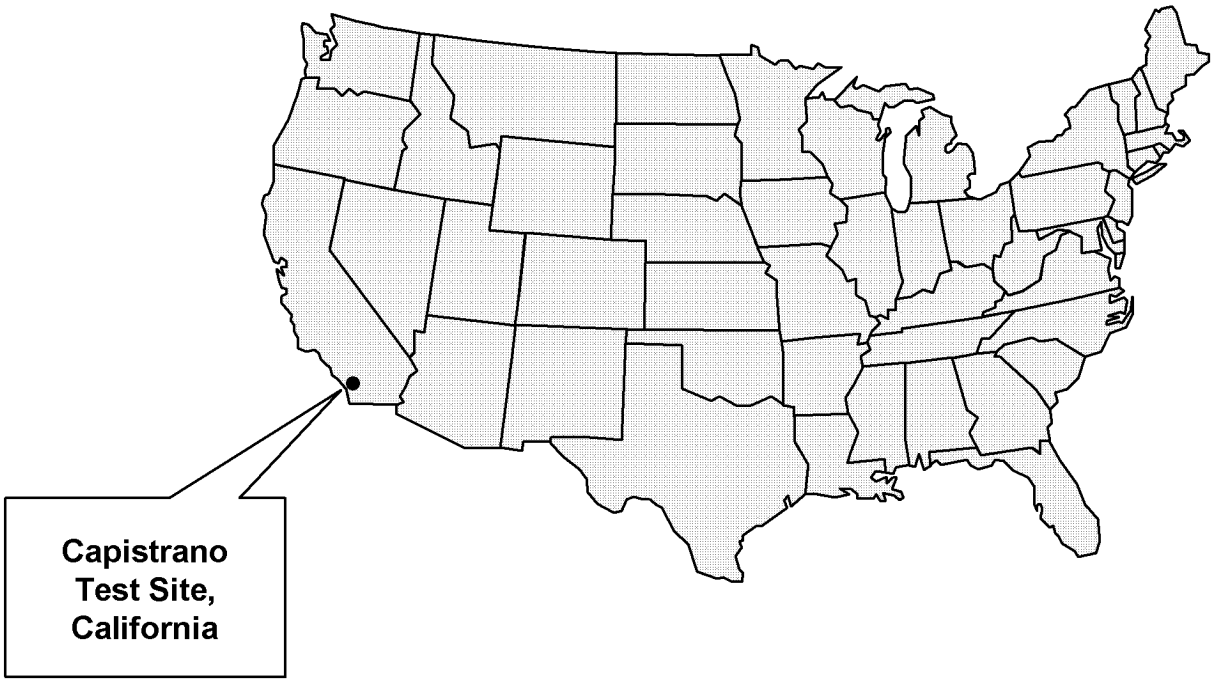
Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

Water Dams: National Inventory of Dams
Source: Federal Emergency Management Agency
Telephone: 202-646-2801
National computer database of more than 74,000 dams maintained by the Federal Emergency Management Agency.

California Earthquake Fault Lines: The fault lines displayed on EDR's Topographic map are digitized quaternary fault lines, prepared in 1975 by the United State Geological Survey. Additional information (also from 1975) regarding activity at specific fault lines comes from California's Preliminary Fault Activity Map prepared by the California Division of Mines and Geology.

California Drinking Water Quality Database
Source: Department of Health Services
Telephone: 916-324-2319
The database includes all drinking water compliance and special studies monitoring for the state of California since 1984. It consists of over 3,200,000 individual analyses along with well and water system information.

California Oil and Gas Well Locations for District 2 and 6
Source: Department of Conservation
Telephone: 916-323-1779



APPENDIX G
HQ USAF/ILEV MEMO ON PROPERTY CATEGORIZATION CODES

APPENDIX G

HQ USAF/ILEV MEMO ON PROPERTY CATEGORIZATION CODES

Fact Sheet

One Space Park
Redondo Beach, CA 90278

NORTHROP GRUMMAN
Space Technology

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Northrop Grumman's Capistrano Test Site
Cradle for Emerging Defense Technologies

Nestled in the rolling hills of Southern California near San Clemente, Northrop Grumman's Capistrano Test Site (CTS), which includes several one-of-a-kind laser test facilities, has been a proving ground for state-of-the-art defense technologies since 1963. Employing a multi-disciplinary team of scientists, engineers and technicians, the 2700-acre site is used to develop and test Northrop Grumman directed energy systems, spacecraft and rocket propulsion systems, and antennas.

CTS has long served as the nation's development site for high-energy laser technologies and systems. All of the nation's high-average-power (greater than 100 kW) lasers, including MIRACL and Alpha, the only megawatt class lasers, were developed at CTS. Other high-average-power lasers and laser technologies developed at CTS are:

- The pathfinder and first "flight" laser modules for the Airborne Laser program, the nation's most advanced concept for destroying ballistic missiles in the boost phase.
- The laser device for the Tactical High Energy Laser (THEL), the nation's only operating laser weapon system, which has shot down 25 Katyusha rockets, fired singly and in salvos.
- The laser technology and system integration work for the space based laser program, the nation's only global boost phase initiative.

CTS has also helped write some of the nation's most distinguished chapters in space history. For example, it was the development site for the engine that landed the Apollo astronauts on the moon six times. Called the Lunar Module Descent Engine, or LMDE, this Northrop Grumman development was repeatedly tested in Orange County before it gently landed the Apollo astronauts on the moon for the first time. "The little engine that could" also rescued the Apollo 13 astronauts after their command module was disabled by a fire. Without the use of the LMDE engine, which swung the astronauts back to Earth, the Apollo 13 capsule might still be careening through space.

The propulsion systems that guided the Pioneer 10 and 11 spacecraft on their departure from our solar system were developed at the site. Today, Northrop Grumman continues to test most of its propulsion technologies on the site, including small station-keeping thrusters that keep satellites in the proper

- more -

location on orbit. CTS has also been selected as the test site for the Missile Defense Agency liquid booster engine, being developed to simulate threat missile systems for upcoming missile defense testing.

The large "open spaces" of CTS make it ideal for testing antennas used in Northrop Grumman space communications systems. The site contains five outdoor test ranges that vary in length from 500 feet to 10,000 feet. The ranges currently are supported by one radome – a white, balloon-like structure that houses and protects the antennas from inclement weather while they're being tested. (The materials best suited for antennas that must operate on satellites 22,000 miles above the Earth are easily degraded by moisture, dirt etc.)

The material used for these radomes is transparent to radio frequency (RF) energy, which allows the antennas to "think" they're in space, free from any RF reflections. The radomes' placement on ridge tops allows line-of-sight testing of various communications antennas at extremely low power levels.

Test Site Keeps Environmental Concerns Foremost

The land around CTS is a combination of rolling hills, canyons, sharp ridges and a small area of fresh water wetlands. Over the years, the company has used less than ten percent of the area for operations. The remaining land is carefully preserved as a balanced habitat for a large number of plant and animal species, many of them threatened by extinction. These include the San Diego Horned Lizard, the Orange-Throated Whiptail Lizard, the Cactus Wren and the Arroyo Toad. More common animals are mule deer, mountain lion, coyote, skunk, gray fox and raccoon.

Northrop Grumman strives to maintain the unspoiled nature of the site. The company routinely permits the local Audobon Society to study birds in the wetland section of the test site. The company has joined with the Orange County Environmental Management Agency (OCEMA) to create "keep out" zones selected for their environmental sensitivities. Northrop Grumman has agreed not to develop these areas without prior coordination with OCEMA.

Equipment at the site is operated under licenses from a variety of agencies including the South Coast Air Quality Management District (AQMD). Northrop Grumman meets all local, state and federal regulations.

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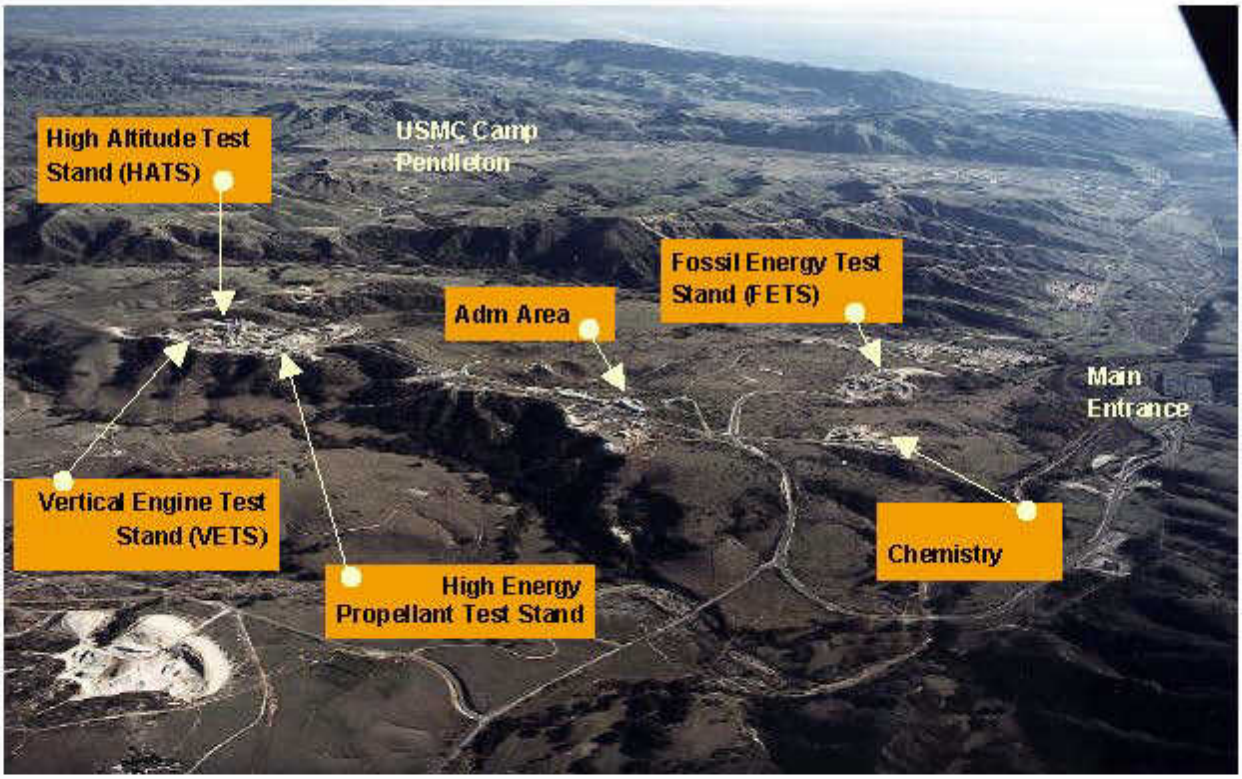
June 2003

Northrop Grumman Capistrano Test Site

Nestled in the hills of Southern California near San Clemente, Northrop Grumman's Capistrano Test Site (CTS) has been a proving ground for state-of-the-art technologies since 1963. The 2,700-acre site contains test areas used to develop and test spacecraft and rocket propulsion systems.

Over the years Capistrano has been the scene of more than 28,000 propulsion systems test firings lasting more than 3.4 million seconds. It was the development site for the engine that landed Apollo astronauts on the moon six times.

Equipment at the site is operated under licenses from a variety of agencies including the South Coast Air Quality management District (AQMD). Northrop Grumman meets all local, state and federal regulations.



High Energy Propellant Test Stand

- Altitude capability
  - Test Chambers
    - 50 lbf
    - 200 lbf
    - Full 100,000 ft simulation
  - Two three stage inter-condensing, steam driven ejector systems; continuous duty
  - Mechanically pumped vacuum plenum system
- Sea Level
  - 20,000 lbf Max thrust

Complete control center facilities with computer driven data acquisition and controls. Low to high speed measurements

Vertical Engine Test Stand

- 4-Position Rocket Test Stand-50,000 lbf
- 1,000 Gal 750 psia WP run tanks
- Two Stage inter-condensing steam ejector system connection capability utilizing a High Temperature Hot Water System
- Complete Control Center facilities with computer driven Data Acquisition & Controls. Low to High Speed Measurements

Fossil Energy Test

- MHD
  - Magnetohydrodynamic reactor testing
  - Coal combustor technology testing
- Thruster test facility
  - Hydrogen peroxide

Chemical Laboratory

- Material Analysis
  - Seals
  - Metals
- Reactant Analysis
  - Rocket propellants
  - Laser gases

Administration

- Administration
  - Office/Management
  - Fire
  - Medical
  - Maintenance
  - Purchasing/Shipping & Receiving/Stores
- Support
  - Weld/Machine Shop
  - Clean Room
  - Electronic Fabrication Shop
  - Valve/Hydraulic Shop
  - Vertical Assembly Area

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
1	R	Albion River, Mendocino Coast HU, Albion River HA	11340013					
				Sedimentation/Siltation		High	77 Miles	2003
					Silviculture			
					Logging Road Construction/Maintenance			
					Nonpoint Source			
1	R	Americano Creek, Bodega HU, Estero Americano HA	11530012					
				Nutrients		Low	38 Miles	
					Pasture Grazing-Riparian and/or Upland			
					Range Grazing-Riparian			
					Range Grazing-Upland			
					Intensive Animal Feeding Operations			
					Manure Lagoons			
					Dairies			
1	R	Big River, Mendocino Coast HU, Big River HA	11330043					
				Sedimentation/Siltation		High	225 Miles	2003
					Silviculture			
					Logging Road Construction/Maintenance			
					Road Construction			
					Disturbed Sites (Land Develop.)			
					Nonpoint Source			
				Temperature		Low	225 Miles	
					Habitat Modification			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Drainage/Filling Of Wetlands			
					Erosion/Siltation			
					Nonpoint Source			
1	R	Eel River Delta, Eel River HU, Lower Eel River HA	11111032					
				Sedimentation/Siltation		Medium	426 Miles	
					Range Grazing-Riparian and/or Upland			
					Silviculture			
					Nonpoint Source			
				Temperature		Medium	426 Miles	
					Removal of Riparian Vegetation			
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
1	R	Eel River, Middle Fork, Eel River HU, Middle Fork HA	11171045					
				Sedimentation/Siltation		Medium	1071 Miles	
					Erosion/Siltation			
				Temperature		Medium	1071 Miles	
					Removal of Riparian Vegetation			
					Nonpoint Source			
1	R	Eel River, Middle Main Fork, Eel River HU, Middle Main HA	11141061					
				Sedimentation/Siltation		Medium	674 Miles	
					Range Grazing-Riparian			
					Range Grazing-Upland			
					Silviculture			
					Harvesting, Restoration, Residue Management			
					Logging Road Construction/Maintenance			
					Construction/Land Development			
					Land Development			
					Hydromodification			
					Habitat Modification			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Erosion/Siltation			
				Temperature		Medium	674 Miles	
					Upstream Impoundment			
					Habitat Modification			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Drainage/Filling Of Wetlands			
					Channel Erosion			
					Erosion/Siltation			
1	R	Eel River, North Fork, Eel River HU, North Fork HA	11150065					
				Sedimentation/Siltation		Medium	382 Miles	
					Silviculture			
					Logging Road Construction/Maintenance			
					Erosion/Siltation			
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Temperature		Medium	382 Miles	
					Habitat Modification			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Nonpoint Source			
1	R	Eel River, South Fork, Eel River HU, South Fork HA	11131030					
				Sedimentation/Siltation		Medium	943 Miles	
					Range Grazing-Riparian and/or Upland			
					Silviculture			
					Logging Road Construction/Maintenance			
					Resource Extraction			
					Hydromodification			
					Flow Regulation/Modification			
					Removal of Riparian Vegetation			
					Erosion/Siltation			
					Nonpoint Source			
				Temperature		Medium	943 Miles	
					Hydromodification			
					Flow Regulation/Modification			
					Removal of Riparian Vegetation			
					Erosion/Siltation			
					Nonpoint Source			
1	R	Eel River, Upper Main HA (Includes Tomki Creek)	11163050					
				Sedimentation/Siltation		Medium	1141 Miles	
					Agriculture-grazing			
					Silviculture			
					Harvesting, Restoration, Residue Management			
					Logging Road Construction/Maintenance			
					Silvicultural Point Sources			
					Construction/Land Development			
					Highway/Road/Bridge Construction			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Erosion/Siltation			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED		PROPOSED TMDL COMPLETION
				Temperature		Medium	1141	Miles	
					Channelization				
					Habitat Modification				
					Removal of Riparian Vegetation				
					Streambank Modification/Destabilization				
					Drainage/Filling Of Wetlands				
					Nonpoint Source				
1	R	Elk River, Eureka Plain HU	11000042						
				Sedimentation/Siltation		High	88	Miles	2003
					Silviculture				
					Harvesting, Restoration, Residue Management				
					Logging Road Construction/Maintenance				
					Removal of Riparian Vegetation				
					Streambank Modification/Destabilization				
					Erosion/Siltation				
					Natural Sources				
					Nonpoint Source				
1	E	Estero Americano, Bodega HU, Estero Americano HA	11530012						
				Nutrients		Medium	199	Acres	
					Pasture Grazing-Riparian and/or Upland				
					Manure Lagoons				
				Sedimentation/Siltation		Low	199	Acres	
					Range Grazing-Riparian				
					Hydromodification				
					Removal of Riparian Vegetation				
					Streambank Modification/Destabilization				
					Erosion/Siltation				
					Nonpoint Source				
1	R	Freshwater Creek, Eureka Plain HU	11000050						
				Sedimentation/Siltation		High	84	Miles	2003
					Silviculture				
					Harvesting, Restoration, Residue Management				
					Logging Road Construction/Maintenance				
					Removal of Riparian Vegetation				
					Streambank Modification/Destabilization				
					Erosion/Siltation				
					Natural Sources				
					Nonpoint Source				

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED		PROPOSED TMDL COMPLETION
1	R	Garcia River, Mendocino Coast HU	11370026						
				Temperature		High	154	Miles	2002
					Habitat Modification				
					Removal of Riparian Vegetation				
					Streambank Modification/Destabilization				
					Nonpoint Source				
1	R	Gualala River, Mendocino Coast HU, Gualala River HA	11385021						
				Sedimentation/Siltation		High	455	Miles	2004
					Specialty Crop Production				
					Silviculture				
					Harvesting, Restoration, Residue Management				
					Logging Road Construction/Maintenance				
					Highway/Road/Bridge Construction				
					Land Development				
					Disturbed Sites (Land Develop.)				
					Erosion/Siltation				
					Nonpoint Source				
				Temperature		Low	455	Miles	
					Removal of Riparian Vegetation				
					Streambank Modification/Destabilization				
					Channel Erosion				
					Erosion/Siltation				
					Nonpoint Source				
1	B	Humboldt Bay, Eureka Plain HU	11000000						
				PCBs		Low	16075	Acres	
				This listing was made by USEPA.					
					Source Unknown				

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
1	R	Jacoby Creek, Eureka Plain HU	11000013					
				Sediment		Low	19 Miles	
					Silviculture			
					Road Construction			
					Land Development			
					Disturbed Sites (Land Develop.)			
					Urban Runoff/Storm Sewers			
					Hydromodification			
					Channelization			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Drainage/Filling Of Wetlands			
					Channel Erosion			
					Erosion/Siltation			
					Sediment Resuspension			
					Natural Sources			
					Nonpoint Source			
1	R	Klamath River, Klamath River HU, Butte Valley HA	10581023					
				Nutrients		Medium	265 Miles	
					Nonpoint Source			
				Temperature		Medium	265 Miles	
					Nonpoint Source			
1	R	Klamath River, Klamath River HU, Lost River HA, Clear Lake, Boles HSAs	10593011					
				Nutrients		Medium	601 Miles	
					Hydromodification			
					Nonpoint Source			
				Temperature		Medium	601 Miles	
					Hydromodification			
					Dam Construction			
					Upstream Impoundment			
					Flow Regulation/Modification			
					Water Diversions			
					Agricultural Water Diversion			
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
1	R	Klamath River, Klamath River HU, Lost River HA, Tule Lake and Mt Dome HSAs	10591063					
				Nutrients		Medium	612 Miles	
					Agriculture			
					Specialty Crop Production			
					Agriculture-subsurface drainage			
					Agriculture-irrigation tailwater			
					Agricultural Return Flows			
					Water Diversions			
					Agricultural Water Diversion			
					Habitat Modification			
					Removal of Riparian Vegetation			
					Drainage/Filling Of Wetlands			
					Natural Sources			
					Nonpoint Source			
				Temperature		Medium	612 Miles	
					Hydromodification			
					Channelization			
					Flow Regulation/Modification			
					Water Diversions			
					Agricultural Water Diversion			
					Habitat Modification			
					Removal of Riparian Vegetation			
					Drainage/Filling Of Wetlands			
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
1	R	Klamath River, Klamath River HU, Lower HA, Klamath Glen HSA	10511086					
				Nutrients		Medium	609 Miles	
					Industrial Point Sources			
					Major Industrial Point Source			
					Minor Industrial Point Source			
					Municipal Point Sources			
					Major Municipal Point Source-dry and/or wet weather discharge			
					Minor Municipal Point Source-dry and/or wet weather discharge			
					Agriculture			
					Irrigated Crop Production			
					Specialty Crop Production			
					Pasture Grazing-Riparian and/or Upland			
					Range Grazing-Riparian			
					Intensive Animal Feeding Operations			
					Agriculture-storm runoff			
					Agriculture-subsurface drainage			
					Agriculture-irrigation tailwater			
				Organic Enrichment/Low Dissolved Oxygen		Medium	609 Miles	
					Industrial Point Sources			
					Municipal Point Sources			
					Agriculture			
					Irrigated Crop Production			
					Specialty Crop Production			
					Range Grazing-Riparian			
					Agriculture-storm runoff			
					Agriculture-subsurface drainage			
					Agriculture-irrigation tailwater			
					Agriculture-animal			
					Upstream Impoundment			
					Flow Regulation/Modification			
					Out-of-state source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Temperature		Medium	609 Miles	
					Hydromodification			
					Dam Construction			
					Upstream Impoundment			
					Flow Regulation/Modification			
					Water Diversions			
					Habitat Modification			
					Removal of Riparian Vegetation			
					Channel Erosion			
1	R	Klamath River, Klamath River HU, Middle HA, Iron Gate Dam to Scott River	10535053					
				Nutrients		Medium	548 Miles	
					Out-of-state source			
					Nonpoint/Point Source			
				Organic Enrichment/Low Dissolved Oxygen		Medium	548 Miles	
					Out-of-state source			
					Nonpoint/Point Source			
				Temperature		Medium	548 Miles	
					Hydromodification			
					Upstream Impoundment			
					Flow Regulation/Modification			
					Habitat Modification			
					Removal of Riparian Vegetation			
					Nonpoint Source			
1	R	Klamath River, Klamath River HU, Middle HA, Oregon to Iron Gate	10537022					
				Nutrients		Medium	129 Miles	
					Industrial Point Sources			
					Municipal Point Sources			
					Agriculture			
					Specialty Crop Production			
					Agricultural Return Flows			
					Internal Nutrient Cycling (primarily lakes)			
					Natural Sources			
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Organic Enrichment/Low Dissolved Oxygen		Medium	129 Miles	
					Industrial Point Sources			
					Municipal Point Sources			
					Agriculture			
					Irrigated Crop Production			
					Specialty Crop Production			
					Range Grazing-Riparian and/or Upland			
					Agriculture-storm runoff			
					Agriculture-subsurface drainage			
					Agriculture-irrigation tailwater			
					Agriculture-animal			
					Upstream Impoundment			
					Flow Regulation/Modification			
					Out-of-state source			
				Temperature		Medium	129 Miles	
					Hydromodification			
					Upstream Impoundment			
					Flow Regulation/Modification			
					Nonpoint Source			
1	R	Klamath River, Klamath River HU, Middle HA, Scott River to Trinity River	10512050					
				Nutrients		Medium	1389 Miles	
					Industrial Point Sources			
					Municipal Point Sources			
					Agriculture			
					Agriculture-storm runoff			
					Agriculture-irrigation tailwater			
					Wastewater - land disposal			
					Upstream Impoundment			
					Natural Sources			
					Nonpoint Source			
					Out-of-state source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED		PROPOSED TMDL COMPLETION
				Organic Enrichment/Low Dissolved Oxygen		Medium	1389	Miles	
					Industrial Point Sources				
					Municipal Point Sources				
					Combined Sewer Overflow				
					Agriculture				
					Agriculture-storm runoff				
					Agriculture-irrigation tailwater				
					Upstream Impoundment				
					Flow Regulation/Modification				
					Out-of-state source				
				Temperature		Medium	1389	Miles	
					Hydromodification				
					Channelization				
					Dam Construction				
					Upstream Impoundment				
					Flow Regulation/Modification				
					Water Diversions				
					Habitat Modification				
					Removal of Riparian Vegetation				
					Streambank Modification/Destabilization				
					Drainage/Filling Of Wetlands				
					Natural Sources				
					Nonpoint Source				
1	R	Klamath River, Klamath River HU, Salmon River HA	10521034						
				Nutrients		High	871	Miles	2004
					Unknown Nonpoint Source				
				Temperature		High	871	Miles	2004
					Removal of Riparian Vegetation				
					Unknown Nonpoint Source				
1	R	Laguna de Santa Rosa, Russian River HU, Middle Russian River HA	11421020						
				Low Dissolved Oxygen		Low	96	Miles	
					Internal Nutrient Cycling (primarily lakes)				
					Nonpoint Source				
					Point Source				
				Nitrogen		Low	96	Miles	
				This listing was made by USEPA.					
					Internal Nutrient Cycling (primarily lakes)				
					Nonpoint Source				
					Point Source				

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Phosphorus		**Low**	**96 Miles**	
				This listing was made by USEPA.				
					Internal Nutrient Cycling (primarily lakes)			
					Nonpoint Source			
					Point Source			
				Sedimentation/Siltation		**Medium**	**96 Miles**	
				Entire Russian River watershed (including Laguna de Santa Rosa) is listed for sedimentation.				
					Road Construction			
					Land Development			
					Disturbed Sites (Land Develop.)			
					Urban Runoff/Storm Sewers			
					Other Urban Runoff			
					Highway/Road/Bridge Runoff			
					Hydromodification			
					Channelization			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Drainage/Filling Of Wetlands			
					Channel Erosion			
					Erosion/Siltation			
					Erosion From Derelict Land			
					Highway Maintenance and Runoff			
					Nonpoint Source			
				Temperature		**Low**	**96 Miles**	
				Entire Russian River watershed (including Laguna de Santa Rosa) is listed for temperature.				
					Hydromodification			
					Upstream Impoundment			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Nonpoint Source			
1	**L**	**Lake Pillsbury (Eel River HU, Upper Main HA, Lake Pillsbury HSA)**	**11163051**					
				Mercury		**Low**	**1973 Acres**	
					Natural Sources			
1	**R**	**Mad River, Mad River HU**	**10910011**					
				Sedimentation/Siltation		**Low**	**654 Miles**	
					Silviculture			
					Resource Extraction			
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED		PROPOSED TMDL COMPLETION
				Temperature		Low	654	Miles	
					Upstream Impoundment				
					Flow Regulation/Modification				
					Habitat Modification				
					Removal of Riparian Vegetation				
					Nonpoint Source				
					Unknown Nonpoint Source				
				Turbidity		Low	654	Miles	
					Silviculture				
					Resource Extraction				
					Nonpoint Source				
1	R	Mattole River, Cape Mendocino HU, Mattole River HA	11230072						
				Sedimentation/Siltation		High	503	Miles	2004
					Specialty Crop Production				
					Range Grazing-Riparian and/or Upland				
					Range Grazing-Riparian				
					Silviculture				
					Road Construction				
					Hydromodification				
					Habitat Modification				
					Removal of Riparian Vegetation				
					Streambank Modification/Destabilization				
					Erosion/Siltation				
					Natural Sources				
				Temperature		High	503	Miles	2004
					Range Grazing-Riparian and/or Upland				
					Silviculture				
					Road Construction				
					Habitat Modification				
					Removal of Riparian Vegetation				
					Natural Sources				
					Nonpoint Source				
1	L	Mendocino, Lake	11432060						
				Mercury		Low	1704	Acres	
					Resource Extraction				
					Nonpoint Source				

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
1	E	Navarro River Delta, Mendocino Coast HU, Navarro River HA	11350077					
				Sedimentation/Siltation		High	48 Acres	2004
					Erosion/Siltation			
1	R	Navarro River, Mendocino Coast HU	11350077					
				Sedimentation/Siltation		High	415 Miles	2004
					Agriculture			
					Nonirrigated Crop Production			
					Irrigated Crop Production			
					Specialty Crop Production			
					Range Grazing-Riparian and/or Upland			
					Range Grazing-Riparian			
					Range Grazing-Upland			
					Agriculture-grazing			
					Silviculture			
					Harvesting, Restoration, Residue Management			
					Logging Road Construction/Maintenance			
					Silvicultural Point Sources			
					Construction/Land Development			
					Highway/Road/Bridge Construction			
					Land Development			
					Disturbed Sites (Land Develop.)			
					Resource Extraction			
					Flow Regulation/Modification			
					Water Diversions			
					Habitat Modification			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Drainage/Filling Of Wetlands			
					Channel Erosion			
					Erosion/Siltation			
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED		PROPOSED TMDL COMPLETION
				Temperature		High	415	Miles	2004
					Agriculture				
					Agricultural Return Flows				
					Resource Extraction				
					Flow Regulation/Modification				
					Water Diversions				
					Habitat Modification				
					Removal of Riparian Vegetation				
					Streambank Modification/Destabilization				
					Drainage/Filling Of Wetlands				
					Nonpoint Source				
1	R	Noyo River, Mendocino Coast HU, Noyo River HA	11320010						
				Sedimentation/Siltation		High	144	Miles	2003
					Silviculture				
					Nonpoint Source				
1	R	Redwood Creek, Redwood Creek HU	10710020						
				Sedimentation/Siltation		Medium	332	Miles	
					Range Grazing-Riparian				
					Silviculture				
					Harvesting, Restoration, Residue Management				
					Logging Road Construction/Maintenance				
					Construction/Land Development				
					Disturbed Sites (Land Develop.)				
					Removal of Riparian Vegetation				
					Streambank Modification/Destabilization				
					Erosion/Siltation				
					Natural Sources				
				Temperature		Low	332	Miles	
					Logging Road Construction/Maintenance				
					Removal of Riparian Vegetation				
					Streambank Modification/Destabilization				
					Erosion/Siltation				
					Natural Sources				
					Nonpoint Source				

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
1	R	Russian River, Russian River HU, Lower Russian River HA, Austin Creek HSA	11412013					
				Sedimentation/Siltation		Medium	81 Miles	
					Silviculture			
					Construction/Land Development			
					Disturbed Sites (Land Develop.)			
					Dam Construction			
					Flow Regulation/Modification			
					Erosion/Siltation			
				Temperature		Low	81 Miles	
					Hydromodification			
					Flow Regulation/Modification			
					Habitat Modification			
					Removal of Riparian Vegetation			
					Nonpoint Source			
1	R	Russian River, Russian River HU, Lower Russian River HA, Guerneville HSA	11411041					
				Pathogens		Low	195 Miles	
				Listing covers only the Monte Rio area of this watershed from the confluence of Dutch Bill Creek to the confluence of Fife Creek and Healdsburg Memorial Beach from the Hwy 101 crossing to the railroad crossing upstream of the Beach.				
					Nonpoint/Point Source			
				Sedimentation/Siltation		Medium	195 Miles	
					Agriculture			
					Irrigated Crop Production			
					Specialty Crop Production			
					Agriculture-storm runoff			
					Agriculture-grazing			
					Silviculture			
					Construction/Land Development			
					Highway/Road/Bridge Construction			
					Land Development			
					Hydromodification			
					Channelization			
					Dam Construction			
					Upstream Impoundment			
					Flow Regulation/Modification			
					Habitat Modification			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Drainage/Filling Of Wetlands			
					Channel Erosion			
					Erosion/Siltation			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Temperature		Low	195 Miles	
					Hydromodification			
					Upstream Impoundment			
					Flow Regulation/Modification			
					Habitat Modification			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Nonpoint Source			
1	R	Russian River, Russian River HU, Middle Russian River HA, Big Sulphur Creek HSA	11426023					
				Sedimentation/Siltation		Medium	85 Miles	
					Geothermal Development			
					Erosion/Siltation			
					Nonpoint Source			
				Temperature		Low	85 Miles	
					Flow Regulation/Modification			
					Habitat Modification			
					Removal of Riparian Vegetation			
					Nonpoint Source			
1	R	Russian River, Russian River HU, Middle Russian River HA, Dry Creek HSA	11424034					
				Sedimentation/Siltation		Medium	255 Miles	
					Agriculture			
					Agriculture-storm runoff			
					Silviculture			
					Logging Road Construction/Maintenance			
					Construction/Land Development			
					Highway/Road/Bridge Construction			
					Disturbed Sites (Land Develop.)			
					Hydromodification			
					Channelization			
					Dam Construction			
					Upstream Impoundment			
					Flow Regulation/Modification			
					Habitat Modification			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Drainage/Filling Of Wetlands			
					Channel Erosion			
					Erosion/Siltation			
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Temperature		Low	255 Miles	
					Hydromodification			
					Upstream Impoundment			
					Flow Regulation/Modification			
					Habitat Modification			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Nonpoint Source			
1	R	Russian River, Russian River HU, Middle Russian River HA, Geyserville HSA	11425032					
				Sedimentation/Siltation		Medium	243 Miles	
					Agriculture			
					Nonirrigated Crop Production			
					Irrigated Crop Production			
					Specialty Crop Production			
					Range Grazing-Riparian			
					Range Grazing-Upland			
					Agriculture-storm runoff			
					Agriculture-grazing			
					Silviculture			
					Construction/Land Development			
					Geothermal Development			
					Disturbed Sites (Land Develop.)			
					Surface Runoff			
					Resource Extraction			
					Channelization			
					Bridge Construction			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Drainage/Filling Of Wetlands			
					Channel Erosion			
					Erosion/Siltation			
					Natural Sources			
					Nonpoint Source			
				Temperature		Low	243 Miles	
					Flow Regulation/Modification			
					Habitat Modification			
					Removal of Riparian Vegetation			
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
1	R	Russian River, Russian River HU, Middle Russian River HA, Mark West Creek HSA	11423021					
				Sedimentation/Siltation		Medium	99 Miles	
					Agriculture			
					Irrigated Crop Production			
					Specialty Crop Production			
					Range Grazing-Riparian and/or Upland			
					Range Grazing-Riparian			
					Intensive Animal Feeding Operations			
					Agriculture-storm runoff			
					Agriculture-grazing			
					Silviculture			
					Harvesting, Restoration, Residue Management			
					Construction/Land Development			
					Highway/Road/Bridge Construction			
					Land Development			
					Disturbed Sites (Land Develop.)			
					Other Urban Runoff			
					Surface Runoff			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Drainage/Filling Of Wetlands			
					Channel Erosion			
					Erosion/Siltation			
				Temperature		Low	99 Miles	
					Hydromodification			
					Upstream Impoundment			
					Flow Regulation/Modification			
					Habitat Modification			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
1	R	Russian River, Russian River HU, Upper Russian River HA, Coyote Valley HSA	11432060					
				Sedimentation/Siltation		Medium	171 Miles	
					Agriculture			
					Silviculture			
					Construction/Land Development			
					Hydromodification			
					Channelization			
					Dam Construction			
					Flow Regulation/Modification			
					Bridge Construction			
					Habitat Modification			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Drainage/Filling Of Wetlands			
					Channel Erosion			
					Erosion/Siltation			
				Temperature		Low	171 Miles	
					Hydromodification			
					Upstream Impoundment			
					Flow Regulation/Modification			
					Habitat Modification			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Nonpoint Source			
1	R	Russian River, Russian River HU, Upper Russian River HA, Forsythe Creek HSA	11433040					
				Sedimentation/Siltation		Medium	122 Miles	
					Erosion/Siltation			
					Nonpoint Source			
				Temperature		Low	122 Miles	
					Hydromodification			
					Upstream Impoundment			
					Flow Regulation/Modification			
					Habitat Modification			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
1	R	Russian River, Russian River HU, Upper Russian River HA, Ukiah HSA	11431071					
				Sedimentation/Siltation		Medium	460 Miles	
					Agriculture			
					Silviculture			
					Construction/Land Development			
					Resource Extraction			
					Habitat Modification			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Drainage/Filling Of Wetlands			
					Channel Erosion			
					Erosion/Siltation			
					Highway Maintenance and Runoff			
					Natural Sources			
				Temperature		Low	460 Miles	
					Hydromodification			
					Upstream Impoundment			
					Flow Regulation/Modification			
					Habitat Modification			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Nonpoint Source			
1	R	Santa Rosa Creek, Russian River HU, Middle Russian River HA	11422013					
				Pathogens		Low	87 Miles	
					Nonpoint Source			
					Point Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Sedimentation/Siltation		**Medium**	**87 Miles**	
				Entire Russian River watershed (including Santa Rosa Creek) is listed for sedimentation.				
					Agriculture			
					Nonirrigated Crop Production			
					Irrigated Crop Production			
					Specialty Crop Production			
					Pasture Grazing-Riparian and/or Upland			
					Range Grazing-Riparian			
					Range Grazing-Upland			
					Dairies			
					Construction/Land Development			
					Highway/Road/Bridge Construction			
					Land Development			
					Urban Runoff/Storm Sewers			
					Urban Runoff--Non-industrial Permitted			
					Other Urban Runoff			
					Surface Runoff			
					Hydromodification			
					Channelization			
					Bridge Construction			
					Habitat Modification			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Drainage/Filling Of Wetlands			
					Channel Erosion			
					Erosion/Siltation			
					Natural Sources			
					Nonpoint Source			
				Temperature		**Low**	**87 Miles**	
				Entire Russian River watershed (including Santa Rosa Creek) is listed for temperature.				
					Hydromodification			
					Upstream Impoundment			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
1	R	Scott River, Klamath River HU, Scott River HA	10541035					
				Sedimentation/Siltation		Medium	902 Miles	
					Irrigated Crop Production			
					Pasture Grazing-Riparian and/or Upland			
					Silviculture			
					Resource Extraction			
					Mill Tailings			
					Natural Sources			
					Nonpoint Source			
				Temperature		Medium	902 Miles	
					Irrigated Crop Production			
					Pasture Grazing-Riparian and/or Upland			
					Agricultural Return Flows			
					Silviculture			
					Flow Regulation/Modification			
					Water Diversions			
					Habitat Modification			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Drainage/Filling Of Wetlands			
					Other			
					Nonpoint Source			
1	R	Shasta River, Klamath River HU, Shasta River HA	10550001					
				Organic Enrichment/Low Dissolved Oxygen		Medium	630 Miles	
					Minor Municipal Point Source-dry and/or wet weather discharge			
					Agriculture-storm runoff			
					Agriculture-irrigation tailwater			
					Dairies			
					Hydromodification			
					Dam Construction			
					Flow Regulation/Modification			
					Habitat Modification			
				Temperature		Medium	630 Miles	
					Agriculture-irrigation tailwater			
					Flow Regulation/Modification			
					Habitat Modification			
					Removal of Riparian Vegetation			
					Drainage/Filling Of Wetlands			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
1	L	Sonoma, Lake	11424030					
				Mercury		Low	2377 Acres	
					Resource Extraction			
					Nonpoint Source			
1	R	Stemple Creek/Estero do San Antonio, Bodega HU, Estero de San Antonio HA	11540010					
				Nutrients		Medium	61 Miles	
				This pollutant was relisted for this water body by USEPA in 1998.				
					Agriculture			
					Irrigated Crop Production			
					Pasture Grazing-Riparian and/or Upland			
					Range Grazing-Riparian			
					Intensive Animal Feeding Operations			
					Concentrated Animal Feeding Operations (permitted, point source)			
					Agriculture-storm runoff			
					Land Development			
					Hydromodification			
					Channelization			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Drainage/Filling Of Wetlands			
					Channel Erosion			
					Natural Sources			
				Sediment		Low	61 Miles	
					Agriculture			
					Grazing-Related Sources			
					Land Development			
					Erosion/Siltation			
					Nonpoint Source			
1	R	Ten Mile River, Mendocino Coast HU, Rockport HA, Ten Mile River HSA	11313045					
				Sedimentation/Siltation		High	162 Miles	2003
					Silviculture			
					Harvesting, Restoration, Residue Management			
					Logging Road Construction/Maintenance			
				Temperature		Low	162 Miles	
					Habitat Modification			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
1	R	Trinity River, East Fork, Trinity River HU, Upper HA	10640030					
				Sedimentation/Siltation		Medium	92 Miles	
					Silviculture			
					Harvesting, Restoration, Residue Management			
					Logging Road Construction/Maintenance			
					Resource Extraction			
					Surface Mining			
					Placer Mining			
					Mine Tailings			
					Hydromodification			
					Dam Construction			
					Flow Regulation/Modification			
					Habitat Modification			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Channel Erosion			
					Erosion/Siltation			
					Natural Sources			
					Nonpoint Source			
1	R	Trinity River, South Fork, Trinity River HU, South Fork HA	10621035					
				Sedimentation/Siltation		Medium	1161 Miles	
					Range Grazing-Riparian			
					Silviculture			
					Nonpoint Source			
				Temperature		Low	1161 Miles	
					Range Grazing-Riparian			
					Water Diversions			
					Habitat Modification			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
1	R	Trinity River, Trinity River HU, Lower Trinity HA	10611034					
				Sedimentation/Siltation		Medium	1256 Miles	
					Silviculture			
					Harvesting, Restoration, Residue Management			
					Logging Road Construction/Maintenance			
					Silvicultural Point Sources			
					Resource Extraction			
					Surface Mining			
					Mine Tailings			
					Hydromodification			
					Dam Construction			
					Upstream Impoundment			
					Flow Regulation/Modification			
					Habitat Modification			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Drainage/Filling Of Wetlands			
					Channel Erosion			
					Erosion/Siltation			
					Natural Sources			
1	R	Trinity River, Trinity River HU, Middle HA	10631021					
				Sedimentation/Siltation		Medium	331 Miles	
					Silviculture			
					Harvesting, Restoration, Residue Management			
					Logging Road Construction/Maintenance			
					Silvicultural Point Sources			
					Resource Extraction			
					Placer Mining			
					Mine Tailings			
					Hydromodification			
					Dam Construction			
					Upstream Impoundment			
					Flow Regulation/Modification			
					Streambank Modification/Destabilization			
					Channel Erosion			
					Erosion/Siltation			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED		PROPOSED TMDL COMPLETION
1	R	Trinity River, Trinity River HU, Upper HA	10640003						
				Sedimentation/Siltation		Medium	570	Miles	
					Silviculture				
					Harvesting, Restoration, Residue Management				
					Logging Road Construction/Maintenance				
					Resource Extraction				
					Surface Mining				
					Placer Mining				
					Mine Tailings				
					Hydromodification				
					Dam Construction				
					Flow Regulation/Modification				
					Habitat Modification				
					Removal of Riparian Vegetation				
					Streambank Modification/Destabilization				
					Channel Erosion				
					Erosion/Siltation				
					Natural Sources				
					Nonpoint Source				
1	L	Tule Lake and Lower Klamath Lake National Wildlife Refuge (Klamath River HU)	10591020						
				pH (high)		Low	26998	Acres	
					Internal Nutrient Cycling (primarily lakes)				
					Nonpoint Source				
1	R	Van Duzen River, Eel River HU, Van Duzen River HA	11121012						
				Sedimentation/Siltation		Medium	585	Miles	
					Range Grazing-Riparian				
					Range Grazing-Upland				
					Silviculture				
					Harvesting, Restoration, Residue Management				
					Logging Road Construction/Maintenance				
					Silvicultural Point Sources				
					Construction/Land Development				
					Habitat Modification				
					Removal of Riparian Vegetation				
					Streambank Modification/Destabilization				
					Channel Erosion				
					Erosion/Siltation				
					Natural Sources				

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
2	R	Alameda Creek	20430051					
				Diazinon		High	51 Miles	2004
				This listing was made by USEPA.				
					Urban Runoff/Storm Sewers			
2	R	Alamitos Creek	20540041					
				Mercury		Medium	7.1 Miles	
				TMDL will be developed as part of the Santa Clara Basin Watershed Management Initiative. Additional monitoring and assessment is needed.				
					Mine Tailings			
2	R	Arroyo Corte Madera Del Presidio	20320020					
				Diazinon		High	4 Miles	2004
				This listing was made by USEPA.				
					Urban Runoff/Storm Sewers			
2	R	Arroyo De La Laguna	20430084					
				Diazinon		High	7.4 Miles	2004
				This listing was made by USEPA.				
					Urban Runoff/Storm Sewers			
2	R	Arroyo Del Valle	20430023					
				Diazinon		High	31 Miles	2004
				This listing was made by USEPA.				
					Urban Runoff/Storm Sewers			
2	R	Arroyo Las Positas	20430080					
				Diazinon		High	14 Miles	2004
					Urban Runoff/Storm Sewers			
2	R	Arroyo Mocho	20430080					
				Diazinon		High	34 Miles	2004
					Urban Runoff/Storm Sewers			
2	R	Butano Creek	20240031					
				Sedimentation/Siltation		Medium	3.6 Miles	
				Impairment to steelhead habitat.				
					Nonpoint Source			
2	R	Calabazas Creek	20640012					
				Diazinon		High	4.7 Miles	2004
				This listing was made by USEPA.				
					Urban Runoff/Storm Sewers			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
2	L	Calero Reservoir	20540031					
				Mercury		Medium	334 Acres	
				TMDL will be developed as part of the Santa Clara Basin Watershed Management Initiative. Additional monitoring and assessment is needed.				
					Surface Mining			
					Mine Tailings			
2	E	Carquinez Strait	20710020					
				Chlordane		Low	5657 Acres	
				This listing was made by USEPA.				
					Nonpoint Source			
				DDT		Low	5657 Acres	
					Nonpoint Source			
				Diazinon		Low	5657 Acres	
				Diazinon levels cause water column toxicity. Two patterns: pulses through riverine systems linked to agricultural application in late winter and pulse from residential land use areas linked to homeowner pesticide use in late spring, early summer. Chlorpyrifos may also be the cause of toxicity; more data needed, however.				
					Nonpoint Source			
				Dieldrin		Low	5657 Acres	
				This listing was made by USEPA.				
					Nonpoint Source			
				Dioxin Compounds		Low	5657 Acres	
				The specific compounds are 2,3,7,8-TCDD, 1,2,3,7,8-PeCDD, 1,2,3,4,7,8-HxCDD, 1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 1,2,3,4,6,7,8-HpCDD, and OCDD. This listing was made by USEPA.				
					Atmospheric Deposition			
				Exotic Species		Medium	5657 Acres	
				Disrupt natural benthos; change pollutant availability in food chain; disrupt food availability to native species.				
					Ballast Water			
				Furan Compounds		Low	5657 Acres	
				The specific compounds are 2,3,7,8-TCDF, 1,2,3,7,8-PeCDF, 2,3,4,7,8-PeCDF, 1,2,3,4,7,8-HxCDF, 1,2,3,6, 7,8,-HxCDF, 1,2,3,7,8,9-HxCDF, 2,3,4,6,7,8-HxCDF, 1,2,3,4,6,7,8-HpCDF, 1,2,3,4,7,8,9-HpCDF, and OCDF. This listing was made by USEPA.				
					Atmospheric Deposition			
				Mercury		High	5657 Acres	2003
				Current data indicate fish consumption and wildlife consumption impacted uses. Major source is historic: gold mining sediments and local mercury mining; most significant ongoing source is erosion and drainage from abandoned mines; moderate to low level inputs from point sources.				
					Industrial Point Sources			
					Municipal Point Sources			
					Resource Extraction			
					Atmospheric Deposition			
					Natural Sources			
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				PCBs		**High**	**5657 Acres**	**2004**
				This listing covers non dioxin-like PCBs.Interim health advisory for fish; uncertainty regarding water column concentration data.				
					Unknown Nonpoint Source			
				PCBs (dioxin-like)		**Low**	**5657 Acres**	
				The specific dioxin like compounds are 3,4,4,5-TCB (81), 3,3,3,3-TCB (77), 3,3,4,4,5-PeCB (126), 3,3,4,4,4,4-HxCB (169), 2,3,3,4,4-PeCB (105), 2,3,4,4,5-PeCB (114), 2,3,4,4,5-PeCB (118), 2,3,4,4,5-PeCB (123), 2,3,3,4,4,5-HxCB (156), 2,3,3,4,4,5-HxCB (157), 2,3,4,4,5,5,-HxCB (167), 2,3,3,4,4,5,5-HpCB (189). This listing was made by USEPA.				
					Unknown Nonpoint Source			
				Selenium		**Low**	**5657 Acres**	
				Affected use is one branch of the food chain; most sensitive indicator is hatchability in nesting diving birds, significant contributions from oil refineries (control program in place) and agriculture (carried downstream by rivers); exotic species may have made food chain more susceptible to accumulation of selenium; health consumption advisory in effect for scaup and scoter (diving ducks); low TMDL priority because Individual Control Strategy in place.				
					Industrial Point Sources			
					Agriculture			
2	**E**	**Castro Cove, Richmond (San Pablo Basin)**	**20660014**					
				Dieldrin (sediment)		**Low**	**71 Acres**	
					Urban Runoff/Storm Sewers			
					Point Source			
				Mercury (sediment)		**Low**	**71 Acres**	
					Urban Runoff/Storm Sewers			
					Point Source			
				PAHs (sediment)		**Low**	**71 Acres**	
					Urban Runoff/Storm Sewers			
					Point Source			
				Selenium (sediment)		**Low**	**71 Acres**	
					Urban Runoff/Storm Sewers			
					Point Source			
2	**B**	**Central Basin, San Francisco (part of SF Bay, Central)**	**20440010**					
				Chlordane		**Low**	**40 Acres**	
				This listing was made by USEPA.				
					Nonpoint Source			
				DDT		**Low**	**40 Acres**	
				This listing was made by USEPA.				
					Nonpoint Source			
				Diazinon		**Low**	**40 Acres**	
				Diazinon levels cause water column toxicity. Two patterns: pulses through riverine systems linked to agricultural application in late winter and pulse from residential land use areas linked to homeowner pesticide use in late spring, early summer. Chlorpyrifos may also be the cause of toxicity; more data needed, however.				
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Dieldrin		**Low**	**40 Acres**	
				This listing was made by USEPA.				
					Nonpoint Source			
				Dioxin Compounds		**Low**	**40 Acres**	
				The specific compounds are 2,3,7,8-TCDD, 1,2,3,7,8-PeCDD, 1,2,3,4,7,8-HxCDD, 1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 1,2,3,4,6,7,8-HpCDD, and OCDD. This listing was made by USEPA.				
					Atmospheric Deposition			
				Exotic Species		**Medium**	**40 Acres**	
				Disrupt natural benthos; change pollutant availability in food chain; disrupt food availability to native species.				
					Ballast Water			
				Furan Compounds		**Low**	**40 Acres**	
				The specific compounds are 2,3,7,8-TCDF, 1,2,3,7,8-PeCDF, 2,3,4,7,8-PeCDF, 1,2,3,4,7,8-HxCDF, 1,2,3,6,7,8-HxCDF, 1,2,3,7,8,9-HxCDF, 2,3,4,6,7,8-HxCDF, 1,2,3,4,6,7,8-HpCDF, 1,2,3,4,7,8,9-HpCDF, and OCDF. This listing was made by USEPA.				
					Atmospheric Deposition			
				Mercury		**High**	**40 Acres**	**2003**
				Current data indicate fish consumption and wildlife consumption impacted uses: health consumption advisory in effect for multiple fish species including striped bass and shark. Major source is historic: gold mining sediments and local mercury mining; most significant ongoing source is erosion and drainage from abandoned mines; moderate to low level inputs from point sources.				
					Industrial Point Sources			
					Minor Industrial Point Source			
					Municipal Point Sources			
					Resource Extraction			
					Atmospheric Deposition			
					Natural Sources			
					Nonpoint Source			
				Mercury (sediment)		**Low**	**40 Acres**	
					Urban Runoff/Storm Sewers			
					Point Source			
				PAHs (sediment)		**Low**	**40 Acres**	
					Urban Runoff/Storm Sewers			
					Point Source			
				PCBs		**High**	**40 Acres**	**2004**
				This listing covers non dioxin-like PCBs.Interim health advisory for fish; uncertainty regarding water column concentration data.				
					Unknown Nonpoint Source			
				PCBs (dioxin-like)		**Low**	**40 Acres**	
				The specific dioxin like compounds are 3,4,4,5-TCB (81), 3,3,3,3-TCB (77), 3,3,4,4,5-PeCB (126), 3,3,4,4,4,4-HxCB (169), 2,3,3,4,4-PeCB (105), 2,3,4,4,5-PeCB (114), 2,3,4,4,5-PeCB (118), 2,3,4,4,5-PeCB (123), 2,3,3,4,4,5-HxCB (156), 2,3,3,4,4,5-HxCB (157), 2,3,4,4,5,5,-HxCB (167), 2,3,3,4,4,5,5-HpCB (189). This listing was made by USEPA.				
					Unknown Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Selenium		**Low**	**40 Acres**	
				Affected use is one branch of the food chain; most sensitive indicator is hatchability in nesting diving birds, significant contributions from oil refineries (control program in place) and agriculture (carried downstream by rivers); exotic species may have made food chain more susceptible to accumulation of selenium; health consumption advisory in effect for scaup and scoter (diving ducks); low TMDL priority because Individual Control Strategy in place.				
					Industrial Point Sources			
					Agriculture			
					Natural Sources			
					Exotic Species			
2	**R**	**Corte Madera Creek**	**20320011**					
				Diazinon		**High**	**4.1 Miles**	**2004**
				This listing was made by USEPA.				
					Urban Runoff/Storm Sewers			
2	**R**	**Coyote Creek (Marin County)**	**20320020**					
				Diazinon		**High**	**2.6 Miles**	**2004**
				This listing was made by USEPA.				
					Urban Runoff/Storm Sewers			
2	**R**	**Coyote Creek (Santa Clara Co.)**	**20530021**					
				Diazinon		**High**	**55 Miles**	**2004**
				This listing was made by USEPA.				
					Urban Runoff/Storm Sewers			
2	**R**	**Gallinas Creek**	**20620013**					
				Diazinon		**High**	**2.1 Miles**	**2004**
				This listing was made by USEPA.				
					Urban Runoff/Storm Sewers			
2	**R**	**Guadalupe Creek**	**20540050**					
				Mercury		**Medium**	**8.1 Miles**	
				TMDL will be developed as part of the Santa Clara Basin Watershed Management Initiative. Additional monitoring and assessment is needed.				
					Mine Tailings			
2	**L**	**Guadalupe Reservoir**	**20540040**					
				Mercury		**Medium**	**63 Acres**	
				TMDL will be developed as part of the Santa Clara Basin Watershed Management Initiative. Additional monitoring and assessment is needed.				
					Surface Mining			
					Mine Tailings			
2	**R**	**Guadalupe River**	**20540050**					
				Diazinon		**High**	**18 Miles**	**2004**
				This listing was made by USEPA.				
					Urban Runoff/Storm Sewers			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Mercury		**Medium**	**18 Miles**	
				TMDL will be developed as part of the Santa Clara Basin Watershed Management Initiative. Additional monitoring and assessment is needed.				
					Mine Tailings			
2	**E**	**Islais Creek**	**20440010**					
				Ammonia		**Low**	**46 Acres**	
					Industrial Point Sources			
					Combined Sewer Overflow			
				Chlordane (sediment)		**Low**	**46 Acres**	
					Industrial Point Sources			
					Combined Sewer Overflow			
				Dieldrin (sediment)		**Low**	**46 Acres**	
					Industrial Point Sources			
					Combined Sewer Overflow			
				Endosulfan sulfate (sediment)		**Low**	**46 Acres**	
					Industrial Point Sources			
					Combined Sewer Overflow			
				Hydrogen Sulfide		**Low**	**46 Acres**	
					Industrial Point Sources			
					Combined Sewer Overflow			
				PAHs (sediment)		**Low**	**46 Acres**	
					Industrial Point Sources			
					Combined Sewer Overflow			
				PCBs (sediment)		**Low**	**46 Acres**	
					Industrial Point Sources			
					Combined Sewer Overflow			
2	**R**	**Lagunitas Creek**	**20113020**					
				Nutrients		**Low**	**17 Miles**	
				Tributary to Tomales Bay. TMDLs will be developed as part of evolving watershed management effort. Additional monitoring and assessment needed.				
					Agriculture			
					Urban Runoff/Storm Sewers			
				Pathogens		**Low**	**17 Miles**	
				Tributary to Tomales Bay. TMDLs will be developed as part of evolving watershed management effort. Additional monitoring and assessment needed.				
					Agriculture			
					Urban Runoff/Storm Sewers			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Sedimentation/Siltation		**Medium**	**17 Miles**	
				Tributary to Tomales Bay. TMDLs will be developed as part of evolving watershed management effort. Additional monitoring and assessment needed.				
					Agriculture			
					Urban Runoff/Storm Sewers			
2	**L**	**Lake Herman**	**20721030**					
				Mercury		**Low**	**108 Acres**	
				Additional monitoring and assessment needed. Problem due to historical mining.				
					Surface Mining			
2	**L**	**Lake Merced**	**20210010**					
				Low Dissolved Oxygen		**Low**	**299 Acres**	
				This listing was made by USEPA.				
					Source Unknown			
				pH		**Low**	**299 Acres**	
				This listing was made by USEPA.				
					Source Unknown			
2	**L**	**Lake Merritt**	**20420040**					
				Organic Enrichment/Low Dissolved Oxygen		**Low**	**142 Acres**	
				This listing was made by USEPA.				
					Source Unknown			
				Trash		**Low**	**142 Acres**	
					Urban Runoff/Storm Sewers			
2	**R**	**Laurel Creek (Solano Co)**	**20440040**					
				Diazinon		**High**	**3 Miles**	**2004**
				This listing was made by USEPA.				
					Urban Runoff/Storm Sewers			
2	**R**	**Ledgewood Creek**	**20723010**					
				Diazinon		**High**	**12 Miles**	**2004**
				This listing was made by USEPA.				
					Urban Runoff/Storm Sewers			
2	**R**	**Los Gatos Creek (R2)**	**20540011**					
				Diazinon		**High**	**19 Miles**	**2004**
				This listing was made by USEPA.				
					Urban Runoff/Storm Sewers			
2	**E**	**Marina Lagoon (San Mateo County)**	**20440040**					
				High Coliform Count		**Low**	**169 Acres**	
					Urban Runoff/Storm Sewers			
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
2	R	Matadero Creek	20550040					
				Diazinon		High	7.3 Miles	2004
				This listing was made by USEPA.				
					Urban Runoff/Storm Sewers			
2	R	Miller Creek	20620012					
				Diazinon		High	9 Miles	2004
				This listing was made by USEPA.				
					Urban Runoff/Storm Sewers			
2	E	Mission Creek	20440010					
				Ammonia		Low	8.5 Acres	
					Industrial Point Sources			
					Combined Sewer Overflow			
				Chlordane (sediment)		Low	8.5 Acres	
					Industrial Point Sources			
					Combined Sewer Overflow			
				Chlorpyrifos (sediment)		Low	8.5 Acres	
					Industrial Point Sources			
					Combined Sewer Overflow			
				Chromium (sediment)		Low	8.5 Acres	
					Industrial Point Sources			
					Combined Sewer Overflow			
				Copper (sediment)		Low	8.5 Acres	
					Industrial Point Sources			
					Combined Sewer Overflow			
				Dieldrin (sediment)		Low	8.5 Acres	
					Industrial Point Sources			
					Combined Sewer Overflow			
				Hydrogen Sulfide		Low	8.5 Acres	
					Industrial Point Sources			
					Combined Sewer Overflow			
				Lead (sediment)		Low	8.5 Acres	
					Industrial Point Sources			
					Combined Sewer Overflow			
				Mercury (sediment)		Low	8.5 Acres	
					Industrial Point Sources			
					Combined Sewer Overflow			
				Mirex (sediment)		Low	8.5 Acres	
					Industrial Point Sources			
					Combined Sewer Overflow			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				PAHs		**Low**	**8.5 Acres**	
					Industrial Point Sources			
					Combined Sewer Overflow			
				PCBs (sediment)		**Low**	**8.5 Acres**	
					Industrial Point Sources			
					Combined Sewer Overflow			
				Silver (sediment)		**Low**	**8.5 Acres**	
					Industrial Point Sources			
					Combined Sewer Overflow			
				Zinc (sediment)		**Low**	**8.5 Acres**	
					Industrial Point Sources			
					Combined Sewer Overflow			
2	**R**	**Mt. Diablo Creek**	**20731040**					
				Diazinon		**High**	**13 Miles**	**2004**
				This listing was made by USEPA.				
					Urban Runoff/Storm Sewers			
2	**R**	**Napa River**	**20650010**					
				Nutrients		**Medium**	**65 Miles**	
				TMDL will be developed as part of ongoing watershed management effort. Additional monitoring and assessment needed.				
					Agriculture			
				Pathogens		**Low**	**65 Miles**	
				TMDL will be developed as part of ongoing watershed management effort. Additional monitoring and assessment needed.				
					Agriculture			
					Urban Runoff/Storm Sewers			
				Sedimentation/Siltation		**Medium**	**65 Miles**	
				TMDL will be developed as part of ongoing watershed management effort. Additional monitoring and assessment needed.				
					Agriculture			
					Construction/Land Development			
					Land Development			
					Urban Runoff/Storm Sewers			
2	**R**	**Novato Creek**	**20620010**					
				Diazinon		**High**	**17 Miles**	**2004**
				This listing was made by USEPA.				
					Urban Runoff/Storm Sewers			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
2	B	Oakland Inner Harbor (Fruitvale Site, part of SF Bay, Central)	20420040					
				Chlordane		Low	0.93 Acres	
				This listing was made by USEPA.				
					Nonpoint Source			
				Chlordane (sediment)		Low	0.93 Acres	
					Source Unknown			
				DDT		Low	0.93 Acres	
				This listing was made by USEPA.				
					Nonpoint Source			
				Diazinon		Low	0.93 Acres	
				Diazinon levels cause water column toxicity. Two patterns: pulses through riverine systems linked to agricultural application in late winter and pulse from residential land use areas linked to homeowner pesticide use in late spring, early summer. Chlorpyrifos may also be the cause of toxicity; more data needed, however.				
					Nonpoint Source			
				Dieldrin		Low	0.93 Acres	
				This listing was made by USEPA.				
					Nonpoint Source			
				Dioxin Compounds		Low	0.93 Acres	
				The specific compounds are 2,3,7,8-TCDD, 1,2,3,7,8-PeCDD, 1,2,3,4,7,8-HxCDD, 1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 1,2,3,4,6,7,8-HpCDD, and OCDD. This listing was made by USEPA.				
					Atmospheric Deposition			
				Exotic Species		Medium	0.93 Acres	
				Disrupt natural benthos; change pollutant availability in food chain; disrupt food availability to native species.				
					Ballast Water			
				Furan Compounds		Low	0.93 Acres	
				The specific compounds are 2,3,7,8-TCDF, 1,2,3,7,8-PeCDF, 2,3,4,7,8-PeCDF, 1,2,3,4,7,8-HxCDF, 1,2,3,6,7,8-HxCDF, 1,2,3,7,8,9-HxCDF, 2,3,4,6,7,8-HxCDF, 1,2,3,4,6,7,8-HpCDF, 1,2,3,4,7,8,9-HpCDF, and OCDF. This listing was made by USEPA.				
					Atmospheric Deposition			
				Mercury		High	0.93 Acres	2003
				Current data indicate fish consumption and wildlife consumption impacted uses: health consumption advisory in effect for multiple fish species including striped bass and shark. Major source is historic: gold mining sediments and local mercury mining; most significant ongoing source is erosion and drainage from abandoned mines; moderate to low level inputs from point sources.				
					Industrial Point Sources			
					Municipal Point Sources			
					Resource Extraction			
					Atmospheric Deposition			
					Natural Sources			
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				PCBs		**High**	**0.93 Acres**	**2004**
				This listing covers non dioxin-like PCBs.Interim health advisory for fish; uncertainty regarding water column concentration data.				
					Unknown Nonpoint Source			
				PCBs (dioxin-like)		**Low**	**0.93 Acres**	
				The specific dioxin like compounds are 3,4,4,5-TCB (81), 3,3,3,3-TCB (77), 3,3,4,4,5-PeCB (126), 3,3,4,4,4,4-HxCB (169), 2,3,3,4,4-PeCB (105), 2,3,4,4,5-PeCB (114), 2,3,4,4,5-PeCB (118), 2,3,4,4,5-PeCB (123), 2,3,3,4,4,5-HxCB (156), 2,3,3,4,4,5-HxCB (157), 2,3,4,4,5,5,-HxCB (167), 2,3,3,4,4,5,5-HpCB (189). This listing was made by USEPA.				
					Unknown Nonpoint Source			
				PCBs (sediment)		**Low**	**0.93 Acres**	
					Source Unknown			
				Selenium		**Low**	**0.93 Acres**	
				Affected use is one branch of the food chain; most sensitive indicator is hatchability in nesting diving birds, significant contributions from oil refineries (control program in place) and agriculture (carried downstream by rivers); exotic species may have made food chain more susceptible to accumulation of selenium; health consumption advisory in effect for scaup and scoter (diving ducks); low TMDL priority because Individual Control Strategy in place.				
					Industrial Point Sources			
					Agriculture			
					Natural Sources			
					Exotic Species			
2	**B**	**Oakland Inner Harbor (Pacific Dry-dock Yard 1 Site, part of SF Bay, Central)**	**20420040**					
				Chlordane		**Low**	**1.8 Acres**	
				This listing was made by USEPA.				
					Nonpoint Source			
				Chlordane (sediment)		**Low**	**1.8 Acres**	
					Source Unknown			
				Chlorpyrifos (sediment)		**Low**	**1.8 Acres**	
					Source Unknown			
				Copper (sediment)		**Low**	**1.8 Acres**	
					Source Unknown			
				DDT		**Low**	**1.8 Acres**	
				This listing was made by USEPA.				
					Nonpoint Source			
				Diazinon		**Low**	**1.8 Acres**	
				Diazinon levels cause water column toxicity. Two patterns: pulses through riverine systems linked to agricultural application in late winter and pulse from residential land use areas linked to homeowner pesticide use in late spring, early summer. Chlorpyrifos may also be the cause of toxicity; more data needed, however.				
					Nonpoint Source			
				Dieldrin		**Low**	**1.8 Acres**	
				This listing was made by USEPA.				
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Dieldrin (sediment)		**Low**	**1.8 Acres**	
					Source Unknown			
				Dioxin Compounds		**Low**	**1.8 Acres**	
				The specific compounds are 2,3,7,8-TCDD, 1,2,3,7,8-PeCDD, 1,2,3,4,7,8-HxCDD, 1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 1,2,3,4,6,7,8-HpCDD, and OCDD. This listing was made by USEPA.				
					Atmospheric Deposition			
				Exotic Species		**Medium**	**1.8 Acres**	
				Disrupt natural benthos; change pollutant availability in food chain; disrupt food availability to native species.				
					Ballast Water			
				Furan Compounds		**Low**	**1.8 Acres**	
				The specific compounds are 2,3,7,8-TCDF, 1,2,3,7,8-PeCDF, 2,3,4,7,8-PeCDF, 1,2,3,4,7,8-HxCDF, 1,2,3,6,7,8-HxCDF, 1,2,3,7,8,9-HxCDF, 2,3,4,6,7,8-HxCDF, 1,2,3,4,6,7,8-HpCDF, 1,2,3,4,7,8,9-HpCDF, and OCDF. This listing was made by USEPA.				
					Atmospheric Deposition			
				Lead (sediment)		**Low**	**1.8 Acres**	
					Source Unknown			
				Mercury		**High**	**1.8 Acres**	**2003**
				Current data indicate fish consumption and wildlife consumption impacted uses: health consumption advisory in effect for multiple fish species including striped bass and shark. Major source is historic: gold mining sediments and local mercury mining; most significant ongoing source is erosion and drainage from abandoned mines; moderate to low level inputs from point sources.				
					Industrial Point Sources			
					Municipal Point Sources			
					Resource Extraction			
					Atmospheric Deposition			
					Natural Sources			
					Nonpoint Source			
				Mercury (sediment)		**Low**	**1.8 Acres**	
					Source Unknown			
				Mirex (sediment)		**Low**	**1.8 Acres**	
					Source Unknown			
				PAHs (sediment)		**Low**	**1.8 Acres**	
					Source Unknown			
				PCBs		**High**	**1.8 Acres**	**2004**
				This listing covers non dioxin-like PCBs.Interim health advisory for fish; uncertainty regarding water column concentration data.				
					Unknown Nonpoint Source			
				PCBs (dioxin-like)		**Low**	**1.8 Acres**	
				The specific dioxin like compounds are 3,4,4,5-TCB (81), 3,3,3,3-TCB (77), 3,3,4,4,5-PeCB (126), 3,3,4,4,4,4-HxCB (169), 2,3,3,4,4-PeCB (105), 2,3,4,4,5-PeCB (114), 2,3,4,4,5-PeCB (118), 2,3,4,4,5-PeCB (123), 2,3,3,4,4,5-HxCB (156), 2,3,3,4,4,5-HxCB (157), 2,3,4,4,5,5,-HxCB (167), 2,3,3,4,4,5,5-HpCB (189). This listing was made by USEPA.				
					Unknown Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				PCBs (sediment)		**Low**	**1.8 Acres**	
					Source Unknown			
				ppDDE (sediment)		**Low**	**1.8 Acres**	
					Source Unknown			
				Selenium		**Low**	**1.8 Acres**	
				Affected use is one branch of the food chain; most sensitive indicator is hatchability in nesting diving birds, significant contributions from oil refineries (control program in place) and agriculture (carried downstream by rivers); exotic species may have made food chain more susceptible to accumulation of selenium; health consumption advisory in effect for scaup and scoter (diving ducks); low TMDL priority because Individual Control Strategy in place.				
					Industrial Point Sources			
					Agriculture			
					Natural Sources			
					Exotic Species			
				Tributyltin (sediment)		**Low**	**1.8 Acres**	
					Source Unknown			
				Zinc (sediment)		**Low**	**1.8 Acres**	
					Source Unknown			
2	**C**	**Pacific Ocean at Fitzgerald Marine Reserve**	**20221012**					
				High Coliform Count		**Low**	**0.46 Miles**	
					Nonpoint Source			
2	**C**	**Pacific Ocean at Pacifica State Beach**	**20221011**					
				High Coliform Count		**Low**	**0.87 Miles**	
				Linda Mar and San Pedro beaches are the areas affected.				
					Urban Runoff/Storm Sewers			
					Nonpoint Source			
2	**C**	**Pacific Ocean at Pillar Point Beach**	**20221012**					
				High Coliform Count		**Low**	**1.1 Miles**	
					Nonpoint Source			
2	**C**	**Pacific Ocean at Rockaway Beach**	**20221011**					
				High Coliform Count		**Low**	**0.29 Miles**	
					Urban Runoff/Storm Sewers			
					Nonpoint Source			
2	**C**	**Pacific Ocean at Venice Beach**	**20222011**					
				High Coliform Count		**Low**	**0.38 Miles**	
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
2	R	Permanente Creek	20550021					
				Diazinon		High	13 Miles	2004
				This listing was made by USEPA.				
					Urban Runoff/Storm Sewers			
2	R	Pescadero Creek	20240013					
				Sedimentation/Siltation		Medium	26 Miles	
				Impairment to steelhead habitat.				
					Nonpoint Source			
2	R	Petaluma River	20630020					
				Diazinon		Low	22 Miles	
				Data source: Abelli-Amen, Petaluma Tree Planters, 1999.				
					Urban Runoff/Storm Sewers			
				Nutrients		Medium	22 Miles	
				TMDL will be developed as part of ongoing watershed management effort. Additional monitoring and assessment needed.				
					Agriculture			
					Construction/Land Development			
					Urban Runoff/Storm Sewers			
				Pathogens		Medium	22 Miles	
				TMDL will be developed as part of ongoing watershed management effort. Additional monitoring and assessment needed.				
					Agriculture			
					Construction/Land Development			
					Urban Runoff/Storm Sewers			
				Sedimentation/Siltation		Medium	22 Miles	
					Agriculture			
					Construction/Land Development			
					Urban Runoff/Storm Sewers			
2	R	Petaluma River (tidal portion)	20630040					
				Diazinon		Low	1.1 Miles	
				Data source: Abelli-Amen, Petaluma Tree Planters, 1999.				
					Urban Runoff/Storm Sewers			
				Nickel		Low	1.1 Miles	
				Exceedance of California Toxic Rule dissolved criteria and National Toxic Rule total criteria; elevated water and sediment tissue levels.				
					Municipal Point Sources			
					Urban Runoff/Storm Sewers			
					Atmospheric Deposition			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Nutrients		**Medium**	**1.1 Miles**	
				TMDL will be developed as part of ongoing watershed management effort. Additional monitoring and assessment needed.				
					Agriculture			
					Construction/Land Development			
					Urban Runoff/Storm Sewers			
				Pathogens		**Medium**	**1.1 Miles**	
				TMDL will be developed as part of ongoing watershed management effort. Additional monitoring and assessment needed.				
					Agriculture			
					Construction/Land Development			
					Urban Runoff/Storm Sewers			
2	**R**	**Pine Creek (Contra Costa Co)**	**20731011**					
				Diazinon		**High**	**13 Miles**	**2004**
				This listing was made by USEPA.				
					Urban Runoff/Storm Sewers			
2	**R**	**Pinole Creek**	**20660020**					
				Diazinon		**High**	**9.2 Miles**	**2004**
				This listing was made by USEPA.				
					Urban Runoff/Storm Sewers			
2	**R**	**Pomponio Creek**	**20240020**					
				High Coliform Count		**Low**	**7.1 Miles**	
					Nonpoint Source			
2	**B**	**Richardson Bay**	**20312010**					
				Chlordane		**Low**	**2439 Acres**	
				This listing was made by USEPA.				
					Nonpoint Source			
				DDT		**Low**	**2439 Acres**	
				This listing was made by USEPA.				
					Nonpoint Source			
				Dieldrin		**Low**	**2439 Acres**	
				This listing was made by USEPA.				
					Unknown Nonpoint Source			
				Dioxin Compounds		**Low**	**2439 Acres**	
				The specific compounds are 2,3,7,8-TCDD, 1,2,3,7,8-PeCDD, 1,2,3,4,7,8-HxCDD, 1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 1,2,3,4,6,7,8-HpCDD, and OCDD. This listing was made by USEPA.				
					Atmospheric Deposition			
				Exotic Species		**Medium**	**2439 Acres**	
				Disrupt natural benthos; change pollutant availability in food chain; disrupt food availability to native species.				
					Ballast Water			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Furan Compounds		**Low**	**2439 Acres**	
				The specific compounds are 2,3,7,8-TCDF, 1,2,3,7,8-PeCDF, 2,3,4,7,8-PeCDF, 1,2,3,4,7,8-HxCDF, 1,2,3,6, 7,8,-HxCDF, 1,2,3,7,8,9-HxCDF, 2,3,4,6,7,8-HxCDF, 1,2,3,4,6,7,8-HpCDF, 1,2,3,4,7,8,9-HpCDF, and OCDF. This listing was made by USEPA.				
					Atmospheric Deposition			
				High Coliform Count		**Low**	**2439 Acres**	
				Affected area, Waldo Point Harbor, is less than 10% of embayment; source has been positively identified as substandard sewage systems in some houseboat areas; extensive local control program in place with significant water quality improvements.				
					Urban Runoff/Storm Sewers			
					Septage Disposal			
					Boat Discharges/Vessel Wastes			
				Mercury		**High**	**2439 Acres**	**2003**
				Current data indicate fish consumption and wildlife consumption impacted uses: health consumption advisory in effect for multiple fish species including striped bass and shark. Major source is historic: gold mining sediments and local mercury mining; most significant ongoing source is erosion and drainage from abandoned mines; moderate to low level inputs from point sources.				
					Municipal Point Sources			
					Resource Extraction			
					Atmospheric Deposition			
					Natural Sources			
					Nonpoint Source			
				PCBs		**High**	**2439 Acres**	**2004**
				This listing covers non dioxin-like PCBs. Interim health advisory for fish; uncertainty regarding water column concentration data.				
					Unknown Nonpoint Source			
				PCBs (dioxin-like)		**Low**	**2439 Acres**	
				The specific dioxin like compounds are 3,4,4,5-TCB (81), 3,3,3,3-TCB (77), 3,3,4,4,5-PeCB (126), 3,3,4,4,4,4-HxCB (169), 2,3,3,4,4-PeCB (105), 2,3,4,4,5-PeCB (114), 2,3,4,4,5-PeCB (118), 2,3,4,4,5-PeCB (123), 2,3,3,4,4,5-HxCB (156), 2,3,3,4,4,5-HxCB (157), 2,3,4,4,5,5,-HxCB (167), 2,3,3,4,4,5,5-HpCB (189). This listing was made by USEPA.				
					Unknown Nonpoint Source			
2	**R**	**Rodeo Creek**	**20660022**					
				Diazinon		**High**	**8 Miles**	**2004**
				This listing was made by USEPA.				
					Urban Runoff/Storm Sewers			
2	**E**	**Sacramento San Joaquin Delta**	**20710010**					
				Chlordane		**Low**	**41736 Acres**	
				This listing was made by USEPA.				
					Nonpoint Source			
				DDT		**Low**	**41736 Acres**	
				This listing was made by USEPA.				
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Diazinon		**Low**	**41736 Acres**	
				Diazinon levels cause water column toxicity. Two patterns: pulses through riverine systems linked to agricultural application in late winter and pulse from residential land use areas linked to homeowner pesticide use in late spring, early summer. Chlorpyrifos may also be the cause of toxicity; more data needed, however.				
					Nonpoint Source			
				Dieldrin		**Low**	**41736 Acres**	
				This listing was made by USEPA.				
					Nonpoint Source			
				Dioxin Compounds		**Low**	**41736 Acres**	
				The specific compounds are 2,3,7,8-TCDD, 1,2,3,7,8-PeCDD, 1,2,3,4,7,8-HxCDD, 1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 1,2,3,4,6,7,8-HpCDD, and OCDD. This listing was made by USEPA.				
					Atmospheric Deposition			
				Exotic Species		**Medium**	**41736 Acres**	
				Disrupt natural benthos; change pollutant availability in food chain; disrupt food availability to native species.				
					Ballast Water			
				Furan Compounds		**Low**	**41736 Acres**	
				The specific compounds are 2,3,7,8-TCDF, 1,2,3,7,8-PeCDF, 2,3,4,7,8-PeCDF, 1,2,3,4,7,8-HxCDF, 1,2,3,6, 7,8,-HxCDF, 1,2,3,7,8,9-HxCDF, 2,3,4,6,7,8-HxCDF, 1,2,3,4,6,7,8-HpCDF, 1,2,3,4,7,8,9-HpCDF, and OCDF. This listing was made by USEPA.				
					Atmospheric Deposition			
				Mercury		**High**	**41736 Acres**	**2003**
				Current data indicate fish consumption and wildlife consumption impacted uses. Major source is historic: gold mining sediments and local mercury mining; most significant ongoing source is erosion and drainage from abandoned mines; moderate to low level inputs from point sources.				
					Industrial Point Sources			
					Municipal Point Sources			
					Resource Extraction			
					Atmospheric Deposition			
					Nonpoint Source			
				Nickel		**Low**	**41736 Acres**	
				This listing was made by USEPA.				
					Source Unknown			
				PCBs		**High**	**41736 Acres**	**2004**
				This listing covers non dioxin-like PCBs.Interim health advisory for fish; uncertainty regarding water column concentration data.				
					Unknown Nonpoint Source			
				PCBs (dioxin-like)		**Low**	**41736 Acres**	
				The specific dioxin like compounds are 3,4,4,5-TCB (81), 3,3,3,3-TCB (77), 3,3,4,4,5-PeCB (126), 3,3,4,4,4,4-HxCB (169), 2,3,3,4,4-PeCB (105), 2,3,4,4,5-PeCB (114), 2,3,4,4,5-PeCB (118), 2,3,4,4,5-PeCB (123), 2,3,3,4,4,5-HxCB (156), 2,3,3,4,4,5-HxCB (157), 2,3,4,4,5,5,-HxCB (167), 2,3,3,4,4,5,5-HpCB (189). This listing was made by USEPA.				
					Unknown Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Selenium		**Low**	**41736 Acres**	
				Affected use is one branch of the food chain; most sensitive indicator is hatchability in nesting diving birds, significant contributions from oil refineries (control program in place) and agriculture (carried downstream by rivers); exotic species may have made food chain more susceptible to accumulation of selenium; health consumption advisory in effect for scaup and scoter (diving ducks); low TMDL priority because Individual Control Strategy in place. Another source is exotic species.				
					Industrial Point Sources			
					Agriculture			
					Natural Sources			
					Exotic Species			
2	**R**	**San Antonio Creek (Marin/Sonoma Co)**	**20630031**					
				Diazinon		**High**	**18 Miles**	**2004**
				This listing was made by USEPA.				
					Urban Runoff/Storm Sewers			
2	**R**	**San Felipe Creek**	**20530041**					
				Diazinon		**High**	**15 Miles**	**2004**
				This listing was made by USEPA.				
					Urban Runoff/Storm Sewers			
2	**B**	**San Francisco Bay, Central**	**20312010**					
				Chlordane		**Low**	**70992 Acres**	
				This listing was made by USEPA.				
					Nonpoint Source			
				DDT		**Low**	**70992 Acres**	
				This listing was made by USEPA.				
					Nonpoint Source			
				Diazinon		**Low**	**70992 Acres**	
				Diazinon levels cause water column toxicity. Two patterns: pulses through riverine systems linked to agricultural application in late winter and pulse from residential land use areas linked to homeowner pesticide use in late spring, early summer. Chlorpyrifos may also be the cause of toxicity; more data needed, however.				
					Nonpoint Source			
				Dieldrin		**Low**	**70992 Acres**	
				This listing was made by USEPA.				
					Nonpoint Source			
				Dioxin Compounds		**Low**	**70992 Acres**	
				The specific compounds are 2,3,7,8-TCDD, 1,2,3,7,8-PeCDD, 1,2,3,4,7,8-HxCDD, 1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 1,2,3,4,6,7,8-HpCDD, and OCDD. This listing was made by USEPA.				
					Atmospheric Deposition			
				Exotic Species		**Medium**	**70992 Acres**	
				Disrupt natural benthos; change pollutant availability in food chain; disrupt food availability to native species.				
					Ballast Water			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Furan Compounds		**Low**	**70992 Acres**	
				The specific compounds are 2,3,7,8-TCDF, 1,2,3,7,8-PeCDF, 2,3,4,7,8-PeCDF, 1,2,3,4,7,8-HxCDF, 1,2,3,6,7,8-HxCDF, 1,2,3,7,8,9-HxCDF, 2,3,4,6,7,8-HxCDF, 1,2,3,4,6,7,8-HpCDF, 1,2,3,4,7,8,9-HpCDF, and OCDF. This listing was made by USEPA.				
					Atmospheric Deposition			
				Mercury		**High**	**70992 Acres**	**2003**
				Current data indicate fish consumption and wildlife consumption impacted uses: health consumption advisory in effect for multiple fish species including striped bass and shark. Major source is historic: gold mining sediments and local mercury mining; most significant ongoing source is erosion and drainage from abandoned mines; moderate to low level inputs from point sources.				
					Industrial Point Sources			
					Municipal Point Sources			
					Resource Extraction			
					Atmospheric Deposition			
					Natural Sources			
					Nonpoint Source			
				PCBs		**High**	**70992 Acres**	**2004**
				This listing covers non dioxin-like PCBs.Interim health advisory for fish; uncertainty regarding water column concentration data.				
					Unknown Nonpoint Source			
				PCBs (dioxin-like)		**Low**	**70992 Acres**	
				The specific dioxin like compounds are 3,4,4,5-TCB (81), 3,3,3,3-TCB (77), 3,3,4,4,5-PeCB (126), 3,3,4,4,4,4-HxCB (169), 2,3,3,4,4-PeCB (105), 2,3,4,4,5-PeCB (114), 2,3,4,4,5-PeCB (118), 2,3,4,4,5-PeCB (123), 2,3,3,4,4,5-HxCB (156), 2,3,3,4,4,5-HxCB (157), 2,3,4,4,5,5,-HxCB (167), 2,3,3,4,4,5,5-HpCB (189). This listing was made by USEPA.				
					Unknown Nonpoint Source			
				Selenium		**Low**	**70992 Acres**	
				Affected use is one branch of the food chain; most sensitive indicator is hatchability in nesting diving birds, significant contributions from oil refineries (control program in place) and agriculture (carried downstream by rivers); exotic species may have made food chain more susceptible to accumulation of selenium; health consumption advisory in effect for scaup and scoter (diving ducks); low TMDL priority because Individual Control Strategy in place.				
					Industrial Point Sources			
					Agriculture			
					Natural Sources			
					Exotic Species			
2	**B**	**San Francisco Bay, Lower**	**20410010**					
				Chlordane		**Low**	**79293 Acres**	
				This listing was made by USEPA.				
					Nonpoint Source			
				DDT		**Low**	**79293 Acres**	
				This listing was made by USEPA.				
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Diazinon		**Low**	**79293 Acres**	
				Diazinon levels cause water column toxicity. Two patterns: pulses through riverine systems linked to agricultural application in late winter and pulse from residential land use areas linked to homeowner pesticide use in late spring, early summer. Chlorpyrifos may also be the cause of toxicity; more data needed, however.				
					Nonpoint Source			
				Dieldrin		**Low**	**79293 Acres**	
				This listing was made by USEPA.				
					Nonpoint Source			
				Dioxin Compounds		**Low**	**79293 Acres**	
				The specific compounds are 2,3,7,8-TCDD, 1,2,3,7,8-PeCDD, 1,2,3,4,7,8-HxCDD, 1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 1,2,3,4,6,7,8-HpCDD, and OCDD. This listing was made by USEPA.				
					Atmospheric Deposition			
				Exotic Species		**Medium**	**79293 Acres**	
				Disrupt natural benthos; change pollutant availability in food chain; disrupt food availability to native species.				
					Ballast Water			
				Furan Compounds		**Low**	**79293 Acres**	
				The specific compounds are 2,3,7,8-TCDF, 1,2,3,7,8-PeCDF, 2,3,4,7,8-PeCDF, 1,2,3,4,7,8-HxCDF, 1,2,3,6, 7,8,-HxCDF, 1,2,3,7,8,9-HxCDF, 2,3,4,6,7,8-HxCDF, 1,2,3,4,6,7,8-HpCDF, 1,2,3,4,7,8,9-HpCDF, and OCDF. This listing was made by USEPA.				
					Atmospheric Deposition			
				Mercury		**High**	**79293 Acres**	**2003**
				Current data indicate fish consumption and wildlife consumption impacted uses: health consumption advisory in effect for multiple fish species including striped bass and shark. Major source is historic: gold mining sediments and local mercury mining; most significant ongoing source is erosion and drainage from abandoned mines; moderate to low level inputs from point sources: water quality objective exceedances. Elevated sediment levels and elevated tissue levels.				
					Industrial Point Sources			
					Municipal Point Sources			
					Resource Extraction			
					Atmospheric Deposition			
					Natural Sources			
					Nonpoint Source			
				Nickel		**Low**	**79293 Acres**	
				This listing was made by USEPA.				
					Source Unknown			
				PCBs		**High**	**79293 Acres**	**2004**
				This listing covers non dioxin-like PCBs.Interim health advisory for fish; uncertainty regarding water column concentration data.				
					Unknown Nonpoint Source			
				PCBs (dioxin-like)		**Low**	**79293 Acres**	
				The specific dioxin like compounds are 3,4,4,5-TCB (81), 3,3,3,3-TCB (77), 3,3,4,4,5-PeCB (126), 3,3,4,4,4,4-HxCB (169), 2,3,3,4,4-PeCB (105), 2,3,4,4,5-PeCB (114), 2,3,4,4,5-PeCB (118), 2,3,4,4,5-PeCB (123), 2,3,3,4,4,5-HxCB (156), 2,3,3,4,4,5-HxCB (157), 2,3,4,4,5,5,-HxCB (167), 2,3,3,4,4,5,5-HpCB (189). This listing was made by USEPA.				
					Unknown Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
2	B	San Francisco Bay, South	20510000					
				Chlordane		Low	21669 Acres	
				This listing was made by USEPA.				
					Nonpoint Source			
				DDT		Low	21669 Acres	
				This listing was made by USEPA.				
					Nonpoint Source			
				Diazinon		Low	21669 Acres	
				Diazinon levels cause water column toxicity. Two patterns: pulses through riverine systems linked to agricultural application in late winter and pulse from residential land use areas linked to homeowner pesticide use in late spring, early summer. Chlorpyrifos may also be the cause of toxicity; more data needed, however.				
					Nonpoint Source			
				Dieldrin		Low	21669 Acres	
				This listing was made by USEPA.				
					Nonpoint Source			
				Dioxin Compounds		Low	21669 Acres	
				The specific compounds are 2,3,7,8-TCDD, 1,2,3,7,8-PeCDD, 1,2,3,4,7,8-HxCDD, 1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 1,2,3,4,6,7,8-HpCDD, and OCDD. This listing was made by USEPA.				
					Atmospheric Deposition			
				Exotic Species		Medium	21669 Acres	
				Disrupt natural benthos; change pollutant availability in food chain; disrupt food availability to native species.				
					Ballast Water			
				Furan Compounds		Low	21669 Acres	
				The specific compounds are 2,3,7,8-TCDF, 1,2,3,7,8-PeCDF, 2,3,4,7,8-PeCDF, 1,2,3,4,7,8-HxCDF, 1,2,3,6,7,8-HxCDF, 1,2,3,7,8,9-HxCDF, 2,3,4,6,7,8-HxCDF, 1,2,3,4,6,7,8-HpCDF, 1,2,3,4,7,8,9-HpCDF, and OCDF. This listing was made by USEPA.				
					Atmospheric Deposition			
				Mercury		High	21669 Acres	2003
				Current data indicate fish consumption and wildlife consumption impacted uses: health consumption advisory in effect for multiple fish species including striped bass and shark. Major source is historic: gold mining sediments and local mercury mining; most significant ongoing source is erosion and drainage from abandoned mines; moderate to low level inputs from point sources: water quality objective exceedances. Elevated sediment level and elevated tissue levels.				
					Industrial Point Sources			
					Municipal Point Sources			
					Resource Extraction			
					Atmospheric Deposition			
					Natural Sources			
					Nonpoint Source			
				PCBs		High	21669 Acres	2004
				This listing covers non dioxin-like PCBs.Interim health advisory for fish; uncertainty regarding water column concentration data.				
					Unknown Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				PCBs (dioxin-like)		**Low**	**21669 Acres**	
				The specific dioxin like compounds are 3,4,4,5-TCB (81), 3,3,3,3-TCB (77), 3,3,4,4,5-PeCB (126), 3,3,4,4,4,4-HxCB (169), 2,3,3,4,4-PeCB (105), 2,3,4,4,5-PeCB (114), 2,3,4,4,5-PeCB (118), 2,3,4,4,5-PeCB (123), 2,3,3,4,4,5-HxCB (156), 2,3,3,4,4,5-HxCB (157), 2,3,4,4,5,5,-HxCB (167), 2,3,3,4,4,5,5-HpCB (189). This listing was made by USEPA.				
					Unknown Nonpoint Source			
				Selenium		**Low**	**21669 Acres**	
				A formal health advisory has been issued by OEHHA for benthic-feeding ducks in South San Francisco Bay. This health advisory clearly establishes that water contact recreation beneficial use (REC-1) is not fully supported and standards are not fully met.				
					Agriculture			
					Domestic Use of Ground Water			
2	**R**	**San Francisquito Creek**	**20550040**					
				Diazinon		**High**	**12 Miles**	**2004**
				This listing was made by USEPA.				
					Urban Runoff/Storm Sewers			
				Sedimentation/Siltation		**Medium**	**12 Miles**	
				Impairment to steelhead habitat.				
					Nonpoint Source			
2	**R**	**San Gregorio Creek**	**20230014**					
				High Coliform Count		**Low**	**11 Miles**	
					Nonpoint Source			
				Sedimentation/Siltation		**Medium**	**11 Miles**	
				Impairment to steelhead habitat.				
					Nonpoint Source			
2	**B**	**San Leandro Bay (part of SF Bay, Central)**	**20420040**					
				Chlordane		**Low**	**588 Acres**	
				This listing was made by USEPA.				
					Nonpoint Source			
				DDT		**Low**	**588 Acres**	
				This listing was made by USEPA.				
					Nonpoint Source			
				DDT (sediment)		**Low**	**588 Acres**	
					Source Unknown			
				Diazinon		**Low**	**588 Acres**	
				Diazinon levels cause water column toxicity. Two patterns: pulses through riverine systems linked to agricultural application in late winter and pulse from residential land use areas linked to homeowner pesticide use in late spring, early summer. Chlorpyrifos may also be the cause of toxicity; more data needed, however.				
					Nonpoint Source			
				Dieldrin		**Low**	**588 Acres**	
				This listing was made by USEPA.				
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Dioxin Compounds		**Low**	**588 Acres**	
					Atmospheric Deposition			
				Exotic Species		**Medium**	**588 Acres**	
				Disrupt natural benthos; change pollutant availability in food chain; disrupt food availability to native species.				
					Ballast Water			
				Furan Compounds		**Low**	**588 Acres**	
				The specific compounds are 2,3,7,8-TCDF, 1,2,3,7,8-PeCDF, 2,3,4,7,8-PeCDF, 1,2,3,4,7,8-HxCDF, 1,2,3,6,7,8-HxCDF, 1,2,3,7,8,9-HxCDF, 2,3,4,6,7,8-HxCDF, 1,2,3,4,6,7,8-HpCDF, 1,2,3,4,7,8,9-HpCDF, and OCDF. This listing was made by USEPA.				
					Atmospheric Deposition			
				Lead (sediment)		**Low**	**588 Acres**	
					Source Unknown			
				Mercury		**High**	**588 Acres**	**2003**
				Current data indicate fish consumption and wildlife consumption impacted uses: health consumption advisory in effect for multiple fish species including striped bass and shark. Major source is historic: gold mining sediments and local mercury mining; most significant ongoing source is erosion and drainage from abandoned mines; moderate to low level inputs from point sources.				
					Industrial Point Sources			
					Municipal Point Sources			
					Resource Extraction			
					Atmospheric Deposition			
					Natural Sources			
					Nonpoint Source			
				Mercury (sediment)		**Low**	**588 Acres**	
					Source Unknown			
				PAHs (sediment)		**Low**	**588 Acres**	
					Source Unknown			
				Pesticides (sediment)		**Low**	**588 Acres**	
					Source Unknown			
				Selenium		**Low**	**588 Acres**	
				Affected use is one branch of the food chain; most sensitive indicator is hatchability in nesting diving birds, significant contributions from oil refineries (control program in place) and agriculture (carried downstream by rivers); exotic species may have made food chain more susceptible to accumulation of selenium; health consumption advisory in effect for scaup and scoter (diving ducks); low TMDL priority because Individual Control Strategy in place.				
					Industrial Point Sources			
					Agriculture			
					Natural Sources			
					Exotic Species			
				Selenium (sediment)		**Low**	**588 Acres**	
					Source Unknown			
				Zinc (sediment)		**Low**	**588 Acres**	
					Source Unknown			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED		PROPOSED TMDL COMPLETION
2	R	San Leandro Creek, Lower	20420012						
				Diazinon		High	9.3	Miles	2004
				This listing was made by USEPA.					
					Urban Runoff/Storm Sewers				
2	R	San Lorenzo Creek	20420023						
				Diazinon		High	11	Miles	2004
				This listing was made by USEPA.					
					Urban Runoff/Storm Sewers				
2	R	San Mateo Creek	20440032						
				Diazinon		High	11	Miles	2004
				This listing was made by USEPA.					
					Urban Runoff/Storm Sewers				
2	B	San Pablo Bay	20610010						
				Chlordane		Low	68349	Acres	
				This listing was made by USEPA.					
					Nonpoint Source				
				DDT		Low	68349	Acres	
				This listing was made by USEPA.					
					Nonpoint Source				
				Diazinon		Low	68349	Acres	
				Diazinon levels cause water column toxicity. Two patterns: pulses through riverine systems linked to agricultural application in late winter and pulse from residential land use areas linked to homeowner pesticide use in late spring, early summer. Chlorpyrifos may also be the cause of toxicity; more data needed, however.					
					Nonpoint Source				
				Dieldrin		Low	68349	Acres	
				This listing was made by USEPA.					
					Nonpoint Source				
				Dioxin Compounds		Low	68349	Acres	
				The specific compounds are 2,3,7,8-TCDD, 1,2,3,7,8-PeCDD, 1,2,3,4,7,8-HxCDD, 1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 1,2,3,4,6,7,8-HpCDD, and OCDD. This listing was made by USEPA.					
					Atmospheric Deposition				
				Exotic Species		Medium	68349	Acres	
				Disrupt natural benthos; change pollutant availability in food chain; disrupt food availability to native species.					
					Ballast Water				
				Furan Compounds		Low	68349	Acres	
				The specific compounds are 2,3,7,8-TCDF, 1,2,3,7,8-PeCDF, 2,3,4,7,8-PeCDF, 1,2,3,4,7,8-HxCDF, 1,2,3,6, 7,8,-HxCDF, 1,2,3,7,8,9-HxCDF, 2,3,4,6,7,8-HxCDF, 1,2,3,4,6,7,8-HpCDF, 1,2,3,4,7,8,9-HpCDF, and OCDF. This listing was made by USEPA.					
					Atmospheric Deposition				

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Mercury		**High**	**68349 Acres**	**2003**
				Current data indicate fish consumption and wildlife consumption impacted uses: health consumption advisory in effect for multiple fish species including striped bass and shark. Major source is historic: gold mining sediments and local mercury mining; most significant ongoing source is erosion and drainage from abandoned mines; moderate to low level inputs from point sources.				
					Municipal Point Sources			
					Resource Extraction			
					Atmospheric Deposition			
					Natural Sources			
					Nonpoint Source			
				Nickel		**Low**	**68349 Acres**	
				This listing was made by USEPA.				
					Source Unknown			
				PCBs		**High**	**68349 Acres**	**2004**
				This listing covers non dioxin-like PCBs.Interim health advisory for fish; uncertainty regarding water column concentration data.				
					Unknown Nonpoint Source			
				PCBs (dioxin-like)		**Low**	**68349 Acres**	
				The specific dioxin like compounds are 3,4,4,5-TCB (81), 3,3,3,3-TCB (77), 3,3,4,4,5-PeCB (126), 3,3,4,4,4,4-HxCB (169), 2,3,3,4,4-PeCB (105), 2,3,4,4,5-PeCB (114), 2,3,4,4,5-PeCB (118), 2,3,4,4,5-PeCB (123), 2,3,3,4,4,5-HxCB (156), 2,3,3,4,4,5-HxCB (157), 2,3,4,4,5,5,-HxCB (167), 2,3,3,4,4,5,5-HpCB (189). This listing was made by USEPA.				
					Unknown Nonpoint Source			
				Selenium		**Low**	**68349 Acres**	
				Affected use is one branch of the food chain; most sensitive indicator is hatchability in nesting diving birds, significant contributions from oil refineries (control program in place) and agriculture (carried downstream by rivers); exotic species may have made food chain more susceptible to accumulation of selenium; health consumption advisory in effect for scaup and scoter (diving ducks); low TMDL priority because Individual Control Strategy in place.				
					Industrial Point Sources			
					Agriculture			
					Natural Sources			
					Exotic Species			
2	**R**	**San Pablo Creek**	**20660014**					
				Diazinon		**High**	**9.9 Miles**	**2004**
				This listing was made by USEPA.				
					Urban Runoff/Storm Sewers			
2	**L**	**San Pablo Reservoir**	**20660012**					
				Mercury		**Low**	**784 Acres**	
					Atmospheric Deposition			
2	**R**	**San Pedro Creek**	**20221011**					
				High Coliform Count		**Low**	**2.4 Miles**	
					Urban Runoff/Storm Sewers			
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
2	R	San Rafael Creek	20320012					
				Diazinon		High	3.6 Miles	2004
				This listing was made by USEPA.				
					Urban Runoff/Storm Sewers			
2	R	San Vicente Creek	20221012					
				High Coliform Count		Low	3.8 Miles	
					Nonpoint Source			
2	R	Saratoga Creek	20550040					
				Diazinon		High	18 Miles	2004
				This listing was made by USEPA.				
					Urban Runoff/Storm Sewers			
2	R	Sonoma Creek	20640050					
				Nutrients		Medium	30 Miles	
				TMDL will be developed as part of ongoing watershed management effort. Additional monitoring and assessment needed.				
					Agriculture			
					Construction/Land Development			
					Land Development			
					Urban Runoff/Storm Sewers			
				Pathogens		Low	30 Miles	
				TMDL will be developed as part of ongoing watershed management effort. Additional monitoring and assessment needed.				
					Agriculture			
					Construction/Land Development			
					Land Development			
					Urban Runoff/Storm Sewers			
				Sedimentation/Siltation		Medium	30 Miles	
				TMDL will be developed as part of ongoing watershed management effort. Additional monitoring and assessment needed.				
					Agriculture			
					Construction/Land Development			
					Land Development			
					Urban Runoff/Storm Sewers			
2	R	Stevens Creek	20550020					
				Diazinon		High	20 Miles	2004
				This listing was made by USEPA.				
					Urban Runoff/Storm Sewers			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
2	B	Suisun Bay	20710020					
				Chlordane		Low	27498 Acres	
				This listing was made by USEPA.				
					Nonpoint Source			
				DDT		Low	27498 Acres	
				This listing was made by USEPA.				
					Nonpoint Source			
				Diazinon		Low	27498 Acres	
				Diazinon levels cause water column toxicity. Two patterns: pulses through riverine systems linked to agricultural application in late winter and pulse from residential land use areas linked to homeowner pesticide use in late spring, early summer. Chlorpyrifos may also be the cause of toxicity; more data needed, however.				
					Nonpoint Source			
				Dieldrin		Low	27498 Acres	
				This listing was made by USEPA.				
					Nonpoint Source			
				Dioxin Compounds		Low	27498 Acres	
				The specific compounds are 2,3,7,8-TCDD, 1,2,3,7,8-PeCDD, 1,2,3,4,7,8-HxCDD, 1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 1,2,3,4,6,7,8-HpCDD, and OCDD. This listing was made by USEPA.				
					Atmospheric Deposition			
				Exotic Species		Medium	27498 Acres	
				Disrupt natural benthos; change pollutant availability in food chain; disrupt food availability to native species.				
					Ballast Water			
				Furan Compounds		Low	27498 Acres	
				The specific compounds are 2,3,7,8-TCDF, 1,2,3,7,8-PeCDF, 2,3,4,7,8-PeCDF, 1,2,3,4,7,8-HxCDF, 1,2,3,6,7,8-HxCDF, 1,2,3,7,8,9-HxCDF, 2,3,4,6,7,8-HxCDF, 1,2,3,4,6,7,8-HpCDF, 1,2,3,4,7,8,9-HpCDF, and OCDF. This listing was made by USEPA.				
					Atmospheric Deposition			
				Mercury		High	27498 Acres	2003
				Current data indicate fish consumption and wildlife consumption impacted uses. Major source is historic: gold mining sediments and local mercury mining; most significant ongoing source is erosion and drainage from abandoned mines; moderate to low level inputs from point sources.				
					Industrial Point Sources			
					Resource Extraction			
					Atmospheric Deposition			
					Natural Sources			
					Nonpoint Source			
				Nickel		Low	27498 Acres	
				This listing was made by USEPA.				
					Source Unknown			
				PCBs		High	27498 Acres	2004
				This listing covers non-dioxin-like PCBs. Interim health advisory for fish; uncertainty regarding water column concentration data.				
					Unknown point source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				PCBs (dioxin-like)		**Low**	**27498 Acres**	
				The specific dioxin-like compounds are 3,4,4,5-TCB (81), 3,3,3,3-TCB (77), 3,3,4,4,5-PeCB (126), 3,3,4,4,4,4-HxCB (169), 2,3,3,4,4-PeCB (105), 2,3,4,4,5-PeCB (114), 2,3,4,4,5-PeCB (118), 2,3,4,4,5-PeCB (123), 2,3,3,4,4,5-HxCB (156), 2,3,3,4,4,5-HxCB (157), 2,3,4,4,5,5-HxCB (167), 2,3,3,4,4,5,5-HpCB (189). This listing was made by USEPA.			
					Unknown Nonpoint Source			
				Selenium		**Low**	**27498 Acres**	
				Affected use is one branch of the food chain; most sensitive indicator is hatchability in nesting diving birds, significant contributions from oil refineries (control program in place) and agriculture (carried downstream by rivers); exotic species may have made food chain more susceptible to accumulation of selenium; health consumption advisory in effect for scaup and scoter (diving ducks); low TMDL priority because Individual Control Strategy in place.			
					Industrial Point Sources			
					Natural Sources			
					Exotic Species			
2	**T**	**Suisun Marsh Wetlands**	**20723000**					
				Metals		**Low**	**66339 Acres**	
				Additional monitoring and assessment needed.				
					Agriculture			
					Urban Runoff/Storm Sewers			
					Flow Regulation/Modification			
				Nutrients		**Low**	**66339 Acres**	
				Additional monitoring and assessment needed.				
					Agriculture			
					Urban Runoff/Storm Sewers			
					Flow Regulation/Modification			
				Organic Enrichment/Low Dissolved Oxygen		**Low**	**66339 Acres**	
				Additional monitoring and assessment needed.				
					Agriculture			
					Urban Runoff/Storm Sewers			
					Flow Regulation/Modification			
				Salinity/TDS/Chlorides		**Low**	**66339 Acres**	
				Additional monitoring and assessment needed.				
					Agriculture			
					Urban Runoff/Storm Sewers			
					Flow Regulation/Modification			
2	**E**	**Suisun Slough**	**20723000**					
				Diazinon		**High**	**1124 Acres**	**2004**
				This listing was made by USEPA.				
					Urban Runoff/Storm Sewers			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
2	B	Tomales Bay	20114033					
				Mercury		Medium	8545 Acres	
				Current data indicate fish consumption and wildlife consumption impacted uses: health consumption advisory in effect for multiple fish species including striped bass and shark. Major source is historic: gold mining sediments and local mercury mining; most significant ongoing source is erosion and drainage from abandoned mines; moderate to low level inputs from point sources.				
					Mine Tailings			
				Nutrients		Medium	8545 Acres	
				TMDL will be developed as part of ongoing watershed management effort. Tributary streams, Lagunitas Creek and Walker Creek, must be managed first. Additional monitoring and assessment needed.				
					Agriculture			
				Pathogens		High	8545 Acres	2004
				TMDL will be developed as part of ongoing watershed management effort. Tributary streams, Lagunitas Creek and Walker Creek, must be managed first. Additional monitoring and assessment needed.				
					Intensive Animal Feeding Operations			
					Septage Disposal			
				Sedimentation/Siltation		Medium	8545 Acres	
				TMDL will be developed as part of ongoing watershed management effort. Tributary streams, Lagunitas Creek and Walker Creek, must be managed first. Additional monitoring and assessment needed.				
					Agriculture			
					Upstream Impoundment			
2	R	Walker Creek	20112013					
				Mercury		Medium	16 Miles	
				Tributary to Tomales Bay. TMDLs will be developed as part of evolving watershed management effort. Additional monitoring and assessment needed.				
					Surface Mining			
					Mine Tailings			
				Nutrients		Medium	16 Miles	
				Tributary to Tomales Bay. TMDLs will be developed as part of evolving watershed management effort. Additional monitoring and assessment needed.				
					Agriculture			
				Sedimentation/Siltation		Medium	16 Miles	
				Tributary to Tomales Bay. TMDLs will be developed as part of evolving watershed management effort. Additional monitoring and assessment needed.				
					Agriculture			
2	R	Walnut Creek	20731040					
				Diazinon		High	9 Miles	2004
				This listing was made by USEPA.				
					Urban Runoff/Storm Sewers			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
2	R	Wildcat Creek	20660013					
				Diazinon		High	12 Miles	2004
				This listing was made by USEPA.				
					Urban Runoff/Storm Sewers			
3	R	Alamo Creek	31230072					
				Fecal Coliform		Low	5.8 Miles	
					Agriculture			
					Range Grazing-Riparian and/or Upland			
					Natural Sources			
3	R	Alisal Creek (Salinas)	30970093					
				Fecal Coliform		Low	7.4 Miles	
					Agriculture			
					Urban Runoff/Storm Sewers			
					Natural Sources			
					Nonpoint Source			
				Nitrate		Low	7.4 Miles	
					Source Unknown			
3	R	Aptos Creek	30413023					
				Pathogens		Medium	8.4 Miles	
				Impaired length for pathogens is below Bridge Creek to the mouth (approximately 5 miles).				
					Urban Runoff/Storm Sewers			
				Sedimentation/Siltation		Low	8.4 Miles	
					Disturbed Sites (Land Develop.)			
					Channel Erosion			
3	R	Arroyo Burro Creek	31532010					
				Pathogens		Low	6.1 Miles	
					Urban Runoff/Storm Sewers			
					Nonpoint Source			
3	R	Atascadero Creek (San Luis Obispo County)	30981124					
				Fecal Coliform		Low	5.4 Miles	
					Source Unknown			
				Low Dissolved Oxygen		Low	5.4 Miles	
					Source Unknown			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
3	R	Bean Creek	30412041					
				Sedimentation/Siltation		Low	8.9 Miles	
					Road Construction			
					Disturbed Sites (Land Develop.)			
					Resource Extraction			
					Erosion/Siltation			
					Nonpoint Source			
3	R	Bear Creek(Santa Cruz County)	30412030					
				Sedimentation/Siltation		Low	6.3 Miles	
					Silviculture			
					Road Construction			
					Disturbed Sites (Land Develop.)			
					Erosion/Siltation			
					Nonpoint Source			
3	R	Blanco Drain	30911010					
				Pesticides		Medium	15 Miles	
					Agriculture			
					Irrigated Crop Production			
					Agriculture-storm runoff			
					Agriculture-irrigation tailwater			
					Agricultural Return Flows			
					Nonpoint Source			
3	R	Blosser Channel	31210030					
				Fecal Coliform		Low	0.02 Miles	
					Agriculture			
					Pasture Grazing-Riparian and/or Upland			
					Urban Runoff/Storm Sewers			
					Natural Sources			
3	R	Boulder Creek	30412020					
				Sedimentation/Siltation		Low	7.6 Miles	
					Specialty Crop Production			
					Silviculture			
					Road Construction			
					Disturbed Sites (Land Develop.)			
					Erosion/Siltation			
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
3	R	Bradley Canyon Creek	31210030					
				Fecal Coliform		Low	17 Miles	
					Agriculture			
					Pasture Grazing-Riparian and/or Upland			
					Urban Runoff/Storm Sewers			
					Natural Sources			
3	R	Bradley Channel	31210030					
				Fecal Coliform		Low	3.1 Miles	
					Source Unknown			
3	R	Branciforte Creek	30412051					
				Sedimentation/Siltation		Low	5.8 Miles	
					Silviculture			
					Road Construction			
					Nonpoint Source			
3	R	Carbonera Creek	30412050					
				Nutrients		Low	10 Miles	
					Nonpoint Source			
				Pathogens		Medium	10 Miles	
					Urban Runoff/Storm Sewers			
					Nonpoint Source			
				Sedimentation/Siltation		High	10 Miles	2002
					Construction/Land Development			
					Nonpoint Source			
3	R	Carpinteria Creek	31534020					
				Pathogens		Low	5.8 Miles	
					Agriculture			
					Land Disposal			
					Septage Disposal			
3	E	Carpinteria Marsh (El Estero Marsh)	31534020					
				Nutrients		Low	188 Acres	
					Agriculture			
				Organic Enrichment/Low Dissolved Oxygen		Low	188 Acres	
					Agriculture			
				Priority Organics		Low	188 Acres	
					Urban Runoff/Storm Sewers			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Sedimentation/Siltation		Low	188 Acres	
					Agriculture			
					Construction/Land Development			
					Storm sewers			
3	R	Cholame Creek	31700053					
				Boron		Low	8.7 Miles	
					Source Unknown			
				Fecal Coliform		Low	8.7 Miles	
					Agriculture			
					Pasture Grazing-Riparian and/or Upland			
					Natural Sources			
					Nonpoint Source			
3	R	Chorro Creek	31022012					
				Fecal Coliform		Low	14 Miles	
					Source Unknown			
				Nutrients		High	14 Miles	2002
					Municipal Point Sources			
					Agriculture			
					Irrigated Crop Production			
					Agriculture-storm runoff			
				Sedimentation/Siltation		High	14 Miles	2002
					Agriculture			
					Irrigated Crop Production			
					Range Grazing-Riparian and/or Upland			
					Range Grazing-Upland			
					Agriculture-storm runoff			
					Construction/Land Development			
					Road Construction			
					Resource Extraction			
					Hydromodification			
					Channelization			
					Streambank Modification/Destabilization			
					Channel Erosion			
					Erosion/Siltation			
					Natural Sources			
					Golf course activities			
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
3	R	Chumash Creek	31022011					
				Fecal Coliform		Low	2.1 Miles	
					Source Unknown			
				Low Dissolved Oxygen		Low	2.1 Miles	
				This listing was made by USEPA.				
					Natural Sources			
3	R	Clear Creek (San Benito County)	30550013					
				Mercury		Medium	9.6 Miles	
					Resource Extraction			
3	R	Corralitos Creek	30510010					
				Fecal Coliform		Low	13 Miles	
					Source Unknown			
3	R	Dairy Creek	31022010					
				Fecal Coliform		Low	4.5 Miles	
					Source Unknown			
				Low Dissolved Oxygen		Low	4.5 Miles	
					Source Unknown			
3	E	Elkhorn Slough	30600014					
				Pathogens		Low	2034 Acres	
					Natural Sources			
					Nonpoint Source			
				Pesticides		Low	2034 Acres	
					Agriculture			
					Irrigated Crop Production			
					Agriculture-storm runoff			
					Agricultural Return Flows			
					Erosion/Siltation			
					Contaminated Sediments			
					Nonpoint Source			
				Sedimentation/Siltation		Low	2034 Acres	
					Agriculture			
					Irrigated Crop Production			
					Agriculture-storm runoff			
					Channel Erosion			
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
3	R	Espinosa Slough	30911010					
				Nutrients		Low	1.5 Miles	
					Agriculture			
					Storm sewers			
				Pesticides		Medium	1.5 Miles	
					Agriculture			
					Urban Runoff/Storm Sewers			
				Priority Organics		Medium	1.5 Miles	
					Nonpoint Source			
3	R	Fall Creek	30412022					
				Sedimentation/Siltation		Low	5.1 Miles	
					Road Construction			
					Habitat Modification			
					Erosion/Siltation			
					Nonpoint Source			
3	R	Gabilan Creek	30919000					
				Fecal Coliform		Low	6.4 Miles	
					Urban Runoff/Storm Sewers			
					Natural Sources			
					Nonpoint Source			
3	E	Goleta Slough/Estuary	31531020					
				Metals		Low	196 Acres	
					Industrial Point Sources			
				Pathogens		Low	196 Acres	
					Urban Runoff/Storm Sewers			
				Priority Organics		Low	196 Acres	
					Nonpoint Source			
				Sedimentation/Siltation		Low	196 Acres	
					Construction/Land Development			
3	L	Hernandez Reservoir	30550016					
				Mercury		Medium	626 Acres	
					Surface Mining			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
3	R	Kings Creek	30412011					
				Sedimentation/Siltation		Low	4.4 Miles	
					Silviculture			
					Road Construction			
					Disturbed Sites (Land Develop.)			
					Erosion/Siltation			
					Nonpoint Source			
3	R	Las Tablas Creek	30981293					
				Metals		High	5.7 Miles	2002
					Surface Mining			
3	R	Las Tablas Creek, North Fork	30981290					
				Metals		High	6.5 Miles	2002
					Surface Mining			
3	R	Las Tablas Creek, South Fork	30981290					
				Metals		High	4.7 Miles	2002
					Surface Mining			
3	R	Llagas Creek	30530020					
				Chloride		Low	16 Miles	
				Impaired section for Chlorides is located downstream of confluence with Miller Slough (approximately 1 mile of stream near Southside Drive).				
					Nonpoint Source			
					Point Source			
				Fecal Coliform		Low	16 Miles	
				Impaired section for Fecal Coliform is located between the confluence with Church Creek and the confluence with Pajaro River (approximately 9.5 miles of stream length).				
					Pasture Grazing-Riparian and/or Upland			
					Natural Sources			
					Nonpoint Source			
				Low Dissolved Oxygen		Low	16 Miles	
				This listing was made by USEPA.				
					Municipal Point Sources			
					Irrigated Crop Production			
					Agricultural Return Flows			
					Habitat Modification			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Nutrients		**Medium**	**16 Miles**	
				Impaired section for Nutrients is located between the confluence with Church Creek and the confluence with Pajaro River (approximately 9.5 miles of stream length).				
					Municipal Point Sources			
					Agriculture			
					Irrigated Crop Production			
					Pasture Grazing-Riparian and/or Upland			
					Agriculture-storm runoff			
					Agriculture-irrigation tailwater			
					Agricultural Return Flows			
					Urban Runoff/Storm Sewers			
					Habitat Modification			
					Nonpoint Source			
					Unknown point source			
				pH		**Low**	**16 Miles**	
					Source Unknown			
				Sedimentation/Siltation		**Medium**	**16 Miles**	
				Impaired section for Sediment/Siltation is located between the confluence with Church Creek and the confluence with Pajaro River (approximately 9.5 miles of stream length).				
					Agriculture			
					Hydromodification			
					Habitat Modification			
				Sodium		**Low**	**16 Miles**	
				Impaired section for Sodium is located downstream of confluence with Miller Slough (approximately 1 mile of stream near Southside Drive).				
					Source Unknown			
					Nonpoint Source			
				Total Dissolved Solids		**Low**	**16 Miles**	
				Impaired section for Total Dissolved Solids is located between the confluence with Church Creek and the confluence with Pajaro River (approximately 9.5 miles of stream length).				
					Nonpoint Source			
					Point Source			
3	**R**	**Lompico Creek**	**30412040**					
				Nutrients		**Low**	**4.5 Miles**	
					Septage Disposal			
				Pathogens		**Medium**	**4.5 Miles**	
					Septage Disposal			
					Natural Sources			
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Sedimentation/Siltation		**High**	**4.5 Miles**	**2002**
					Construction/Land Development			
					Natural Sources			
3	**R**	**Los Osos Creek**	**31023012**					
				Fecal Coliform		**Low**	**9.9 Miles**	
					Source Unknown			
				Low Dissolved Oxygen		**Low**	**9.9 Miles**	
				This listing was made by USEPA.				
					Agriculture			
					Pasture Grazing-Riparian and/or Upland			
					Urban Runoff/Storm Sewers			
					Natural Sources			
				Nutrients		**High**	**9.9 Miles**	**2002**
					Agriculture			
					Irrigated Crop Production			
					Agriculture-storm runoff			
					Agricultural Return Flows			
				Sedimentation/Siltation		**High**	**9.9 Miles**	**2002**
					Agriculture			
					Irrigated Crop Production			
					Range Grazing-Riparian and/or Upland			
					Agriculture-storm runoff			
					Hydromodification			
					Channelization			
					Dredging			
					Habitat Modification			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Channel Erosion			
					Erosion/Siltation			
					Natural Sources			
					Nonpoint Source			
3	**R**	**Love Creek**	**30412021**					
				Sedimentation/Siltation		**Low**	**3.8 Miles**	
					Agriculture			
					Silviculture			
					Road Construction			
					Disturbed Sites (Land Develop.)			
					Erosion/Siltation			
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
3	R	Main Street Canal	31210030					
				Nitrate		Low	5.1 Miles	
					Agriculture			
					Urban Runoff/Storm Sewers			
					Nonpoint Source			
3	R	Mission Creek	31532011					
				Pathogens		Low	8.6 Miles	
					Urban Runoff/Storm Sewers			
					Transient encampments			
				Unknown Toxicity		Low	8.6 Miles	
					Urban Runoff/Storm Sewers			
3	C	Monterey Bay South (Coastline)	30950042					
				Metals		Low	12 Miles	
					Surface Mining			
				Pesticides		Low	12 Miles	
					Agriculture			
3	B	Monterey Harbor	30950042					
				Metals		Medium	76 Acres	
					Railroad Slag Pile			
				Unknown Toxicity		Low	76 Acres	
					Source Unknown			
3	E	Moro Cojo Slough	30913011					
				Low Dissolved Oxygen		Low	62 Acres	
					Source Unknown			
				Pesticides		Medium	62 Acres	
					Agriculture			
					Irrigated Crop Production			
					Agriculture-storm runoff			
					Agricultural Return Flows			
					Nonpoint Source			
				Sedimentation/Siltation		Low	62 Acres	
					Agriculture			
					Irrigated Crop Production			
					Agriculture-storm runoff			
					Construction/Land Development			
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
3	B	Morro Bay	31023012					
				Metals		Medium	1922 Acres	
				Affected area is 2300 acres. Open water habitat is approximately 1900 acres and delta area is approximately 400 acres.				
					Surface Mining			
					Nonpoint Source			
					Boat Discharges/Vessel Wastes			
				Pathogens		High	1922 Acres	2002
				Affected area is 2300 acres. Open water habitat is approximately 1900 acres and delta area is approximately 400 acres.				
					Range Grazing-Upland			
					Urban Runoff/Storm Sewers			
					Septage Disposal			
					Natural Sources			
					Nonpoint Source			
				Sedimentation/Siltation		High	1922 Acres	2002
				Affected area is 2300 acres. Open water habitat is approximately 1900 acres and delta area is approximately 400 acres.				
					Agriculture			
					Irrigated Crop Production			
					Construction/Land Development			
					Resource Extraction			
					Channelization			
					Channel Erosion			
3	B	Moss Landing Harbor	30600014					
				Pathogens		Low	79 Acres	
					Agriculture			
					Nonpoint Source			
					Boat Discharges/Vessel Wastes			
				Pesticides		Low	79 Acres	
					Agriculture			
					Irrigated Crop Production			
					Specialty Crop Production			
				Sedimentation/Siltation		Low	79 Acres	
					Agriculture			
					Irrigated Crop Production			
					Agriculture-storm runoff			
					Hydromodification			
					Dredging			
					Channel Erosion			
					Erosion/Siltation			
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED		PROPOSED TMDL COMPLETION
3	R	Mountain Charlie Gulch	30412040						
				Sedimentation/Siltation		Low	3.9	Miles	
					Silviculture				
					Road Construction				
					Erosion/Siltation				
					Nonpoint Source				
3	L	Nacimiento Reservoir	30982000						
				Metals		High	5736	Acres	2003
					Surface Mining				
					Natural Sources				
3	R	Newell Creek (Upper)	30412031						
				Sedimentation/Siltation		Low	3.5	Miles	
					Agriculture				
					Silviculture				
					Road Construction				
					Disturbed Sites (Land Develop.)				
					Channel Erosion				
					Erosion/Siltation				
					Nonpoint Source				
3	R	Nipomo Creek	31210011						
				Fecal Coliform		Low	9.3	Miles	
					Agriculture				
					Urban Runoff/Storm Sewers				
					Natural Sources				
3	E	Old Salinas River Estuary	30911010						
				Fecal Coliform		Low	74	Acres	
					Source Unknown				
				Low Dissolved Oxygen		Low	74	Acres	
					Source Unknown				
				Nutrients		Medium	74	Acres	
					Agriculture				
					Irrigated Crop Production				
					Agriculture-irrigation tailwater				
					Nonpoint Source				

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Pesticides		**Medium**	**74 Acres**	
					Agriculture			
					Irrigated Crop Production			
					Agriculture-storm runoff			
					Agriculture-irrigation tailwater			
					Agricultural Return Flows			
					Nonpoint Source			
3	**R**	**Orcutt Solomon Creek**	**31210030**					
				Boron		**Low**	**4.7 Miles**	
				This listing was made by USEPA.				
					Natural Sources			
				Fecal Coliform		**Low**	**4.7 Miles**	
					Agriculture			
					Pasture Grazing-Riparian and/or Upland			
					Natural Sources			
					Nonpoint Source			
				Nitrate		**Low**	**4.7 Miles**	
					Source Unknown			
3	**R**	**Oso Flaco Creek**	**31210030**					
				Fecal Coliform		**Low**	**6.3 Miles**	
					Source Unknown			
				Nitrate		**Low**	**6.3 Miles**	
					Source Unknown			
3	**L**	**Oso Flaco Lake**	**31210030**					
				Nitrate		**Low**	**56 Acres**	
					Agriculture			
					Nonpoint Source			
3	**C**	**Pacific Ocean at Arroyo Burro Beach (Santa Barbara County)**	**31532010**					
				Total Coliform		**Low**	**3.1 Miles**	
					Source Unknown			
3	**C**	**Pacific Ocean at Carpinteria State Beach (Carpinteria Creek mouth, Santa Barbara County)**	**31534020**					
				Fecal Coliform		**Low**	**0.35 Miles**	
					Source Unknown			
				Total Coliform		**Low**	**0.35 Miles**	
					Source Unknown			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

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3	C	Pacific Ocean at East Beach (mouth of Mission Creek, Santa Barbara County)	31532011					
				Fecal Coliform		Low	0.06 Miles	
					Agriculture			
					Urban Runoff/Storm Sewers			
					Natural Sources			
					Nonpoint Source			
					Unknown Nonpoint Source			
				Total Coliform		Low	0.06 Miles	
					Agriculture			
					Urban Runoff/Storm Sewers			
					Nonpoint Source			
					Unknown Nonpoint Source			
3	C	Pacific Ocean at East Beach (mouth of Sycamore Creek, Santa Barbara County)	31532012					
				Total Coliform		Low	0.06 Miles	
					Source Unknown			
3	C	Pacific Ocean at Gaviota Beach (mouth of Canada de la Gaviota Creek, Santa Barbara County)	31510031					
				Total Coliform		Low	0.06 Miles	
					Source Unknown			
3	C	Pacific Ocean at Hammonds Beach (Santa Barbara County)	31533010					
				Fecal Coliform		Low	0.06 Miles	
					Source Unknown			
3	C	Pacific Ocean at Hope Ranch Beach (Santa Barbara County)	31532010					
				Fecal Coliform		Low	0.06 Miles	
					Source Unknown			
3	C	Pacific Ocean at Jalama Beach (Santa Barbara County)	31510051					
				Fecal Coliform		Low	3.3 Miles	
					Agriculture			
					Pasture Grazing-Riparian and/or Upland			
					Natural Sources			
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Total Coliform		**Low**	**3.3 Miles**	
					Agriculture			
					Pasture Grazing-Riparian and/or Upland			
					Natural Sources			
					Nonpoint Source			
3	**C**	**Pacific Ocean at Ocean Beach (Santa Barbara County)**	**31410050**					
				Fecal Coliform		**Low**	**0.06 Miles**	
					Source Unknown			
				Total Coliform		**Low**	**0.06 Miles**	
					Source Unknown			
3	**C**	**Pacific Ocean at Point Rincon (mouth of Rincon Cr, Santa Barbara County)**	**31534012**					
				Fecal Coliform		**Low**	**0.06 Miles**	
					Source Unknown			
				Total Coliform		**Low**	**0.06 Miles**	
					Source Unknown			
3	**C**	**Pacific Ocean at Refugio Beach (Santa Barbara County)**	**31510022**					
				Total Coliform		**Low**	**0.06 Miles**	
					Source Unknown			
3	**R**	**Pajaro River**	**30510030**					
				Fecal Coliform		**Low**	**32 Miles**	
				Impaired length is above Llagas Creek (approximately 4.5 miles).				
					Pasture Grazing-Riparian and/or Upland			
					Natural Sources			
					Nonpoint Source			
				Nutrients		**Medium**	**32 Miles**	
					Agriculture			
					Irrigated Crop Production			
					Agriculture-storm runoff			
					Agriculture-subsurface drainage			
					Agriculture-irrigation tailwater			
					Agricultural Return Flows			
					Urban Runoff/Storm Sewers			
					Wastewater - land disposal			
					Channelization			
					Removal of Riparian Vegetation			
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Sedimentation/Siltation		Medium	32 Miles	
					Agriculture			
					Irrigated Crop Production			
					Range Grazing-Riparian and/or Upland			
					Agriculture-storm runoff			
					Resource Extraction			
					Surface Mining			
					Hydromodification			
					Channelization			
					Habitat Modification			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Channel Erosion			
3	R	Pennington Creek	31022011					
				Fecal Coliform		Low	5.3 Miles	
					Source Unknown			
3	R	Rider Gulch Creek	30510010					
				Sedimentation/Siltation		Medium	1.8 Miles	
					Agriculture			
					Silviculture			
					Construction/Land Development			
3	R	Salinas Reclamation Canal	30911010					
				Fecal Coliform		Low	5.9 Miles	
					Agriculture			
					Pasture Grazing-Riparian and/or Upland			
					Urban Runoff/Storm Sewers			
					Natural Sources			
				Low Dissolved Oxygen		Low	5.9 Miles	
					Source Unknown			
				Nitrate		Low	5.9 Miles	
					Source Unknown			
				Pesticides		Medium	5.9 Miles	
					Minor Industrial Point Source			
					Agriculture			
					Irrigated Crop Production			
					Agriculture-storm runoff			
					Agriculture-irrigation tailwater			
					Agricultural Return Flows			
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Priority Organics		Medium	5.9 Miles	
					Minor Industrial Point Source			
					Agriculture			
					Irrigated Crop Production			
					Agriculture-storm runoff			
					Agriculture-irrigation tailwater			
					Agricultural Return Flows			
					Urban Runoff/Storm Sewers			
					Source Unknown			
					Nonpoint Source			
3	R	Salinas River (lower, estuary to near Gonzales Rd crossing, watersheds 30910 and 30920)	30917000					
				Fecal Coliform		Low	31 Miles	
					Source Unknown			
				Nutrients		Medium	31 Miles	
					Agriculture			
				Pesticides		Medium	31 Miles	
					Agriculture			
					Irrigated Crop Production			
					Agriculture-storm runoff			
					Agriculture-irrigation tailwater			
					Agricultural Return Flows			
					Nonpoint Source			
				Salinity/TDS/Chlorides		Low	31 Miles	
					Agriculture			
					Natural Sources			
					Nonpoint Source			
				Sedimentation/Siltation		Medium	31 Miles	
					Agriculture			
					Irrigated Crop Production			
					Range Grazing-Riparian and/or Upland			
					Agriculture-storm runoff			
					Road Construction			
					Land Development			
					Channel Erosion			
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
3	R	Salinas River (midddle, near Gonzales Rd crossing to confluence with Nacimiento River)	30981177					
				Pesticides		Medium	72 Miles	
				Area affected is the lower 20 miles of the middle Salinas River.				
					Agriculture			
					Irrigated Crop Production			
					Agriculture-storm runoff			
					Agriculture-irrigation tailwater			
					Agricultural Return Flows			
					Nonpoint Source			
				Salinity/TDS/Chlorides		Low	72 Miles	
				Area affected is the lower 20 miles of the middle Salinas River.				
					Agriculture			
					Natural Sources			
					Nonpoint Source			
				Sedimentation/Siltation		Medium	72 Miles	
					Agriculture			
					Irrigated Crop Production			
					Range Grazing-Riparian and/or Upland			
					Agriculture-storm runoff			
					Road Construction			
					Land Development			
					Channel Erosion			
					Nonpoint Source			
3	R	Salinas River (upper, confluence of Nacimiento River to Santa Margarita Reservoir)	30981112					
				Chloride		Low	49 Miles	
					Agriculture			
					Pasture Grazing-Riparian and/or Upland			
					Urban Runoff/Storm Sewers			
				Sodium		Low	49 Miles	
					Agriculture			
					Pasture Grazing-Riparian and/or Upland			
					Urban Runoff/Storm Sewers			
3	E	Salinas River Lagoon (North)	30911010					
				Nutrients		Medium	197 Acres	
					Nonpoint Source			
				Pesticides		Medium	197 Acres	
					Agriculture			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Sedimentation/Siltation		Medium	197 Acres	
					Nonpoint Source			
3	E	Salinas River Refuge Lagoon (South)	30911010					
				Nutrients		Medium	30 Acres	
					Agriculture			
				Pesticides		Medium	30 Acres	
					Agriculture			
				Salinity/TDS/Chlorides		Low	30 Acres	
					Agriculture			
3	R	San Antonio Creek (San Antonio Watershed, Rancho del las Flores Bridge at Hwy 135 to downstream at Railroad Bridge)	31300050					
				Boron		Low	14 Miles	
				This listing was made by USEPA.				
					Natural Sources			
3	R	San Antonio Creek (South Coast Watershed)	31531011					
				Sedimentation/Siltation		Low	6.5 Miles	
					Agriculture			
					Nonpoint Source			
3	R	San Benito River	30530020					
				Fecal Coliform		Low	86 Miles	
					Source Unknown			
				Sedimentation/Siltation		Medium	86 Miles	
					Agriculture			
					Resource Extraction			
					Nonpoint Source			
3	R	San Bernardo Creek	31022012					
				Fecal Coliform		Low	6.9 Miles	
					Source Unknown			
3	R	San Lorenzo Creek	30970023					
				Boron		Low	49 Miles	
					Source Unknown			
				Fecal Coliform		Low	49 Miles	
					Agriculture			
					Pasture Grazing-Riparian and/or Upland			
					Urban Runoff/Storm Sewers			
					Natural Sources			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
3	R	San Lorenzo River	30412022					
				Nutrients		Low	27 Miles	
					Septage Disposal			
					Nonpoint Source			
				Pathogens		Medium	27 Miles	
					Urban Runoff/Storm Sewers			
					Septage Disposal			
				Sedimentation/Siltation		High	27 Miles	2002
					Silviculture			
					Construction/Land Development			
					Land Development			
					Urban Runoff/Storm Sewers			
3	E	San Lorenzo River Lagoon	30412053					
				Pathogens		Medium	66 Acres	
					Urban Runoff/Storm Sewers			
					Natural Sources			
3	R	San Luis Obispo Creek (Below W Marsh Street)	31024012					
				Nutrients		High	9.6 Miles	2004
					Municipal Point Sources			
					Agriculture			
					Irrigated Crop Production			
					Agriculture-storm runoff			
				Pathogens		High	9.6 Miles	2004
					Source Unknown			
				Priority Organics		High	9.6 Miles	2002
					Source Unknown			
3	R	San Luisito Creek	31022011					
				Fecal Coliform		Low	6.7 Miles	
					Source Unknown			
3	R	Santa Maria River	31210030					
				Fecal Coliform		Low	51 Miles	
					Agriculture			
					Pasture Grazing-Riparian and/or Upland			
					Urban Runoff/Storm Sewers			
					Natural Sources			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Nitrate		Low	51 Miles	
					Agriculture			
					Pasture Grazing-Riparian and/or Upland			
					Urban Runoff/Storm Sewers			
3	R	Santa Ynez River	31410050					
				Nutrients		Low	47 Miles	
					Nonpoint Source			
				Salinity/TDS/Chlorides		Low	47 Miles	
					Agriculture			
				Sedimentation/Siltation		Low	47 Miles	
					Agriculture			
					Urban Runoff/Storm Sewers			
					Resource Extraction			
3	L	Schwan Lake	30412053					
				Nutrients		Low	23 Acres	
					Nonpoint Source			
				Pathogens		Medium	23 Acres	
					Urban Runoff/Storm Sewers			
					Natural Sources			
3	R	Shingle Mill Creek	30412022					
				Nutrients		Low	1.6 Miles	
					Septage Disposal			
				Sedimentation/Siltation		High	1.6 Miles	2002
					Construction/Land Development			
					Nonpoint Source			
3	E	Soquel Lagoon	30413014					
				Nutrients		Low	1.2 Acres	
					Septage Disposal			
					Nonpoint Source			
				Pathogens		Medium	1.2 Acres	
					Urban Runoff/Storm Sewers			
					Natural Sources			
					Nonpoint Source			
				Sedimentation/Siltation		Low	1.2 Acres	
					Construction/Land Development			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
3	R	Tembladero Slough	30911010					
				Fecal Coliform		Low	5 Miles	
					Agriculture			
					Pasture Grazing-Riparian and/or Upland			
					Urban Runoff/Storm Sewers			
					Natural Sources			
				Nutrients		Low	5 Miles	
					Agriculture			
					Irrigated Crop Production			
					Agriculture-storm runoff			
					Agriculture-irrigation tailwater			
					Agricultural Return Flows			
					Nonpoint Source			
				Pesticides		Medium	5 Miles	
					Agriculture			
					Irrigated Crop Production			
					Agriculture-storm runoff			
					Agricultural Return Flows			
					Nonpoint Source			
3	R	Tequisquita Slough	30530020					
				Fecal Coliform		Low	7.2 Miles	
					Agriculture			
					Natural Sources			
					Nonpoint Source			
3	R	Valencia Creek	30413023					
				Pathogens		Medium	6.2 Miles	
					Agriculture			
					Septage Disposal			
				Sedimentation/Siltation		Low	6.2 Miles	
					Agriculture			
					Construction/Land Development			
3	R	Waddell Creek, East Branch	30411010					
				Nutrients		Low	3.5 Miles	
					Municipal Point Sources			
3	R	Walters Creek	31022011					
				Fecal Coliform		Low	2.8 Miles	
					Source Unknown			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
3	R	Warden Creek	31023010					
				Fecal Coliform		Low	6 Miles	
					Source Unknown			
				Low Dissolved Oxygen		Low	6 Miles	
					Source Unknown			
3	R	Watsonville Slough	30510030					
				Pathogens		Medium	6.2 Miles	
					Urban Runoff/Storm Sewers			
					Source Unknown			
					Nonpoint Source			
				Pesticides		Low	6.2 Miles	
					Agriculture			
					Irrigated Crop Production			
					Agriculture-storm runoff			
					Agriculture-irrigation tailwater			
					Nonpoint Source			
				Sedimentation/Siltation		Medium	6.2 Miles	
					Agriculture			
					Irrigated Crop Production			
					Agriculture-storm runoff			
					Nonpoint Source			
3	R	Zayante Creek	30412040					
				Sedimentation/Siltation		Low	9.2 Miles	
					Agriculture			
					Silviculture			
					Road Construction			
					Disturbed Sites (Land Develop.)			
					Erosion/Siltation			
					Nonpoint Source			
4	C	Abalone Cove Beach	40511000					
				Beach Closures		High	1.1 Miles	2002
					Nonpoint Source			
				DDT (sediment)		Low	1.1 Miles	
					Nonpoint Source			
				PCBs		Low	1.1 Miles	
				Fish Consumption Advisory for PCBs.				
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
4	R	Aliso Canyon Wash	40521000					
				Selenium		High	10 Miles	2003
					Nonpoint Source			
4	C	Amarillo Beach	40431000					
				DDT		Low	0.64 Miles	
				Fish Consumption Advisory for DDT.				
					Nonpoint Source			
				PCBs		Low	0.64 Miles	
				Fish Consumption Advisory for PCBs.				
					Nonpoint Source			
4	R	Arroyo Seco Reach 1 (LA River to West Holly Ave.)	40515010					
				Algae		High	5.2 Miles	2002
					Nonpoint Source			
				High Coliform Count		High	5.2 Miles	2002
					Nonpoint Source			
				Trash		Low	5.2 Miles	
					Nonpoint Source			
4	R	Arroyo Seco Reach 2 (Figueroa St. to Riverside Dr.)	40515010					
				Algae		High	4.4 Miles	2002
					Nonpoint Source			
				High Coliform Count		High	4.4 Miles	2002
					Nonpoint Source			
				Trash		Low	4.4 Miles	
					Nonpoint Source			
4	R	Ashland Avenue Drain	40513000					
				High Coliform Count		High	2.3 Miles	2002
					Nonpoint Source			
				Organic Enrichment/Low Dissolved Oxygen		Low	2.3 Miles	
					Nonpoint Source			
				Toxicity		Low	2.3 Miles	
					Nonpoint Source			
4	C	Avalon Beach	40511000					
				Bacteria Indicators		Low	0.67 Miles	
				Area affected is between Pier and BB restaurant (2/3), between Pier and BB restaurant (1/3), between storm drain and Pier (1/3). and between BB restaurant and the Tuna Club.				
					Nonpoint/Point Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
4	R	Ballona Creek	40513000					
				Cadmium (sediment)		High	6.5 Miles	2004
					Nonpoint/Point Source			
				ChemA (tissue)		High	6.5 Miles	2004
					Source Unknown			
				Chlordane (tissue)		High	6.5 Miles	2004
					Nonpoint/Point Source			
				Copper, Dissolved		High	6.5 Miles	2004
					Nonpoint Source			
				DDT (tissue)		High	6.5 Miles	2004
					Nonpoint/Point Source			
				Dieldrin (tissue)		High	6.5 Miles	2004
					Nonpoint/Point Source			
				Enteric Viruses		High	6.5 Miles	2003
					Nonpoint/Point Source			
				High Coliform Count		High	6.5 Miles	2003
					Nonpoint/Point Source			
				Lead, Dissolved		High	6.5 Miles	2004
					Nonpoint Source			
				PCBs (tissue)		High	6.5 Miles	2004
					Nonpoint/Point Source			
				pH		Low	6.5 Miles	
					Urban Runoff/Storm Sewers Nonpoint Source			
				Sediment Toxicity		High	6.5 Miles	2004
					Nonpoint/Point Source			
				Selenium, Total		Low	6.5 Miles	
					Urban Runoff/Storm Sewers Nonpoint Source			
				Silver (sediment)		Low	6.5 Miles	
					Nonpoint Source			
				Toxicity		High	6.5 Miles	2004
					Nonpoint/Point Source			
				Zinc, Dissolved		Low	6.5 Miles	
					Urban Runoff/Storm Sewers Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
4	R	Ballona Creek Estuary	40513000					
				Chlordane (tissue & sediment)		High	2.3 Miles	2004
					Nonpoint/Point Source			
				DDT (sediment)		High	2.3 Miles	2004
					Nonpoint/Point Source			
				High Coliform Count		High	2.3 Miles	2003
					Nonpoint/Point Source			
				Lead (sediment)		High	2.3 Miles	2004
					Nonpoint/Point Source			
				PAHs (sediment)		Low	2.3 Miles	
					Nonpoint/Point Source			
				PCBs (tissue & sediment)		High	2.3 Miles	2004
					Nonpoint/Point Source			
				Sediment Toxicity		High	2.3 Miles	2004
					Nonpoint/Point Source			
				Shellfish Harvesting Advisory		High	2.3 Miles	2003
					Nonpoint/Point Source			
				Zinc (sediment)		High	2.3 Miles	2003
					Nonpoint/Point Source			
4	T	Ballona Creek Wetlands	40517000					
				Exotic Vegetation		Low	289 Acres	
					Nonpoint Source			
				Habitat alterations		Low	289 Acres	
					Nonpoint Source			
				Hydromodification		Low	289 Acres	
					Nonpoint Source			
				Reduced Tidal Flushing		Low	289 Acres	
					Nonpoint Source			
				Trash		Low	289 Acres	
					Nonpoint Source			
4	R	Bell Creek	40521000					
				High Coliform Count		High	8.9 Miles	2002
					Nonpoint/Point Source			
4	C	Big Rock Beach	40431000					
				Beach Closures		High	0.74 Miles	2002
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				DDT		**Low**	**0.74 Miles**	
				Fish consumption advisory for DDT.				
					Nonpoint Source			
				High Coliform Count		**High**	**0.74 Miles**	**2002**
					Nonpoint Source			
				PCBs		**Low**	**0.74 Miles**	
				Fish Consumption Advisory for PCBs.				
					Nonpoint Source			
4	**C**	**Bluff Cove Beach**	**40511000**					
				Beach Closures		**High**	**0.55 Miles**	**2002**
					Nonpoint Source			
				DDT		**Low**	**0.55 Miles**	
				Fish Consumption Advisory for DDT.				
					Nonpoint Source			
				PCBs		**Low**	**0.55 Miles**	
				Fish Consumption Advisory for PCBs.				
					Nonpoint Source			
4	**R**	**Brown Barranca/Long Canyon**	**40321000**					
				Nitrate and Nitrite		**High**	**2.6 Miles**	**2003**
					Nonpoint Source			
4	**R**	**Burbank Western Channel**	**40521000**					
				Algae		**High**	**13 Miles**	**2002**
					Nonpoint/Point Source			
				Ammonia		**High**	**13 Miles**	**2002**
					Nonpoint/Point Source			
				Cadmium		**Low**	**13 Miles**	
					Nonpoint/Point Source			
				Odors		**High**	**13 Miles**	**2002**
					Nonpoint/Point Source			
				Scum/Foam-unnatural		**High**	**13 Miles**	**2002**
					Nonpoint/Point Source			
				Trash		**Low**	**13 Miles**	
					Nonpoint/Point Source			
4	**C**	**Cabrillo Beach (Inner) LA Harbor Area**	**40512000**					
				Beach Closures (Coliform)		**High**	**0.56 Miles**	**2004**
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				DDT		**Medium**	**0.56 Miles**	
				Fish consumption advisory for DDT.				
					Nonpoint Source			
				PCBs		**Medium**	**0.56 Miles**	
				Fish consumption advisory for PCBs.				
					Nonpoint Source			
4	**C**	**Cabrillo Beach (Outer)**	**40512000**					
				Beach Closures		**High**	**0.58 Miles**	**2002**
					Nonpoint Source			
				DDT		**Low**	**0.58 Miles**	
				Fish consumption advisory for DDT.				
					Nonpoint Source			
				High Coliform Count		**High**	**0.58 Miles**	**2002**
					Nonpoint Source			
				PCBs		**Low**	**0.58 Miles**	
				Fish consumption advisory for PCBs.				
					Nonpoint Source			
4	**E**	**Calleguas Creek Reach 1 (was Mugu Lagoon on 1998 303(d) list)**	**40311000**					
				Chlordane (tissue)		**Medium**	**344 Acres**	
					Nonpoint Source			
				Copper		**Medium**	**344 Acres**	
					Nonpoint/Point Source			
				DDT (tissue & sediment)		**Medium**	**344 Acres**	
					Nonpoint Source			
				Endosulfan (tissue)		**Medium**	**344 Acres**	
					Nonpoint Source			
				Mercury		**Medium**	**344 Acres**	
					Nonpoint/Point Source			
				Nickel		**Medium**	**344 Acres**	
					Nonpoint/Point Source			
				Nitrogen		**High**	**344 Acres**	**2002**
					Nonpoint/Point Source			
				PCBs (tissue)		**Medium**	**344 Acres**	
					Nonpoint/Point Source			
				Sediment Toxicity		**Medium**	**344 Acres**	
					Nonpoint/Point Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Sedimentation/Siltation		Medium	344 Acres	
					Agriculture Natural Sources			
				Zinc		Medium	344 Acres	
					Nonpoint/Point Source			
4	R	Calleguas Creek Reach 2 (estuary to Potrero Rd- was Calleguas Creek Reaches 1 and 2 on 1998 303d list)	40312000					
				Ammonia		High	4.3 Miles	2002
					Nonpoint/Point Source			
				ChemA (tissue)		Medium	4.3 Miles	
				Historical use of pesticides and lubricants.				
					Nonpoint Source			
				Chlordane (tissue)		Medium	4.3 Miles	
					Nonpoint Source			
				Copper, Dissolved		Low	4.3 Miles	
					Nonpoint Source			
				DDT		Low	4.3 Miles	
					Nonpoint Source			
				DDT (tissue & sediment)		Medium	4.3 Miles	
					Nonpoint Source			
				Endosulfan (tissue)		Medium	4.3 Miles	
					Nonpoint Source			
				Fecal Coliform		Low	4.3 Miles	
				Area affected is at the mouth of the creek.				
					Nonpoint/Point Source			
				Nitrogen		High	4.3 Miles	2002
					Nonpoint/Point Source			
				PCBs (tissue)		Medium	4.3 Miles	
					Nonpoint/Point Source			
				Sediment Toxicity		Medium	4.3 Miles	
					Nonpoint/Point Source			
				Sedimentation/Siltation		Low	4.3 Miles	
					Agriculture Natural Sources			
				Toxaphene (tissue & sediment)		Low	4.3 Miles	
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
4	R	Calleguas Creek Reach 3 (Potrero Road upstream to confluence with Conejo Creek on 1998 303d list)	40312000					
				Chloride		Medium	3.5 Miles	
					Nonpoint/Point Source			
				Nitrate and Nitrite		High	3.5 Miles	2002
					Nonpoint/Point Source			
				Sedimentation/Siltation		Low	3.5 Miles	
					Agriculture			
					Natural Sources			
				Total Dissolved Solids		High	3.5 Miles	2003
					Nonpoint/Point Source			
4	R	Calleguas Creek Reach 4 (was Revolon Slough Main Branch: Mugu Lagoon to Central Avenue on 1998 303d list)	40311000					
				Algae		High	7.2 Miles	2002
					Nonpoint Source			
				Boron		Medium	7.2 Miles	
				This listing was made by USEPA.				
					Nonpoint Source			
				ChemA (tissue)		Medium	7.2 Miles	
				Historical use of pesticides and lubricants.				
					Nonpoint Source			
				Chlordane (tissue & sediment)		Medium	7.2 Miles	
					Nonpoint Source			
				Chlorpyrifos (tissue)		Medium	7.2 Miles	
					Nonpoint Source			
				DDT (tissue & sediment)		Medium	7.2 Miles	
					Nonpoint Source			
				Dieldrin (tissue)		Medium	7.2 Miles	
					Nonpoint Source			
				Endosulfan (tissue & sediment)		Medium	7.2 Miles	
					Nonpoint Source			
				Fecal Coliform		Low	7.2 Miles	
					Nonpoint/Point Source			
				Nitrate as Nitrate (NO3)		Low	7.2 Miles	
					Nonpoint/Point Source			
				Nitrogen		High	7.2 Miles	2002
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				PCBs (tissue)		Medium	7.2 Miles	
					Nonpoint Source			
				Sedimentation/Siltation		Low	7.2 Miles	
					Agriculture Natural Sources			
				Selenium		Medium	7.2 Miles	
					Nonpoint Source			
				Sulfates		Medium	7.2 Miles	
				This listing was made by USEPA.				
					Nonpoint Source			
				Total Dissolved Solids		Medium	7.2 Miles	
				This listing was made by USEPA.				
					Nonpoint Source			
				Toxaphene (tissue & sediment)		Medium	7.2 Miles	
					Nonpoint Source			
				Toxicity		High	7.2 Miles	2004
					Nonpoint Source			
				Trash		Low	7.2 Miles	
					Nonpoint Source			
4	R	Calleguas Creek Reach 5 (was Beardsley Channel on 1998 303d list)	40311000					
				Algae		High	4.3 Miles	2002
					Nonpoint Source			
				ChemA (tissue)		Medium	4.3 Miles	
					Nonpoint Source			
				Chlordane (tissue & sediment)		Medium	4.3 Miles	
					Nonpoint Source			
				Chlorpyrifos (tissue)		High	4.3 Miles	2003
					Nonpoint Source			
				Dacthal (sediment)		Medium	4.3 Miles	
					Nonpoint Source			
				DDT (tissue & sediment)		Medium	4.3 Miles	
					Nonpoint Source			
				Dieldrin (tissue)		Medium	4.3 Miles	
					Nonpoint Source			
				Endosulfan (tissue & sediment)		Medium	4.3 Miles	
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Nitrogen		High	4.3 Miles	2002
					Nonpoint Source			
				PCBs (tissue)		Medium	4.3 Miles	
					Nonpoint Source			
				Sedimentation/Siltation		Low	4.3 Miles	
					Agriculture Natural Sources			
				Toxaphene (tissue & sediment)		Medium	4.3 Miles	
					Nonpoint Source			
				Toxicity		High	4.3 Miles	2004
					Nonpoint Source			
				Trash		Low	4.3 Miles	
					Nonpoint Source			
4	R	Calleguas Creek Reach 6 (was Arroyo Las Posas Reaches 1 and 2 on 1998 303d list)	40362000					
				Ammonia		High	15 Miles	2002
					Nonpoint/Point Source			
				Chloride		Medium	15 Miles	
					Nonpoint/Point Source			
				DDT (sediment)		Medium	15 Miles	
					Nonpoint Source			
				Fecal Coliform		Low	15 Miles	
					Nonpoint/Point Source			
				Nitrate and Nitrite		High	15 Miles	2002
					Nonpoint/Point Source			
				Nitrate as Nitrate (NO3)		High	15 Miles	2002
					Nonpoint/Point Source			
				Sedimentation/Siltation		Low	15 Miles	
					Agriculture Natural Sources			
				Sulfates		High	15 Miles	2003
					Nonpoint/Point Source			
				Total Dissolved Solids		High	15 Miles	2003
					Nonpoint/Point Source			
4	R	Calleguas Creek Reach 7 (was Arroyo Simi Reaches 1 and 2 on 1998 303d list)	40367000					
				Ammonia		High	14 Miles	2002
					Nonpoint/Point Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Boron		High	14 Miles	2003
					Nonpoint Source			
				Chloride		Medium	14 Miles	
					Nonpoint Source			
				Fecal Coliform		Low	14 Miles	
					Nonpoint Source			
				Organophosphorus Pesticides		Low	14 Miles	
					Municipal Point Sources			
					Agriculture			
				Sedimentation/Siltation		Low	14 Miles	
					Agriculture			
					Natural Sources			
				Sulfates		High	14 Miles	2003
					Nonpoint Source			
				Total Dissolved Solids		High	14 Miles	2003
					Nonpoint Source			
4	R	Calleguas Creek Reach 8 (was Tapo Canyon Reach 1)	40366000					
				Boron		High	7.2 Miles	2003
					Nonpoint/Point Source			
				Chloride		High	7.2 Miles	2002
					Nonpoint/Point Source			
				Sedimentation/Siltation		Low	7.2 Miles	
					Nonpoint Source			
				Sulfates		High	7.2 Miles	2003
					Nonpoint/Point Source			
				Total Dissolved Solids		High	7.2 Miles	2003
					Nonpoint/Point Source			
4	R	Calleguas Creek Reach 9A (was lower part of Conejo Creek Reach 1 on 1998 303d list)	40312000					
				Algae		High	1.7 Miles	2002
					Nonpoint/Point Source			
				ChemA (tissue)		Low	1.7 Miles	
					Nonpoint Source			
				Chlordane (tissue)		Low	1.7 Miles	
				Historical use of pesticides and lubricants.				
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				DDT (tissue)	**Nonpoint Source**	**Low**	**1.7 Miles**	
				Dieldrin (tissue) *Historical use of pesticides and lubricants.*	**Nonpoint Source**	**Low**	**1.7 Miles**	
				Endosulfan (tissue)	**Nonpoint Source**	**Low**	**1.7 Miles**	
				Fecal Coliform	**Nonpoint/Point Source**	**Low**	**1.7 Miles**	
				Hexachlorocyclohexane/HCH (tissue) *Historical use of pesticides and lubricants.*	**Nonpoint Source**	**Low**	**1.7 Miles**	
				Nitrate as Nitrate (NO3)	**Nonpoint/Point Source**	**Low**	**1.7 Miles**	
				Nitrate as Nitrogen	**Nonpoint/Point Source**	**Low**	**1.7 Miles**	
				Nitrite as Nitrogen	**Nonpoint/Point Source**	**Low**	**1.7 Miles**	
				PCBs (tissue) *Historical use of pesticides and lubricants.*	**Nonpoint Source**	**Low**	**1.7 Miles**	
				Sulfates	**Nonpoint/Point Source**	**High**	**1.7 Miles**	**2003**
				Total Dissolved Solids	**Nonpoint/Point Source**	**High**	**1.7 Miles**	**2003**
				Toxaphene (tissue & sediment)	**Nonpoint Source**	**Medium**	**1.7 Miles**	
4	**R**	**Calleguas Creek Reach 9B (was part of Conejo Creek Reaches 1 and 2 on 1998 303d list)**	**40363000**					
				Algae	**Nonpoint/Point Source**	**High**	**6.2 Miles**	**2002**
				Ammonia	**Nonpoint/Point Source**	**High**	**6.2 Miles**	**2002**
				ChemA (tissue)	**Nonpoint Source**	**Low**	**6.2 Miles**	
				Chloride	**Nonpoint/Point Source**	**Medium**	**6.2 Miles**	

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				DDT (tissue)	Nonpoint Source	Low	6.2 Miles	
				Endosulfan (tissue)	Nonpoint Source	Low	6.2 Miles	
				Fecal Coliform	Nonpoint/Point Source	Low	6.2 Miles	
				Sulfates	Nonpoint/Point Source	High	6.2 Miles	2003
				Total Dissolved Solids	Nonpoint/Point Source	High	6.2 Miles	2003
				Toxaphene (tissue & sediment)	Nonpoint Source	Medium	6.2 Miles	
				Toxicity	Nonpoint/Point Source	High	6.2 Miles	2004
4	R	Calleguas Creek Reach 10 (Conejo Creek (Hill Canyon)-was part of Conejo Crk Reaches 2 & 3, and lower Conejo Crk/Arroyo Conejo N Fk on 1998 303d list)	40364000					
				Algae	Nonpoint/Point Source	High	3 Miles	2002
				Ammonia	Nonpoint/Point Source	High	3 Miles	2002
				ChemA (tissue)	Nonpoint Source	Medium	3 Miles	
				Chloride	Nonpoint/Point Source	Medium	3 Miles	
				DDT (tissue)	Nonpoint Source	Medium	3 Miles	
				Endosulfan (tissue)	Nonpoint Source	Medium	3 Miles	
				Fecal Coliform	Nonpoint Source	Low	3 Miles	
				Nitrite as Nitrogen	Nonpoint/Point Source	Low	3 Miles	
				Sulfates	Nonpoint Source	High	3 Miles	2003
				Total Dissolved Solids	Nonpoint/Point Source	High	3 Miles	2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Toxaphene (tissue & sediment)		Medium	3 Miles	
					Nonpoint Source			
				Toxicity		High	3 Miles	2004
					Nonpoint/Point Source			
4	R	Calleguas Creek Reach 11 (Arroyo Santa Rosa, was part of Conejo Creek Reach 3 on 1998 303d list)	40365000					
				Algae		High	8.7 Miles	2002
					Nonpoint/Point Source			
				Ammonia		High	8.7 Miles	2002
					Nonpoint/Point Source			
				ChemA (tissue)		Medium	8.7 Miles	
					Nonpoint Source			
				DDT (tissue)		Medium	8.7 Miles	
					Nonpoint Source			
				Endosulfan (tissue)		Medium	8.7 Miles	
					Nonpoint Source			
				Fecal Coliform		Low	8.7 Miles	
					Nonpoint/Point Source			
				Sedimentation/Siltation		Low	8.7 Miles	
					Agriculture Natural Sources			
				Sulfates		High	8.7 Miles	2003
					Nonpoint/Point Source			
				Total Dissolved Solids		High	8.7 Miles	2003
					Nonpoint/Point Source			
				Toxaphene (tissue & sediment)		Medium	8.7 Miles	
					Nonpoint/Point Source			
				Toxicity		High	8.7 Miles	2004
					Nonpoint/Point Source			
4	R	Calleguas Creek Reach 12 (was Conejo Creek/Arroyo Conejo North Fork on 1998 303d list)	40364000					
				Ammonia		High	5.5 Miles	2002
					Nonpoint/Point Source			
				Chlordane (tissue)		Medium	5.5 Miles	
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				DDT (tissue)	Nonpoint Source	Medium	5.5 Miles	
				Sulfates	Nonpoint/Point Source	High	5.5 Miles	2003
				Total Dissolved Solids	Nonpoint/Point Source	High	5.5 Miles	2003
4	R	Calleguas Creek Reach 13 (Conejo Creek South Fork, was Conejo Cr Reach 4 and part of Reach 3 on 1998 303d list)	40368000					
				Algae	Nonpoint/Point Source	High	17 Miles	2002
				Ammonia	Nonpoint/Point Source	High	17 Miles	2002
				ChemA (tissue)	Nonpoint Source	Medium	17 Miles	
				Chloride	Nonpoint/Point Source	Medium	17 Miles	
				DDT (tissue)	Nonpoint Source	Medium	17 Miles	
				Endosulfan (tissue)	Nonpoint Source	Medium	17 Miles	
				Sulfates	Nonpoint/Point Source	High	17 Miles	2003
				Total Dissolved Solids	Nonpoint/Point Source	High	17 Miles	2003
				Toxaphene (tissue & sediment)	Nonpoint/Point Source	Medium	17 Miles	
				Toxicity	Nonpoint Source	High	17 Miles	2004
4	R	Canada Larga (Ventura River Watershed)	40210010		Nonpoint/Point Source			
				Fecal Coliform	*Horse stables, land use, cattle, and wildlife may be sources.* Nonpoint Source	Low	8 Miles	
				Low Dissolved Oxygen	Nonpoint Source	Low	8 Miles	
4	C	Carbon Beach	40416000					
				Beach Closures	Nonpoint Source	High	1.5 Miles	2002

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				DDT		**Low**	**1.5 Miles**	
				Fish consumption advisory for DDT.				
					Nonpoint Source			
				PCBs		**Low**	**1.5 Miles**	
				Fish consumption advisory for PCBs.				
					Nonpoint Source			
4	**C**	**Castlerock Beach**	**40513000**					
				Bacteria Indicators		**Low**	**0.21 Miles**	
					Nonpoint/Point Source			
				Beach Closures		**High**	**0.21 Miles**	**2002**
					Nonpoint Source			
				DDT		**Low**	**0.21 Miles**	
				Fish Consumption Advisory for DDT.				
					Nonpoint Source			
				PCBs		**Low**	**0.21 Miles**	
				Fish Consumption Advisory for PCBs.				
					Nonpoint Source			
4	**B**	**Channel Islands Harbor**	**40311000**					
				Lead (sediment)		**Medium**	**209 Acres**	
					Nonpoint Source			
				Zinc (sediment)		**Medium**	**209 Acres**	
					Nonpoint Source			
4	**C**	**Channel Islands Harbor Beach**	**40311000**					
				Bacteria Indicators		**Low**	**0.08 Miles**	
					Nonpoint/Point Source			
4	**T**	**Colorado Lagoon**	**40512000**					
				Chlordane (tissue & sediment)		**Medium**	**13 Acres**	
					Nonpoint Source			
				DDT (tissue)		**Medium**	**13 Acres**	
					Nonpoint Source			
				Dieldrin (tissue)		**Medium**	**13 Acres**	
					Nonpoint Source			
				Lead (sediment)		**Medium**	**13 Acres**	
					Nonpoint Source			
				PAHs (sediment)		**Medium**	**13 Acres**	
					Nonpoint Source			
				PCBs (tissue)		**Medium**	**13 Acres**	
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Sediment Toxicity	Nonpoint Source	Medium	13 Acres	
				Zinc (sediment)	Nonpoint Source	Medium	13 Acres	
4	R	Compton Creek	40515010					
				Copper	Nonpoint/Point Source	High	8.5 Miles	2003
				High Coliform Count	Nonpoint/Point Source	High	8.5 Miles	2002
				Lead	Nonpoint/Point Source	High	8.5 Miles	2003
				pH	Nonpoint/Point Source	High	8.5 Miles	2002
4	R	Coyote Creek	40515010					
				Abnormal Fish Histology	Nonpoint/Point Source	Medium	13 Miles	
				Algae	Nonpoint/Point Source	High	13 Miles	2003
				Copper, Dissolved	Nonpoint Source	Low	13 Miles	
				High Coliform Count	Nonpoint/Point Source	High	13 Miles	2003
				Lead, Dissolved	Nonpoint Source	Low	13 Miles	
				Selenium, Total	Nonpoint Source	Low	13 Miles	
				Toxicity *This listing was made by USEPA.*	Point Source	Medium	13 Miles	
				Zinc, Dissolved	Nonpoint Source	Low	13 Miles	
4	L	Crystal Lake	40543000					
				Organic Enrichment/Low Dissolved Oxygen	Nonpoint Source	Medium	3.7 Acres	
4	C	Dan Blocker Memorial (Coral) Beach	40431000					
				High Coliform Count	Nonpoint Source	High	2.1 Miles	2002

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
4	C	Dockweiler Beach	40512000					
				Beach Closures		High	4.6 Miles	2002
					Nonpoint Source			
				High Coliform Count		High	4.6 Miles	2002
					Nonpoint Source			
4	R	Dominguez Channel (above Vermont)	40512000					
				Aldrin (tissue)		Medium	6.7 Miles	
					Nonpoint/Point Source			
				Ammonia		Medium	6.7 Miles	
					Nonpoint/Point Source			
				ChemA (tissue)		Medium	6.7 Miles	
					Nonpoint/Point Source			
				Chlordane (tissue)		Medium	6.7 Miles	
					Nonpoint/Point Source			
				Chromium (sediment)		Medium	6.7 Miles	
					Nonpoint/Point Source			
				Copper		Medium	6.7 Miles	
					Nonpoint/Point Source			
				DDT (tissue & sediment)		Medium	6.7 Miles	
					Nonpoint/Point Source			
				Dieldrin (tissue)		Medium	6.7 Miles	
					Nonpoint/Point Source			
				High Coliform Count		High	6.7 Miles	2003
					Nonpoint/Point Source			
				Lead (tissue)		Medium	6.7 Miles	
					Nonpoint/Point Source			
				PAHs (sediment)		Medium	6.7 Miles	
					Nonpoint/Point Source			
				PCBs (tissue)		Medium	6.7 Miles	
					Nonpoint/Point Source			
				Zinc (sediment)		Low	6.7 Miles	
					Nonpoint/Point Source			
4	R	Dominguez Channel (Estuary to Vermont)	40512000					
				Aldrin (tissue)		Medium	8.3 Miles	
					Nonpoint/Point Source			
				Ammonia		Medium	8.3 Miles	
					Nonpoint/Point Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Benthic Community Effects		Medium	8.3 Miles	
					Nonpoint/Point Source			
				ChemA (tissue)		Medium	8.3 Miles	
					Nonpoint/Point Source			
				Chlordane (tissue)		Medium	8.3 Miles	
					Nonpoint/Point Source			
				Chromium (sediment)		Medium	8.3 Miles	
					Nonpoint/Point Source			
				DDT (tissue & sediment)		Medium	8.3 Miles	
					Nonpoint/Point Source			
				Dieldrin (tissue)		Medium	8.3 Miles	
					Nonpoint/Point Source			
				High Coliform Count		High	8.3 Miles	2003
					Nonpoint/Point Source			
				Lead (tissue)		Medium	8.3 Miles	
					Nonpoint/Point Source			
				PAHs (sediment)		Medium	8.3 Miles	
					Nonpoint/Point Source			
				Zinc (sediment)		Medium	8.3 Miles	
					Nonpoint/Point Source			
4	R	Dry Canyon Creek	40521000					
				Fecal Coliform		Low	3.9 Miles	
					Urban Runoff/Storm Sewers Natural Sources			
				Selenium, Total		Low	3.9 Miles	
					Nonpoint Source			
4	R	Duck Pond Agricultural Drains/Mugu Drain/Oxnard Drain No 2	40311000					
				ChemA (tissue)		Medium	12 Miles	
					Nonpoint Source			
				Chlordane (tissue)		Medium	12 Miles	
					Nonpoint Source			
				DDT (tissue & sediment)		Medium	12 Miles	
					Nonpoint Source			
				Nitrogen		High	12 Miles	2002
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Sediment Toxicity	Nonpoint Source	Medium	12 Miles	
				Toxaphene (tissue)	Nonpoint Source	Medium	12 Miles	
				Toxicity	Nonpoint Source	High	12 Miles	2004
4	L	Echo Park Lake	40515010					
				Algae	Nonpoint Source	Low	13 Acres	
				Ammonia	Nonpoint Source	Low	13 Acres	
				Copper	Nonpoint Source	Low	13 Acres	
				Eutrophic	Nonpoint Source	Low	13 Acres	
				Lead	Nonpoint Source	Low	13 Acres	
				Odors	Nonpoint Source	Low	13 Acres	
				PCBs (tissue)	Nonpoint Source	Low	13 Acres	
				pH	Nonpoint Source	Low	13 Acres	
4	L	El Dorado Lakes	40515010					
				Algae	Nonpoint Source	Medium	35 Acres	
				Ammonia	Nonpoint Source	Medium	35 Acres	
				Copper	Nonpoint Source	Medium	35 Acres	
				Eutrophic	Nonpoint Source	Medium	35 Acres	
				Lead	Nonpoint Source	Medium	35 Acres	
				Mercury (tissue)	Nonpoint Source	Medium	35 Acres	

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				pH		Medium	35 Acres	
					Nonpoint Source			
4	L	Elizabeth Lake	40351000					
				Eutrophic		Medium	123 Acres	
					Nonpoint Source			
				Organic Enrichment/Low Dissolved Oxygen		Medium	123 Acres	
					Nonpoint Source			
				pH		Medium	123 Acres	
					Nonpoint Source			
				Trash		Medium	123 Acres	
					Nonpoint Source			
4	C	Escondido Beach	40434000					
				Beach Closures		High	1.2 Miles	2002
					Nonpoint Source			
				DDT		Low	1.2 Miles	
				Fish consumption advisory for DDT.				
					Nonpoint Source			
				PCBs		Low	1.2 Miles	
				Fish consumption advisory for PCBs.				
					Nonpoint Source			
4	C	Flat Rock Point Beach Area	40511000					
				Beach Closures		High	0.11 Miles	2002
					Nonpoint Source			
				DDT		Low	0.11 Miles	
				Fish Consumption Advisory for DDT.				
					Nonpoint Source			
				PCBs		Low	0.11 Miles	
				Fish Consumption Advisory for PCBs.				
					Nonpoint Source			
4	R	Fox Barranca (tributary to Calleguas Creek Reach 6)	40362000					
				Boron		High	6.7 Miles	2003
					Nonpoint Source			
				Nitrate and Nitrite		High	6.7 Miles	2002
					Nonpoint Source			
				Sulfates		High	6.7 Miles	2003
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Total Dissolved Solids		High	6.7 Miles	2003
					Nonpoint Source			
4	C	Hermosa Beach	40512000					
				Beach Closures		High	2 Miles	2002
					Nonpoint Source			
4	C	Hobie Beach (Channel Islands Harbor)	40311000					
				Bacteria Indicators		Low	0.06 Miles	
					Nonpoint/Point Source			
4	R	Hopper Creek	40341000					
				Sulfates		Low	13 Miles	
					Nonpoint/Point Source			
				Total Dissolved Solids		Low	13 Miles	
					Nonpoint/Point Source			
4	C	Inspiration Point Beach	40511000					
				Beach Closures		High	0.14 Miles	2002
					Nonpoint Source			
				DDT		Low	0.14 Miles	
				Fish Consumption Advisory for DDT.				
					Nonpoint Source			
				PCBs		Low	0.14 Miles	
				Fish Consumption Advisroy for PCBs.				
					Nonpoint Source			
4	C	La Costa Beach	40416000					
				Beach Closures		High	0.74 Miles	2002
					Nonpoint Source			
				DDT		Low	0.74 Miles	
				Fish Consumption Advisory for DDT.				
					Nonpoint Source			
				PCBs		Low	0.74 Miles	
				Fish Consumption Advisory for PCBs.				
					Nonpoint Source			
4	L	Lake Calabasas	40521000					
				Ammonia		Low	18 Acres	
					Nonpoint Source			
				DDT (tissue)		Low	18 Acres	
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Eutrophic		Low	18 Acres	
					Nonpoint Source			
				Odors		Low	18 Acres	
					Nonpoint Source			
				Organic Enrichment/Low Dissolved Oxygen		Low	18 Acres	
					Nonpoint Source			
				pH		Low	18 Acres	
					Nonpoint Source			
4	L	Lake Hughes	40351000					
				Algae		Medium	21 Acres	
					Nonpoint Source			
				Eutrophic		Medium	21 Acres	
					Nonpoint Source			
				Fish Kills		Medium	21 Acres	
					Nonpoint Source			
				Odors		Medium	21 Acres	
					Nonpoint Source			
				Trash		Medium	21 Acres	
					Nonpoint Source			
4	L	Lake Lindero	40423000					
				Algae		High	15 Acres	2002
					Nonpoint Source			
				Chloride		Low	15 Acres	
					Nonpoint Source			
				Eutrophic		High	15 Acres	2002
					Nonpoint Source			
				Odors		High	15 Acres	2002
					Nonpoint Source			
				Specific conductivity		Low	15 Acres	
					Nonpoint Source			
				Trash		Medium	15 Acres	
					Nonpoint Source			
4	L	Lake Sherwood	40426000					
				Algae		High	135 Acres	2003
					Nonpoint Source			
				Ammonia		High	135 Acres	2002
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Eutrophic		**High**	**135 Acres**	**2002**
					Nonpoint Source			
				Mercury (tissue)		**High**	**135 Acres**	**2004**
					Nonpoint Source			
				Organic Enrichment/Low Dissolved Oxygen		**High**	**135 Acres**	**2002**
					Nonpoint Source			
4	**C**	**Las Flores Beach**	**40415000**					
				DDT		**Low**	**1.1 Miles**	
				Fish Consumption Advisory for DDT.				
					Nonpoint Source			
				High Coliform Count		**High**	**1.1 Miles**	**2002**
					Nonpoint Source			
				PCBs		**Low**	**1.1 Miles**	
				Fish Consumption Advisory for PCBs.				
					Nonpoint Source			
4	**C**	**Las Tunas Beach**	**40412000**					
				Beach Closures		**High**	**1.2 Miles**	**2002**
					Nonpoint Source			
				DDT		**Low**	**1.2 Miles**	
				Fish Consumption Advisory for DDT.				
					Nonpoint Source			
				PCBs		**Low**	**1.2 Miles**	
				Fish Consumption Advisory for PCBs.				
					Nonpoint Source			
4	**R**	**Las Virgenes Creek**	**40422010**					
				High Coliform Count		**High**	**12 Miles**	**2003**
					Nonpoint Source			
				Nutrients (Algae)		**High**	**12 Miles**	**2003**
					Nonpoint Source			
				Organic Enrichment/Low Dissolved Oxygen		**High**	**12 Miles**	**2002**
					Nonpoint Source			
				Scum/Foam-unnatural		**High**	**12 Miles**	**2002**
					Nonpoint Source			
				Sedimentation/Siltation		**Low**	**12 Miles**	
					Source Unknown			
				Selenium		**High**	**12 Miles**	**2004**
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Trash		Medium	12 Miles	
					Nonpoint Source			
4	L	Legg Lake	40531000					
				Ammonia		Medium	25 Acres	
					Nonpoint Source			
				Copper		Medium	25 Acres	
					Nonpoint Source			
				Lead		Medium	25 Acres	
					Nonpoint Source			
				Odors		Medium	25 Acres	
					Nonpoint Source			
				pH		Medium	25 Acres	
					Nonpoint Source			
				Trash		Low	25 Acres	
					Nonpoint Source			
4	C	Leo Carillo Beach (South of County Line)	40444000					
				Beach Closures		High	1.8 Miles	2002
					Nonpoint Source			
				High Coliform Count		High	1.8 Miles	2002
					Nonpoint Source			
4	L	Lincoln Park Lake	40515010					
				Ammonia		Low	3.8 Acres	
					Nonpoint Source			
				Eutrophic		Low	3.8 Acres	
					Nonpoint Source			
				Lead		Low	3.8 Acres	
					Nonpoint Source			
				Odors		Low	3.8 Acres	
					Nonpoint Source			
				Organic Enrichment/Low Dissolved Oxygen		Low	3.8 Acres	
					Nonpoint Source			
4	R	Lindero Creek Reach 1	40423000					
				Algae		High	3 Miles	2003
					Nonpoint Source			
				High Coliform Count		High	3 Miles	2003
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Scum/Foam-unnatural	Nonpoint Source	High	3 Miles	2002
				Selenium	Nonpoint Source	High	3 Miles	2004
				Trash	Nonpoint Source	Medium	3 Miles	
4	R	Lindero Creek Reach 2 (Above Lake)	40425000					
				Algae	Nonpoint Source	High	4.5 Miles	2003
				High Coliform Count	Nonpoint Source	High	4.5 Miles	2003
				Scum/Foam-unnatural	Nonpoint Source	High	4.5 Miles	2002
				Selenium	Nonpoint Source	High	4.5 Miles	2004
				Trash	Nonpoint Source	Medium	4.5 Miles	
4	B	Long Beach Harbor Main Channel, SE, W Basin, Pier J, Breakwater	40518000					
				Benthic Community Effects	Nonpoint Source	Medium	1076 Acres	
				DDT (tissue) *Fish Consumption Advisory.*	Nonpoint Source	Medium	1076 Acres	
				PAHs (sediment)	Nonpoint Source	Medium	1076 Acres	
				PCBs (tissue) *Fish Consumption Advisory.*	Nonpoint Source	Medium	1076 Acres	
				Sediment Toxicity	Nonpoint Source	Medium	1076 Acres	
4	C	Long Point Beach	40511000					
				DDT *Fish Consumption Advisory for DDT.*	Nonpoint Source	Low	0.7 Miles	
				High Coliform Count	Nonpoint Source	High	0.7 Miles	2002

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				PCBs		**Low**	**0.7 Miles**	
				Fish Consumption Advisory for PCBs.				
					Nonpoint Source			
4	**B**	**Los Angeles Fish Harbor**	**40518000**					
				DDT		**Medium**	**34 Acres**	
					Nonpoint Source			
				PAHs		**Medium**	**34 Acres**	
					Nonpoint Source			
				PCBs		**Medium**	**34 Acres**	
					Nonpoint Source			
4	**B**	**Los Angeles Harbor Consolidated Slip**	**40512000**					
				Benthic Community Effects		**Medium**	**36 Acres**	
					Nonpoint Source			
				Cadmium (sediment)		**Low**	**36 Acres**	
				Historical use of pesticides and lubricants, stormwater runoff, aerial deposition, and historical discharges for metals.				
					Nonpoint Source			
				Chlordane (tissue & sediment)		**Medium**	**36 Acres**	
					Nonpoint Source			
				Chromium (sediment)		**Medium**	**36 Acres**	
					Nonpoint Source			
				Copper (sediment)		**Low**	**36 Acres**	
					Nonpoint Source			
				DDT (tissue & sediment)		**Medium**	**36 Acres**	
				Fish Consumption Advisory for DDT.				
					Nonpoint Source			
				Dieldrin (tissue)		**Low**	**36 Acres**	
				Historical use of pesticides and lubricants, stormwater runoff, aerial deposition, and historical discharges for metals.				
					Nonpoint Source			
				Lead (sediment)		**Medium**	**36 Acres**	
					Nonpoint Source			
				Mercury (sediment)		**Low**	**36 Acres**	
				Historical use of pesticides and lubricants, stormwater runoff, aerial deposition, and historical discharges for metals.				
					Nonpoint Source			
				Nickel (sediment)		**Low**	**36 Acres**	
					Nonpoint Source			
				PAHs (sediment)		**Medium**	**36 Acres**	
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				PCBs (tissue & sediment)		**Medium**	**36 Acres**	
				Fish Consumption Advisory for PCBs.				
					Nonpoint Source			
				Sediment Toxicity		**Medium**	**36 Acres**	
					Nonpoint Source			
				Toxaphene (tissue)		**Low**	**36 Acres**	
					Nonpoint Source			
				Zinc (sediment)		**Low**	**36 Acres**	
				Historical use of pesticides and lubricants, stormwater runoff, aerial deposition, and historical discharges for metals.				
					Nonpoint Source			
4	**B**	**Los Angeles Harbor Inner Breakwater**	**40512000**					
				DDT		**Medium**	**74 Acres**	
					Nonpoint Source			
				PAHs		**Medium**	**74 Acres**	
					Nonpoint Source			
				PCBs		**Medium**	**74 Acres**	
					Nonpoint Source			
4	**B**	**Los Angeles Harbor Main Channel**	**40518000**					
				Beach Closures		**High**	**279 Acres**	**2004**
					Nonpoint/Point Source			
				Copper (tissue & sediment)		**Medium**	**279 Acres**	
					Nonpoint/Point Source			
				DDT (tissue & sediment)		**Medium**	**279 Acres**	
				Fish Consumption Advisory for DDT.				
					Nonpoint/Point Source			
				PAHs (tissue & sediment)		**Medium**	**279 Acres**	
					Nonpoint/Point Source			
				PCBs (tissue & sediment)		**Medium**	**279 Acres**	
				Fish Consumption Advisory for PCBs.				
					Nonpoint/Point Source			
				Sediment Toxicity		**Medium**	**279 Acres**	
					Nonpoint/Point Source			
				Zinc (tissue & sediment)		**Medium**	**279 Acres**	
					Nonpoint/Point Source			
4	**B**	**Los Angeles Harbor Southwest Slip**	**40512000**					
				DDT		**Medium**	**63 Acres**	
				Fish Consumption Advisory for DDT.				
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				PCBs		**Medium**	**63 Acres**	
				Fish Consumption Advisory for PCBs.				
					Nonpoint Source			
				Sediment Toxicity		**Medium**	**63 Acres**	
					Nonpoint Source			
4	**E**	**Los Angeles River Estuary (Queensway Bay)**	**40512000**					
				Chlordane (sediment)		**Low**	**261 Acres**	
				Historical use of pesticides and lubricants.				
					Nonpoint Source			
				DDT (sediment)		**Low**	**261 Acres**	
				Historical use of pesticides and lubricants.				
					Nonpoint Source			
				Lead (sediment)		**Low**	**261 Acres**	
				Historical use of pesticides and lubricants.				
					Nonpoint Source			
				PCBs (sediment)		**Low**	**261 Acres**	
				Historical use of pesticides and lubricants.				
					Nonpoint Source			
				Zinc (sediment)		**Low**	**261 Acres**	
				Historical use of pesticides and lubricants.				
					Nonpoint Source			
4	**R**	**Los Angeles River Reach 1 (Estuary to Carson Street)**	**40512000**					
				Aluminum, Total		**Low**	**3.4 Miles**	
					Nonpoint/Point Source			
				Ammonia		**High**	**3.4 Miles**	**2003**
					Nonpoint/Point Source			
				Cadmium, Dissolved		**Low**	**3.4 Miles**	
					Nonpoint/Point Source			
				Copper, Dissolved		**High**	**3.4 Miles**	**2003**
					Nonpoint/Point Source			
				High Coliform Count		**High**	**3.4 Miles**	**2003**
					Nonpoint/Point Source			
				Lead		**High**	**3.4 Miles**	**2003**
					Nonpoint/Point Source			
				Nutrients (Algae)		**High**	**3.4 Miles**	**2003**
					Nonpoint/Point Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				pH	Nonpoint/Point Source	High	3.4 Miles	2003
				Scum/Foam-unnatural	Nonpoint/Point Source	High	3.4 Miles	2003
				Zinc, Dissolved	Nonpoint/Point Source	High	3.4 Miles	2003
4	R	Los Angeles River Reach 2 (Carson to Figueroa Street)	40515010					
				Ammonia	Nonpoint/Point Source	High	19 Miles	2003
				High Coliform Count	Nonpoint/Point Source	High	19 Miles	2003
				Lead	Nonpoint/Point Source	High	19 Miles	2003
				Nutrients (Algae)	Nonpoint/Point Source	High	19 Miles	2003
				Odors	Nonpoint/Point Source	High	19 Miles	2003
				Oil	Nonpoint/Point Source	Low	19 Miles	
				Scum/Foam-unnatural	Nonpoint/Point Source	High	19 Miles	2002
4	R	Los Angeles River Reach 3 (Figueroa St. to Riverside Dr.)	40521000					
				Ammonia	Nonpoint/Point Source	High	7.9 Miles	2003
				Nutrients (Algae)	Nonpoint/Point Source	High	7.9 Miles	2003
				Odors	Nonpoint/Point Source	High	7.9 Miles	2003
				Scum/Foam-unnatural	Nonpoint/Point Source	High	7.9 Miles	2003
4	R	Los Angeles River Reach 4 (Sepulveda Dr. to Sepulveda Dam)	40521000					
				Ammonia	Nonpoint/Point Source	High	11 Miles	2003
				High Coliform Count	Nonpoint/Point Source	High	11 Miles	2003

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Lead		High	11 Miles	2003
					Nonpoint/Point Source			
				Nutrients (Algae)		High	11 Miles	2003
					Nonpoint/Point Source			
				Odors		High	11 Miles	2003
					Nonpoint/Point Source			
				Scum/Foam-unnatural		High	11 Miles	2003
					Nonpoint/Point Source			
4	R	Los Angeles River Reach 5 (within Sepulveda Basin)	40521000					
				Ammonia		High	5.4 Miles	2003
					Nonpoint/Point Source			
				Nutrients (Algae)		High	5.4 Miles	2003
					Nonpoint/Point Source			
				Odors		High	5.4 Miles	2003
					Nonpoint/Point Source			
				Oil		Low	5.4 Miles	
					Nonpoint/Point Source			
				Scum/Foam-unnatural		High	5.4 Miles	2003
					Nonpoint/Point Source			
4	R	Los Angeles River Reach 6 (Above Sepulveda Flood Control Basin)	40521000					
				Dichloroethylene/1,1-DCE		Low	7 Miles	
					Nonpoint Source			
				High Coliform Count		High	7 Miles	2003
					Nonpoint Source			
				Tetrachloroethylene/PCE		Low	7 Miles	
					Nonpoint Source			
				Trichloroethylene/TCE		Low	7 Miles	
					Nonpoint Source			
4	T	Los Cerritos Channel	40515010					
				Ammonia		Medium	31 Acres	
					Nonpoint Source			
				Chlordane (sediment)		Low	31 Acres	
					Source Unknown			
				Copper		Medium	31 Acres	
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				High Coliform Count		Medium	31 Acres	
					Nonpoint Source			
				Lead		Medium	31 Acres	
					Nonpoint Source			
				Zinc		Medium	31 Acres	
					Nonpoint Source			
4	C	Lunada Bay Beach	40511000					
				Beach Closures		Low	0.63 Miles	
					Nonpoint Source			
4	L	Machado Lake (Harbor Park Lake)	40512000					
				Algae		Low	45 Acres	
					Nonpoint Source			
				Ammonia		Low	45 Acres	
					Nonpoint Source			
				ChemA (tissue)		Medium	45 Acres	
				Historical use of pesticides and lubricants.				
					Nonpoint Source			
				Chlordane (tissue)		Low	45 Acres	
				Fish Consumption Advisory.				
					Nonpoint Source			
				DDT (tissue)		Low	45 Acres	
				Fish Consumption Advisory.				
					Nonpoint Source			
				Dieldrin (tissue)		Low	45 Acres	
					Nonpoint Source			
				Eutrophic		Low	45 Acres	
					Nonpoint Source			
				Odors		Low	45 Acres	
					Nonpoint Source			
				PCBs (tissue)		Low	45 Acres	
					Nonpoint Source			
				Trash		Medium	45 Acres	
					Nonpoint Source			
4	C	Malaga Cove Beach	40511000					
				Beach Closures		High	0.39 Miles	2002
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				DDT		Low	0.39 Miles	
				Fish Consumption Advisory for DDT.				
					Nonpoint Source			
				PCBs		Low	0.39 Miles	
				Fish Consumption Advisory for PCBs.				
					Nonpoint Source			
4	L	Malibou Lake	40424000					
				Algae		High	40 Acres	2002
					Nonpoint Source			
				Eutrophic		High	40 Acres	2002
					Nonpoint Source			
				Organic Enrichment/Low Dissolved Oxygen		High	40 Acres	2002
					Nonpoint Source			
4	C	Malibu Beach	40421000					
				Beach Closures		High	0.77 Miles	2002
					Nonpoint Source			
				DDT		Low	0.77 Miles	
				Fish Consumption Advisory for DDT.				
					Nonpoint Source			
4	R	Malibu Creek	40421000					
				Fish barriers		Low	11 Miles	
					Dam Construction			
				High Coliform Count		High	11 Miles	2003
					Nonpoint/Point Source			
				Nutrients (Algae)		High	11 Miles	2003
					Nonpoint/Point Source			
				Scum/Foam-unnatural		High	11 Miles	2003
					Nonpoint/Point Source			
				Sedimentation/Siltation		Low	11 Miles	
					Source Unknown			
				Trash		Medium	11 Miles	
					Nonpoint Source			
4	E	Malibu Lagoon	40421000					
				Benthic Community Effects		Low	15 Acres	
					Nonpoint/Point Source			
				Enteric Viruses		High	15 Acres	2002
					Nonpoint/Point Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Eutrophic		**High**	**15 Acres**	**2002**
					Nonpoint/Point Source			
				High Coliform Count		**High**	**15 Acres**	**2003**
					Nonpoint/Point Source			
				pH		**Low**	**15 Acres**	
				Possible sources might be septic systems, storm drains, and birds.				
					Source Unknown			
				Shellfish Harvesting Advisory		**High**	**15 Acres**	**2002**
					Nonpoint/Point Source			
				Swimming Restrictions		**High**	**15 Acres**	**2002**
					Nonpoint/Point Source			
4	**C**	**Malibu Lagoon Beach (Surfrider)**	**40421000**					
				Beach Closures		**High**	**1 Miles**	**2002**
					Nonpoint Source			
				DDT		**Low**	**1 Miles**	
				Fish Consumption Advisory for DDT.				
					Nonpoint Source			
				High Coliform Count		**High**	**1 Miles**	**2002**
					Nonpoint Source			
				PCBs		**Low**	**1 Miles**	
				Fish Consumption Advisory for PCBs.				
					Nonpoint Source			
4	**C**	**Manhattan Beach**	**40512000**					
				Beach Closures		**High**	**2 Miles**	**2002**
					Nonpoint Source			
4	**B**	**Marina del Rey Harbor - Back Basins**	**40517000**					
				Chlordane (tissue & sediment)		**Medium**	**391 Acres**	
					Nonpoint Source			
				Copper (sediment)		**Low**	**391 Acres**	
					Nonpoint Source			
				DDT (tissue)		**Medium**	**391 Acres**	
					Nonpoint Source			
				Dieldrin (tissue)		**Medium**	**391 Acres**	
					Nonpoint Source			
				Fish Consumption Advisory		**Medium**	**391 Acres**	
					Nonpoint Source			
				High Coliform Count		**High**	**391 Acres**	**2003**
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED		PROPOSED TMDL COMPLETION
				Lead (sediment)		**Medium**	**391**	**Acres**	
					Nonpoint Source				
				PCBs (tissue & sediment)		**Medium**	**391**	**Acres**	
				Historical use of pesticides, storm water runoff/aerial deposition from urban areas. Shellfish harvesting advisory for PCBs in tissue.					
					Nonpoint Source				
				Sediment Toxicity		**Medium**	**391**	**Acres**	
					Nonpoint Source				
				Zinc (sediment)		**Medium**	**391**	**Acres**	
					Nonpoint Source				
4	**C**	**Marina del Rey Harbor Beach**	**40517000**						
				Beach Closures		**High**	**0.29**	**Miles**	**2003**
					Nonpoint Source				
				High Coliform Count		**High**	**0.29**	**Miles**	**2003**
					Nonpoint Source				
4	**R**	**Matilija Creek Reach 1 (Jct. With N. Fork to Reservoir)**	**40220012**						
				Fish barriers		**Low**	**0.63**	**Miles**	
					Dam Construction				
4	**R**	**Matilija Creek Reach 2 (Above Reservoir)**	**40220010**						
				Fish barriers		**Low**	**15**	**Miles**	
					Dam Construction				
4	**L**	**Matilija Reservoir**	**40220012**						
				Fish barriers		**Low**	**121**	**Acres**	
					Dam Construction				
4	**R**	**McCoy Canyon Creek**	**40521000**						
				Fecal Coliform		**Low**	**4**	**Miles**	
					Nonpoint Source				
				Nitrate		**Low**	**4**	**Miles**	
					Nonpoint Source				
				Nitrate as Nitrogen		**Low**	**4**	**Miles**	
					Urban Runoff/Storm Sewers				
					Natural Sources				
				Selenium, Total		**Low**	**4**	**Miles**	
					Urban Runoff/Storm Sewers				
					Natural Sources				

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
4	C	McGrath Beach	40311000					
				High Coliform Count		High	1.5 Miles	2003
					Nonpoint Source			
4	L	McGrath Lake	40311000					
				Chlordane (sediment)		Medium	20 Acres	
					Nonpoint Source			
				DDT (sediment)		Medium	20 Acres	
					Nonpoint Source			
				Dieldrin (sediment)		Low	20 Acres	
				Historical use of pesticides and lubricants, storm water runoff/aerial deposition from agricultural fields.				
					Nonpoint Source			
				Fecal Coliform		Low	20 Acres	
					Agriculture Landfills Natural Sources			
				PCBs (sediment)		Low	20 Acres	
				Historical use of pesticides and lubricants, storm water runoff/aerial deposition from agricultural fields.				
					Nonpoint Source			
				Sediment Toxicity		Medium	20 Acres	
					Nonpoint Source			
4	R	Medea Creek Reach 1 (Lake to Confl. with Lindero)	40424000					
				Algae		High	2.6 Miles	2003
					Nonpoint Source			
				High Coliform Count		High	2.6 Miles	2003
					Nonpoint Source			
				Sedimentation/Siltation		Low	2.6 Miles	
					Source Unknown			
				Selenium		High	2.6 Miles	2004
					Nonpoint Source			
				Trash		Medium	2.6 Miles	
					Nonpoint Source			
4	R	Medea Creek Reach 2 (Abv Confl. with Lindero)	40423000					
				Algae		High	5.4 Miles	2003
					Nonpoint Source			
				High Coliform Count		High	5.4 Miles	2003
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Sedimentation/Siltation		**Low**	**5.4 Miles**	
					Source Unknown			
				Selenium		**High**	**5.4 Miles**	**2004**
					Nonpoint Source			
				Trash		**Medium**	**5.4 Miles**	
					Nonpoint Source			
4	**R**	**Mint Canyon Creek Reach 1 (Confl to Rowler Cyn)**	**40351000**					
				Nitrate and Nitrite		**High**	**8.1 Miles**	**2003**
					Nonpoint Source			
4	**R**	**Monrovia Canyon Creek**	**40531000**					
				Lead		**High**	**3.4 Miles**	**2003**
					Nonpoint Source			
4	**L**	**Munz Lake**	**40351000**					
				Eutrophic		**Medium**	**6.6 Acres**	
					Nonpoint Source			
				Trash		**Medium**	**6.6 Acres**	
					Nonpoint Source			
4	**C**	**Nicholas Canyon Beach**	**40444000**					
				Beach Closures		**High**	**1.7 Miles**	**2002**
					Nonpoint Source			
				DDT		**Low**	**1.7 Miles**	
				Fish Consumption Advisory for DDT.				
					Nonpoint Source			
				PCBs		**Low**	**1.7 Miles**	
				Fish Consumption Advisory for PCBs.				
					Nonpoint Source			
4	**C**	**Ormond Beach**	**40311000**					
				Bacteria Indicators		**Low**	**1.6 Miles**	
				The areas affected are: a 50 yard area north of Oxnard Industrial Drain and a 50 yard area south of J Street drain.				
					Nonpoint/Point Source			
4	**R**	**Palo Comado Creek**	**40423000**					
				High Coliform Count		**High**	**6.8 Miles**	**2003**
					Nonpoint Source			
4	**C**	**Palo Verde Shoreline Park Beach**	**40511000**					
				Pathogens		**High**	**0.24 Miles**	**2002**
					Source Unknown			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED		PROPOSED TMDL COMPLETION
				Pesticides		**Low**	**0.24**	**Miles**	
					Source Unknown				
4	**C**	**Paradise Cove Beach**	**40435000**						
				Beach Closures		**High**	**1.7**	**Miles**	**2002**
					Nonpoint Source				
				DDT		**Low**	**1.7**	**Miles**	
				Fish consumption advisory for DDT.					
					Nonpoint Source				
				High Coliform Count		**High**	**1.7**	**Miles**	**2002**
					Nonpoint Source				
				PCBs		**Low**	**1.7**	**Miles**	
				Fish consumption advisory for PCBs.					
					Nonpoint Source				
4	**L**	**Peck Road Park Lake**	**40531000**						
				Chlordane (tissue)		**Low**	**103**	**Acres**	
					Nonpoint Source				
				DDT (tissue)		**Low**	**103**	**Acres**	
					Nonpoint Source				
				Lead		**Low**	**103**	**Acres**	
					Nonpoint Source				
				Odors		**Low**	**103**	**Acres**	
					Nonpoint Source				
				Organic Enrichment/Low Dissolved Oxygen		**Low**	**103**	**Acres**	
					Nonpoint Source				
4	**C**	**Peninsula Beach**	**40311000**						
				Bacteria Indicators		**Low**	**0.2**	**Miles**	
				Area affected is beach area north of South Jetty.					
					Nonpoint/Point Source				
4	**R**	**Pico Kenter Drain**	**40513000**						
				Ammonia		**Low**	**8**	**Miles**	
					Nonpoint Source				
				Copper		**Medium**	**8**	**Miles**	
					Nonpoint Source				
				Enteric Viruses		**High**	**8**	**Miles**	**2002**
					Nonpoint Source				
				High Coliform Count		**High**	**8**	**Miles**	**2002**
					Nonpoint Source				

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Lead		Medium	8 Miles	
					Nonpoint Source			
				PAHs		Low	8 Miles	
					Nonpoint Source			
				Toxicity		Medium	8 Miles	
					Nonpoint Source			
				Trash		Low	8 Miles	
					Nonpoint Source			
4	R	Piru Creek (tributary to Santa River Reach 4)	40342000					
				pH		Low	63 Miles	
					Nonpoint Source			
					Conservation Dishcarge Releases			
4	C	Point Dume Beach	40435000					
				Beach Closures		High	2.5 Miles	2002
					Nonpoint Source			
				DDT		Low	2.5 Miles	
				Fish consumption advisory for DDT.				
					Nonpoint Source			
				PCBs		Low	2.5 Miles	
				Fish consumtiion advisory for PCBs.				
					Nonpoint Source			
4	C	Point Fermin Park Beach	40512000					
				Beach Closures		High	1.6 Miles	2002
					Nonpoint Source			
				DDT		Low	1.6 Miles	
				Fish consumption advisory for DDT.				
					Nonpoint Source			
				PCBs		Low	1.6 Miles	
				Fish consumption advisory for PCBs.				
					Nonpoint Source			
4	C	Point Vicente Beach	40511000					
				Beach Closures		High	0.63 Miles	2002
					Nonpoint Source			
4	R	Pole Creek (trib to Santa Clara River Reach 3)	40331000					
				Sulfates		Low	9 Miles	
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Total Dissolved Solids		Low	9 Miles	
					Nonpoint Source			
4	B	Port Hueneme Harbor (Back Basins)	40311000					
				DDT (tissue)		Medium	65 Acres	
					Nonpoint Source			
				PCBs (tissue)		Medium	65 Acres	
					Nonpoint Source			
4	C	Portugese Bend Beach	40511000					
				Beach Closures		High	1.4 Miles	2002
					Nonpoint Source			
				DDT		Low	1.4 Miles	
				Fish Consumption Advisory for DDT.				
					Nonpoint Source			
				PCBs		Low	1.4 Miles	
				Fish Consumption Advisory for PCB.				
					Nonpoint Source			
4	C	Promenade Park Beach	40210000					
				Bacteria Indicators		Low	0.37 Miles	
				Area affected is at Oak Street , Redwood Apartments, and south of drain at California Street.				
					Nonpoint/Point Source			
4	L	Puddingstone Reservoir	40552000					
				Chlordane (tissue)		Medium	243 Acres	
					Nonpoint Source			
				DDT (tissue)		Medium	243 Acres	
					Nonpoint Source			
				Mercury (tissue)		Medium	243 Acres	
					Nonpoint Source			
				Organic Enrichment/Low Dissolved Oxygen		Low	243 Acres	
					Nonpoint Source			
				PCBs (tissue)		Low	243 Acres	
					Nonpoint Source			
4	C	Puerco Beach	40431000					
				Beach Closures		High	0.5 Miles	2002
					Nonpoint Source			
				DDT		Low	0.5 Miles	
				Fish Consumption Advisory for DDT.				
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				PCBs		**Low**	**0.5 Miles**	
				Fish Consumption Advisory for PCBs.				
					Nonpoint Source			
4	**C**	**Redondo Beach**	**40512000**					
				Beach Closures		**High**	**1.5 Miles**	**2002**
					Nonpoint Source			
				DDT		**Low**	**1.5 Miles**	
				Fish Consumption Advisory for DDT.				
					Nonpoint Source			
				High Coliform Count		**High**	**1.5 Miles**	**2002**
					Nonpoint Source			
				PCBs		**Low**	**1.5 Miles**	
				Fish Consumption Advisory for PCBs.				
					Nonpoint Source			
4	**C**	**Resort Point Beach**	**40511000**					
				Beach Closures		**High**	**0.15 Miles**	**2002**
					Nonpoint Source			
4	**C**	**Rincon Beach**	**40100010**					
				Bacteria Indicators		**Low**	**0.09 Miles**	
				Area affected is 50 and 150 yards south of mouth of Rincon Creek, and at the end of the footpath.				
					Nonpoint/Point Source			
4	**R**	**Rio De Santa Clara/Oxnard Drain No. 3**	**40311000**					
				ChemA (tissue)		**Medium**	**1.9 Miles**	
					Nonpoint Source			
				Chlordane (tissue)		**Medium**	**1.9 Miles**	
					Nonpoint Source			
				DDT (tissue)		**Medium**	**1.9 Miles**	
					Nonpoint Source			
				Nitrogen		**High**	**1.9 Miles**	**2002**
					Nonpoint Source			
				PCBs (tissue)		**Medium**	**1.9 Miles**	
					Nonpoint Source			
				Sediment Toxicity		**Medium**	**1.9 Miles**	
					Nonpoint Source			
				Toxaphene (tissue)		**Medium**	**1.9 Miles**	
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
4	R	Rio Hondo Reach 1 (Confl. LA River to Snt Ana Fwy)	40515010					
				Copper		High	4.6 Miles	2003
					Nonpoint/Point Source			
				High Coliform Count		High	4.6 Miles	2002
					Nonpoint/Point Source			
				Lead		High	4.6 Miles	2003
					Nonpoint/Point Source			
				pH		High	4.6 Miles	2002
					Nonpoint/Point Source			
				Trash		Low	4.6 Miles	
					Nonpoint/Point Source			
				Zinc		High	4.6 Miles	2003
					Nonpoint/Point Source			
4	R	Rio Hondo Reach 2 (At Spreading Grounds)	40515010					
				High Coliform Count		High	4.9 Miles	2002
					Nonpoint/Point Source			
4	C	Robert H. Meyer Memorial Beach	40441000					
				Beach Closures		High	1.2 Miles	2002
					Nonpoint Source			
				DDT		Low	1.2 Miles	
				Fish Consumption Advisory for DDT.				
					Nonpoint Source			
				PCBs		Low	1.2 Miles	
				Fish Consumption Advisory for PCBs.				
					Nonpoint Source			
4	C	Rocky Point Beach	40511000					
				Beach Closures		High	0.49 Miles	2002
					Nonpoint Source			
4	C	Royal Palms Beach	40511000					
				Beach Closures		High	1.1 Miles	2002
					Nonpoint Source			
				DDT		Low	1.1 Miles	
				Fish consumption advisory for DDT.				
					Nonpoint Source			
				PCBs		Low	1.1 Miles	
				Fish consumption advisory for PCBs.				
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
4	R	San Antonio Creek (Tributary to Ventura River Reach 4)	40220023					
				Nitrogen		Low	9.8 Miles	
					Nonpoint Source			
4	C	San Buenaventure Beach	40210000					
				Bacteria Indicators		Low	0.3 Miles	
				Area affected is south of drain at Kalorama Street and south of drain at San Jon Road.				
					Nonpoint/Point Source			
4	R	San Gabriel River Estuary	40516000					
				Abnormal Fish Histology		Medium	3.4 Miles	
					Nonpoint/Point Source			
4	R	San Gabriel River Reach 1 (Estuary to Firestone)	40515010					
				Abnormal Fish Histology		Medium	6.4 Miles	
					Nonpoint/Point Source			
				Algae		High	6.4 Miles	2003
					Nonpoint/Point Source			
				High Coliform Count		High	6.4 Miles	2003
					Nonpoint/Point Source			
				Toxicity		Medium	6.4 Miles	
				This listing was made by USEPA.				
					Point Source			
4	R	San Gabriel River Reach 2 (Firestone to Whittier Narrows Dam	40515010					
				Copper, Dissolved		Low	12 Miles	
					Nonpoint Source			
				High Coliform Count		High	12 Miles	2003
					Nonpoint/Point Source			
				Lead		Medium	12 Miles	
					Nonpoint/Point Source			
				Zinc, Dissolved		Low	12 Miles	
					Nonpoint Source			
4	R	San Gabriel River Reach 3 (Whittier Narrows to Ramona)	40531000					
				Toxicity		Medium	7.2 Miles	
				This listing was made by USEPA.				
					Point Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
4	R	San Jose Creek Reach 1 (SG Confluence to Temple St.)	40531000					
				Algae		Low	2.7 Miles	
					Nonpoint/Point Source			
				High Coliform Count		Low	2.7 Miles	
					Nonpoint/Point Source			
4	R	San Jose Creek Reach 2 (Temple to I-10 at White Ave.)	40531000					
				Algae		High	17 Miles	2003
					Nonpoint/Point Source			
				High Coliform Count		High	17 Miles	2003
					Nonpoint/Point Source			
4	B	San Pedro Bay Near/Off Shore Zones	40512000					
				Chromium (sediment)		Low	5758 Acres	
					Nonpoint/Point Source			
				Copper (sediment)		Low	5758 Acres	
					Nonpoint/Point Source			
				DDT (tissue & sediment)		Medium	5758 Acres	
				Fish Consumption Advisory for DDT.				
					Nonpoint/Point Source			
				PAHs (sediment)		Medium	5758 Acres	
					Nonpoint/Point Source			
				PCBs		Medium	5758 Acres	
				Fish consumption advisory for PCBs.				
					Nonpoint/Point Source			
				Sediment Toxicity		Medium	5758 Acres	
					Nonpoint/Point Source			
				Zinc (sediment)		Low	5758 Acres	
					Nonpoint/Point Source			
4	E	Santa Clara River Estuary	40311000					
				ChemA		Medium	49 Acres	
					Source Unknown			
				High Coliform Count		Medium	49 Acres	
					Nonpoint Source			
				Toxaphene		Medium	49 Acres	
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
4	R	Santa Clara River Reach 3 (Freeman Diversion to A Street)	40321000					
				Ammonia		High	31 Miles	2003
					Nonpoint/Point Source			
				Chloride		High	31 Miles	2002
					Nonpoint/Point Source			
				Total Dissolved Solids		Low	31 Miles	
					Nonpoint/Point Source			
4	R	Santa Clara River Reach 7 (Blue Cut to West Pier Hwy 99 Bridge)	40351000					
				Chloride		High	9.4 Miles	2002
				Chloride was relisted by USEPA.				
					Nonpoint/Point Source			
				High Coliform Count		Medium	9.4 Miles	
					Nonpoint/Point Source			
				Nitrate and Nitrite		Low	9.4 Miles	
					Nonpoint/Point Source			
4	R	Santa Clara River Reach 8 (W Pier Hwy 99 to Bouquet Cyn Rd.)	40351000					
				Chloride		High	5.2 Miles	2002
				Chloride was relisted by USEPA.				
					Nonpoint/Point Source			
				High Coliform Count		Medium	5.2 Miles	
					Nonpoint/Point Source			
4	R	Santa Clara River Reach 9 (Bouquet Canyon Rd to above Lang Gaging Station)	40351000					
				High Coliform Count		Medium	21 Miles	
					Nonpoint/Point Source			
4	L	Santa Fe Dam Park Lake	40531000					
				Copper		Medium	20 Acres	
					Nonpoint Source			
				Lead		Medium	20 Acres	
					Nonpoint Source			
				pH		Medium	20 Acres	
					Nonpoint Source			
4	B	Santa Monica Bay Offshore/Nearshore	40513000					
				Chlordane (sediment)		Medium	146645 Acres	
					Nonpoint/Point Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				DDT (tissue & sediment)		**Low**	**146645 Acres**	
				Centered on Palos Verdes Shelf.				
					Nonpoint/Point Source			
				Debris		**Low**	**146645 Acres**	
					Nonpoint/Point Source			
				Fish Consumption Advisory		**Low**	**146645 Acres**	
					Nonpoint/Point Source			
				PAHs (sediment)		**Low**	**146645 Acres**	
					Nonpoint/Point Source			
				PCBs (tissue & sediment)		**Low**	**146645 Acres**	
					Nonpoint/Point Source			
				Sediment Toxicity		**Low**	**146645 Acres**	
					Nonpoint/Point Source			
4	**C**	**Santa Monica Beach**	**40513000**					
				Beach Closures		**High**	**3 Miles**	**2002**
					Nonpoint Source			
				High Coliform Count		**High**	**3 Miles**	**2002**
					Nonpoint Source			
4	**R**	**Santa Monica Canyon**	**40513000**					
				High Coliform Count		**High**	**2.7 Miles**	**2002**
					Nonpoint Source			
				Lead		**Medium**	**2.7 Miles**	
					Nonpoint Source			
4	**C**	**Sea Level Beach**	**40441000**					
				Beach Closures		**High**	**0.21 Miles**	**2002**
					Nonpoint Source			
				DDT		**Low**	**0.21 Miles**	
				Fish Consumption Advisory for DDT.				
					Nonpoint Source			
				PCBs		**Low**	**0.21 Miles**	
				Fish Consumption Advisory for PCBs.				
					Nonpoint Source			
4	**R**	**Sepulveda Canyon**	**405.13**					
				Ammonia		**Low**	**0.83 Miles**	
					Nonpoint Source			
				High Coliform Count		**High**	**0.83 Miles**	**2002**
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Lead		Medium	0.83 Miles	
					Nonpoint Source			
4	R	Sespe Creek (tributary to Santa Clara River Reach 3)	40332020					
				Chloride		Low	63 Miles	
					Nonpoint Source			
				pH		Low	63 Miles	
					Nonpoint Source			
4	R	Stokes Creek	40422020					
				High Coliform Count		High	4.7 Miles	2002
					Nonpoint Source			
4	C	Surfers Point at Seaside	40210000					
				Bacteria Indicators		Low	0.53 Miles	
				Area affected is the end of the access path via a wooden gate.				
					Nonpoint/Point Source			
4	C	Topanga Beach	40413000					
				Beach Closures		High	2.5 Miles	2002
					Nonpoint Source			
				DDT		Low	2.5 Miles	
				Fish Consumption Advisory for DDT.				
					Nonpoint Source			
				High Coliform Count		High	2.5 Miles	2002
					Nonpoint Source			
				PCBs		Low	2.5 Miles	
				Fish Consumption Advisory for PCBs.				
					Nonpoint Source			
4	R	Topanga Canyon Creek	40411000					
				Lead		Medium	8.6 Miles	
					Nonpoint Source			
4	C	Torrance Beach	40512000					
				Beach Closures		High	1.1 Miles	2002
					Nonpoint Source			
				High Coliform Count		High	1.1 Miles	2002
					Nonpoint Source			
4	R	Torrance Carson Channel	40512000					
				Copper		Medium	3.4 Miles	
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				High Coliform Count		**High**	**3.4 Miles**	**2003**
					Nonpoint Source			
				Lead		**Medium**	**3.4 Miles**	
					Nonpoint Source			
4	**R**	**Torrey Canyon Creek**	**40341000**					
				Nitrate and Nitrite		**High**	**1.7 Miles**	**2003**
					Nonpoint Source			
4	**C**	**Trancas Beach (Broad Beach)**	**40437000**					
				Beach Closures		**High**	**1.7 Miles**	**2002**
					Nonpoint Source			
				DDT		**Low**	**1.7 Miles**	
				Fish Consumption Advisory for DDT.				
					Nonpoint Source			
				High Coliform Count		**High**	**1.7 Miles**	**2002**
					Nonpoint Source			
				PCBs		**Low**	**1.7 Miles**	
				Fish Consumption Advisory for PCBs.				
					Nonpoint Source			
4	**R**	**Triunfo Canyon Creek Reach 1**	**40424000**					
				Lead		**High**	**2.5 Miles**	**2004**
					Nonpoint Source			
				Mercury		**High**	**2.5 Miles**	**2004**
					Nonpoint Source			
				Sedimentation/Siltation		**Low**	**2.5 Miles**	
					Source Unknown			
4	**R**	**Triunfo Canyon Creek Reach 2**	**40424000**					
				Lead		**High**	**3.3 Miles**	**2004**
					Nonpoint Source			
				Mercury		**High**	**3.3 Miles**	**2004**
					Nonpoint Source			
				Sedimentation/Siltation		**Low**	**3.3 Miles**	
					Source Unknown			
4	**R**	**Tujunga Wash (LA River to Hansen Dam)**	**40521000**					
				Ammonia		**High**	**9.7 Miles**	**2002**
					Nonpoint Source			
				Copper		**High**	**9.7 Miles**	**2003**
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				High Coliform Count		High	9.7 Miles	2002
					Nonpoint Source			
				Odors		High	9.7 Miles	2002
					Nonpoint Source			
				Scum/Foam-unnatural		High	9.7 Miles	2002
					Nonpoint Source			
				Trash		Low	9.7 Miles	
					Nonpoint Source			
4	C	Venice Beach	40513000					
				Beach Closures		High	2.5 Miles	2002
					Nonpoint Source			
				High Coliform Count		High	2.5 Miles	2002
					Nonpoint Source			
4	B	Ventura Harbor: Ventura Keys	40311000					
				High Coliform Count		Medium	179 Acres	
					Nonpoint Source			
4	R	Ventura River Estuary	40210011					
				Algae		Medium	0.2 Miles	
					Nonpoint/Point Source			
				Eutrophic		Medium	0.2 Miles	
					Nonpoint/Point Source			
				Fecal Coliform		Low	0.2 Miles	
				Stables and horse property may be the sources.				
					Nonpoint Source			
				Total Coliform		Low	0.2 Miles	
				Stables and horse property may be the sources.				
					Nonpoint Source			
				Trash		Medium	0.2 Miles	
					Nonpoint/Point Source			
4	R	Ventura River Reach 1 and 2 (Estuary to Weldon Canyon)	40210011					
				Algae		Medium	4.5 Miles	
					Nonpoint/Point Source			
4	R	Ventura River Reach 3 (Weldon Canyon to Confl. w/ Coyote Cr)	40210011					
				Pumping		Medium	2.8 Miles	
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Water Diversion		Medium	2.8 Miles	
					Nonpoint Source			
4	R	Ventura River Reach 4 (Coyote Creek to Camino Cielo Rd)	40220021					
				Pumping		Medium	19 Miles	
					Nonpoint Source			
				Water Diversion		Medium	19 Miles	
					Nonpoint Source			
4	R	Verdugo Wash Reach 1 (LA River to Verdugo Rd.)	40521000					
				Algae		High	2 Miles	2002
					Nonpoint Source			
				High Coliform Count		High	2 Miles	2002
					Nonpoint Source			
				Trash		Low	2 Miles	
					Nonpoint Source			
4	R	Verdugo Wash Reach 2 (Above Verdugo Road)	40524000					
				Algae		High	7.6 Miles	2002
					Nonpoint Source			
				High Coliform Count		High	7.6 Miles	2002
					Nonpoint Source			
				Trash		Low	7.6 Miles	
					Nonpoint Source			
4	R	Walnut Creek Wash (Drains from Puddingstone Res)	40531000					
				pH		High	12 Miles	2003
					Nonpoint/Point Source			
				Toxicity		High	12 Miles	2003
					Nonpoint/Point Source			
4	L	Westlake Lake	40425000					
				Algae		High	119 Acres	2003
					Nonpoint Source			
				Ammonia		High	119 Acres	2002
					Nonpoint Source			
				Eutrophic		High	119 Acres	2002
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Lead		High	119 Acres	2004
					Nonpoint Source			
				Organic Enrichment/Low Dissolved Oxygen		High	119 Acres	2002
					Nonpoint Source			
4	R	Wheeler Canyon/Todd Barranca	40321000					
				Nitrate and Nitrite		High	10 Miles	2003
					Nonpoint Source			
				Sulfates		Low	10 Miles	
					Nonpoint Source			
				Total Dissolved Solids		Low	10 Miles	
					Nonpoint Source			
4	C	Whites Point Beach	40511000					
				Beach Closures		High	1.1 Miles	2002
					Nonpoint Source			
				DDT		Low	1.1 Miles	
				Fish Consumption Advisory for DDT.				
					Nonpoint Source			
				PCBs		Low	1.1 Miles	
				Fish Consumption Advisory for PCBs.				
					Nonpoint Source			
4	C	Will Rogers Beach	40513000					
				Beach Closures		High	3 Miles	2002
					Nonpoint Source			
				High Coliform Count		High	3 Miles	2002
					Nonpoint Source			
4	R	Wilmington Drain	40342000					
				Ammonia		Medium	0.56 Miles	
					Nonpoint Source			
				Copper		Medium	0.56 Miles	
					Nonpoint Source			
				High Coliform Count		High	0.56 Miles	2003
					Nonpoint Source			
				Lead		Medium	0.56 Miles	
					Nonpoint Source			
4	C	Zuma Beach (Westward Beach)	40436000					
				Beach Closures		High	1.6 Miles	2002
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				DDT		**Low**	**1.6 Miles**	
				Fish Consumption Advisory for DDT.				
					Nonpoint Source			
				PCBs		**Low**	**1.6 Miles**	
				Fish Consumption Advisory for PCBs.				
					Nonpoint Source			
5	**R**	**American River, Lower (Nimbus Dam to confluence with Sacramento River)**	**51921000**					
				Mercury		**Low**	**27 Miles**	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
				Unknown Toxicity		**Low**	**27 Miles**	
					Source Unknown			
5	**R**	**Arcade Creek**	**51921000**					
				Chlorpyrifos		**High**	**9.9 Miles**	**2003**
					Urban Runoff/Storm Sewers			
				Copper		**Low**	**9.9 Miles**	
					Urban Runoff/Storm Sewers			
				Diazinon		**High**	**9.9 Miles**	**2003**
				The agricultural source of diazinon for these waterbodies is from aerial deposition.				
					Agriculture			
					Urban Runoff/Storm Sewers			
5	**R**	**Avena Drain**	**53140000**					
				Ammonia		**Low**	**6.4 Miles**	
					Agriculture			
					Dairies			
				Pathogens		**Low**	**6.4 Miles**	
					Agriculture			
					Dairies			
5	**R**	**Bear Creek**	**51320023**					
				Mercury		**Medium**	**15 Miles**	
					Resource Extraction			
5	**R**	**Bear River, Lower (below Camp Far West Reservoir)**	**51510000**					
				Diazinon		**Medium**	**21 Miles**	
					Agriculture			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
5	R	Bear River, Upper	51633010					
				Mercury		Medium	10 Miles	
					Resource Extraction			
5	L	Berryessa, Lake	51221010					
				Mercury		Low	19083 Acres	
					Resource Extraction			
5	L	Black Butte Reservoir	50432000					
				Mercury		Medium	4507 Acres	
					Resource Extraction			
5	R	Butte Slough	52030000					
				Diazinon		Medium	8.9 Miles	
					Crop-Related Sources			
5	R	Cache Creek, Lower (Clear Lake Dam to Cache Creek Settling Basin near Yolo Bypass)	51120000					
				Mercury		Medium	96 Miles	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
				Unknown Toxicity		Low	96 Miles	
					Source Unknown			
5	R	Calaveras River, Lower	54400000					
				Diazinon		Low	5.8 Miles	
					Urban Runoff/Storm Sewers			
				Organic Enrichment/Low Dissolved Oxygen		Low	5.8 Miles	
					Urban Runoff/Storm Sewers			
				Pathogens		Low	5.8 Miles	
					Urban Runoff/Storm Sewers			
					Recreational and Tourism Activities (non-boating)			
5	L	Camanche Reservoir	53120000					
				Copper		Low	7389 Acres	
					Resource Extraction			
				Zinc		Low	7389 Acres	
					Resource Extraction			
5	L	Camp Far West Reservoir	51631013					
				Mercury		Medium	1945 Acres	
					Resource Extraction			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED		PROPOSED TMDL COMPLETION
5	R	Chicken Ranch Slough	51921000						
				Chlorpyrifos		High	8	Miles	2003
					Urban Runoff/Storm Sewers				
				Diazinon		High	8	Miles	2003
				The agricultural source of diazinon for these waterbodies is from aerial deposition.					
					Agriculture				
					Urban Runoff/Storm Sewers				
5	L	Clear Lake	51352000						
				Mercury		High	40070	Acres	2002
					Resource Extraction				
				Nutrients		Medium	40070	Acres	
					Source Unknown				
5	R	Clover Creek	50732000						
				Fecal Coliform		Low	11	Miles	
					Agriculture-grazing				
					Other				
5	R	Colusa Basin Drain	52010000						
				Azinphos-methyl		Medium	49	Miles	
					Agriculture				
				Carbofuran/Furadan		Low	49	Miles	
					Agriculture				
				Diazinon		Medium	49	Miles	
					Agriculture				
				Group A Pesticides		Low	49	Miles	
					Agriculture				
				Malathion		Low	49	Miles	
					Agriculture				
				Methyl Parathion		Low	49	Miles	
					Agriculture				
				Molinate/Odram		Low	49	Miles	
					Agriculture-irrigation tailwater				
				Unknown Toxicity		Low	49	Miles	
					Agriculture				
5	L	Combie, Lake	51633011						
				Mercury		Medium	362	Acres	
				All resource extraction sources are abandoned mines.					
					Resource Extraction				

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
5	L	Davis Creek Reservoir	51332010					
				Mercury		Low	163 Acres	
					Resource Extraction			
5	R	Deer Creek (Yuba County)	51712014					
				pH		Low	4.3 Miles	
					Internal Nutrient Cycling (primarily lakes)			
5	R	Del Puerto Creek	54110000					
				Chlorpyrifos		Low	6.5 Miles	
					Agriculture			
				Diazinon		Low	6.5 Miles	
					Agriculture			
5	E	Delta Waterways (eastern portion)	51000000					
				Chlorpyrifos		High	20135 Acres	2004
					Agriculture			
					Urban Runoff/Storm Sewers			
				DDT		Low	20135 Acres	
					Agriculture			
				Diazinon		High	20135 Acres	2004
					Agriculture			
					Urban Runoff/Storm Sewers			
				Group A Pesticides		Low	20135 Acres	
					Agriculture			
				Mercury		Medium	20135 Acres	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
				Unknown Toxicity		Low	20135 Acres	
					Source Unknown			
5	E	Delta Waterways (Stockton Ship Channel)	54400000					
				Chlorpyrifos		High	952 Acres	2004
					Agriculture			
					Urban Runoff/Storm Sewers			
				DDT		Low	952 Acres	
					Agriculture			
				Diazinon		High	952 Acres	2004
					Agriculture			
					Urban Runoff/Storm Sewers			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Group A Pesticides		Low	952 Acres	
					Agriculture			
				Mercury		Medium	952 Acres	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
				Organic Enrichment/Low Dissolved Oxygen		High	952 Acres	2004
					Municipal Point Sources			
					Urban Runoff/Storm Sewers			
				Unknown Toxicity		Low	952 Acres	
					Source Unknown			
5	E	Delta Waterways (western portion)	51000000					
				Chlorpyrifos		High	22904 Acres	2004
					Agriculture			
					Urban Runoff/Storm Sewers			
				DDT		Low	22904 Acres	
					Agriculture			
				Diazinon		High	22904 Acres	2004
					Agriculture			
					Urban Runoff/Storm Sewers			
				Electrical Conductivity		Medium	22904 Acres	
					Agriculture			
				Group A Pesticides		Low	22904 Acres	
					Agriculture			
				Mercury		Medium	22904 Acres	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
				Unknown Toxicity		Low	22904 Acres	
					Source Unknown			
5	R	Dolly Creek	51854030					
				Copper		Low	1.5 Miles	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
				Zinc		Low	1.5 Miles	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
5	L	Don Pedro Lake	53632010					
				Mercury		Low	11056 Acres	
					Resource Extraction			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
5	R	Dunn Creek (Mt Diablo Mine to Marsh Creek)	54300021					
				Mercury		Low	0.7 Miles	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
				Metals		Low	0.7 Miles	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
5	R	Elder Creek	51911000					
				Chlorpyrifos		High	11 Miles	2003
					Urban Runoff/Storm Sewers			
				Diazinon		High	11 Miles	2003
				The agricultural source of diazinon for these waterbodies is from aerial deposition.				
					Agriculture			
					Urban Runoff/Storm Sewers			
5	R	Elk Grove Creek	51911000					
				Diazinon		High	6.9 Miles	2003
				The agricultural source of diazinon for these waterbodies is from aerial deposition.				
					Agriculture			
					Urban Runoff/Storm Sewers			
5	L	Englebright Lake	51714013					
				Mercury		Medium	754 Acres	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
5	R	Fall River (Pit)	52641031					
				Sedimentation/Siltation		Low	8.6 Miles	
					Agriculture-grazing			
					Silviculture			
					Highway/Road/Bridge Construction			
5	R	Feather River, Lower (Lake Oroville Dam to Confluence with Sacramento River)	51922000					
				Diazinon		High	42 Miles	2003
					Agriculture			
					Urban Runoff/Storm Sewers			
				Group A Pesticides		Low	42 Miles	
					Agriculture			
				Mercury		Medium	42 Miles	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Unknown Toxicity		**Low**	**42 Miles**	
					Source Unknown			
5	**R**	**Five Mile Slough (Alexandria Place to Fourteen Mile Slough)**	**54400000**					
				Chlorpyrifos		**Medium**	**1.6 Miles**	
					Urban Runoff/Storm Sewers			
				Diazinon		**Medium**	**1.6 Miles**	
				The agricultural source of diazinon for this waterbody is from aerial deposition.				
					Agriculture			
					Urban Runoff/Storm Sewers			
				Organic Enrichment/Low Dissolved Oxygen		**Low**	**1.6 Miles**	
					Urban Runoff/Storm Sewers			
				Pathogens		**Low**	**1.6 Miles**	
					Other Urban Runoff			
					Recreational and Tourism Activities (non-boating)			
5	**R**	**French Ravine**	**51632011**					
				Bacteria		**Low**	**1.7 Miles**	
					Land Disposal			
5	**W**	**Grasslands Marshes**	**54120000**					
				Electrical Conductivity		**Low**	**7962 Acres**	
					Agriculture			
5	**R**	**Harding Drain (Turlock Irrigation District Lateral #5)**	**53550000**					
				Ammonia		**Low**	**8.3 Miles**	
					Municipal Point Sources			
					Agriculture			
				Chlorpyrifos		**Low**	**8.3 Miles**	
					Agriculture			
				Diazinon		**Low**	**8.3 Miles**	
					Agriculture			
				Unknown Toxicity		**Low**	**8.3 Miles**	
					Agriculture			
5	**R**	**Harley Gulch**	**51332022**					
				Mercury		**Medium**	**6 Miles**	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
5	R	Horse Creek (Rising Star Mine to Shasta Lake)	50610000					
				Cadmium		Low	0.52 Miles	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
				Copper		Low	0.52 Miles	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
				Lead		Low	0.52 Miles	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
				Zinc		Low	0.52 Miles	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
5	R	Humbug Creek	51732030					
				Copper		Low	2.2 Miles	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
				Mercury		Low	2.2 Miles	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
				Sedimentation/Siltation		Low	2.2 Miles	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
				Zinc		Low	2.2 Miles	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
5	R	Ingram/Hospital Creek	54110000					
				Chlorpyrifos		Low	1 Miles	
					Agricultural Return Flows			
				Diazinon		Low	1 Miles	
					Agricultural Return Flows			
5	R	Jack Slough	51540000					
				Diazinon		Medium	14 Miles	
					Agriculture			
5	R	James Creek	51224010					
				Mercury		Low	6.3 Miles	
				Resource extraction sources are abandoned mines.				
					Resource Extraction			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Nickel		**Low**	**6.3 Miles**	
				Resource extraction sources are abandoned mines.				
					Resource Extraction			
5	**R**	**Kanaka Creek**	**51742022**					
				Arsenic		**Low**	**9.7 Miles**	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
5	**L**	**Keswick Reservoir (portion downstream from Spring Creek)**	**52440013**					
				Cadmium		**Low**	**135 Acres**	
					Resource Extraction			
				Copper		**Low**	**135 Acres**	
					Resource Extraction			
				Zinc		**Low**	**135 Acres**	
					Resource Extraction			
5	**R**	**Kings River, Lower (Island Weir to Stinson and Empire Weirs)**	**55190000**					
				Electrical Conductivity		**Low**	**36 Miles**	
					Agriculture			
				Molybdenum		**Low**	**36 Miles**	
					Agriculture			
				Toxaphene		**Low**	**36 Miles**	
					Agriculture			
5	**R**	**Little Backbone Creek, Lower**	**50620010**					
				Acid Mine Drainage		**Low**	**0.95 Miles**	
					Resource Extraction			
				Cadmium		**Low**	**0.95 Miles**	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
				Copper		**Low**	**0.95 Miles**	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
				Zinc		**Low**	**0.95 Miles**	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
5	R	Little Cow Creek (downstream from Afterthought Mine)	50733023					
				Cadmium		Low	1.1 Miles	
				Resource extraction sources are abandoned mines.				
					Resource Extraction			
				Copper		Low	1.1 Miles	
				Resource extraction sources are abandoned mines.				
					Resource Extraction			
				Zinc		Low	1.1 Miles	
				Resource extraction sources are abandoned mines.				
					Resource Extraction			
5	R	Little Deer Creek	51720012					
				Mercury		Low	4.1 Miles	
					Resource Extraction			
5	R	Little Grizzly Creek	51854031					
				Copper		Medium	9.4 Miles	
					Mine Tailings			
				Zinc		Medium	9.4 Miles	
					Mine Tailings			
5	R	Lone Tree Creek	53140000					
				Ammonia		Low	15 Miles	
					Dairies			
				Biological Oxygen Demand		Low	15 Miles	
					Dairies			
				Electrical Conductivity		Low	15 Miles	
					Dairies			
5	R	Marsh Creek (Dunn Creek to Marsh Creek Reservoir)	54300023					
				Metals		Low	11 Miles	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
5	R	Marsh Creek (Marsh Creek Reservoir to San Joaquin River)	54400000					
				Mercury		Low	10 Miles	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
				Metals		Low	10 Miles	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
5	L	Marsh Creek Reservoir	54300023					
				Mercury		Low	278 Acres	
					Resource Extraction			
5	W	Mendota Pool	55120000					
				Selenium		Low	3045 Acres	
					Agriculture			
					Agricultural Return Flows			
					Groundwater Withdrawal			
					Other			
5	R	Merced River, Lower (McSwain Reservoir to San Joaquin River)	53550000					
				Chlorpyrifos		Medium	50 Miles	
					Agriculture			
				Diazinon		Medium	50 Miles	
					Agriculture			
				Group A Pesticides		Low	50 Miles	
					Agriculture			
5	R	Middle River	54400000					
				Low Dissolved Oxygen		Low	9.7 Miles	
					Hydromodification			
					Source Unknown			
5	R	Mokelumne River, Lower	54400000					
				Copper		Low	29 Miles	
					Resource Extraction			
				Zinc		Low	29 Miles	
					Resource Extraction			
5	R	Mormon Slough (Commerce Street to Stockton Deep Water Channel)	54400000					
				Organic Enrichment/Low Dissolved Oxygen		Low	0.93 Miles	
					Urban Runoff/Storm Sewers			
				Pathogens		Medium	0.93 Miles	
					Urban Runoff/Storm Sewers			
					Recreational and Tourism Activities (non-boating)			
5	R	Mormon Slough (Stockton Diverting Canal to Commerce Street)	53130000					
				Pathogens		Medium	5.2 Miles	
					Urban Runoff/Storm Sewers			
					Recreational and Tourism Activities (non-boating)			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
5	R	Morrison Creek	51911000					
				Diazinon		High	21 Miles	2003
				The agricultural source of diazinon for these waterbodies is from aerial deposition.				
					Agriculture			
					Urban Runoff/Storm Sewers			
5	R	Mosher Slough (downstream of I-5)	54400000					
				Chlorpyrifos		Medium	1.3 Miles	
					Urban Runoff/Storm Sewers			
				Diazinon		Medium	1.3 Miles	
				The agricultural source of diazinon for this waterbody is from aerial deposition.				
					Agriculture			
					Urban Runoff/Storm Sewers			
				Organic Enrichment/Low Dissolved Oxygen		Low	1.3 Miles	
					Urban Runoff/Storm Sewers			
				Pathogens		Low	1.3 Miles	
					Urban Runoff/Storm Sewers			
5	R	Mosher Slough (upstream of I-5)	54400000					
				Pathogens		Low	3.5 Miles	
					Urban Runoff/Storm Sewers			
5	R	Mud Slough	54120000					
				Boron		Low	13 Miles	
					Agriculture			
				Electrical Conductivity		Low	13 Miles	
					Agriculture			
				Pesticides		Low	13 Miles	
					Agriculture			
				Selenium		Medium	13 Miles	
					Agriculture			
				Unknown Toxicity		Low	13 Miles	
					Agriculture			
5	R	Natomas East Main Drainage Canal (aka Steelhead Creek, downstream of confluence with Arcade Creek)	51921000					
				Diazinon		Medium	3.5 Miles	
				The agricultural source is from aerial deposition.				
					Agriculture			
					Urban Runoff/Storm Sewers			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				PCBs		Low	3.5 Miles	
					Industrial Point Sources			
					Agriculture			
					Urban Runoff/Storm Sewers			
5	R	Natomas East Main Drainage Canal (aka Steelhead Creek, upstream of confluence with Arcade Creek)	51921000					
				PCBs		Low	12 Miles	
					Industrial Point Sources			
					Agriculture			
					Urban Runoff/Storm Sewers			
5	R	Newman Wasteway	54120000					
				Chlorpyrifos		Low	8.3 Miles	
					Agriculture			
				Diazinon		Low	8.3 Miles	
					Agriculture			
5	R	Oak Run Creek	50733000					
				Fecal Coliform		Low	5.6 Miles	
					Combined Sewer Overflow			
					Agriculture			
					Grazing-Related Sources			
					Pasture Grazing-Upland			
					Natural Sources			
5	R	Old River (San Joaquin River to Delta-Mendota Canal)	54400000					
				Low Dissolved Oxygen		Low	15 Miles	
					Hydromodification			
					Source Unknown			
5	R	Orestimba Creek (above Kilburn Road)	54110000					
				Azinphos-methyl		Medium	9.1 Miles	
					Agriculture			
				Chlorpyrifos		Medium	9.1 Miles	
					Agriculture			
				DDE		Low	9.1 Miles	
				Historical agricultural use.				
					Agriculture			
				Diazinon		Medium	9.1 Miles	
					Agriculture			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
5	R	Orestimba Creek (below Kilburn Road)	54110000					
				Azinphos-methyl		Medium	2.7 Miles	
					Agriculture			
				Chlorpyrifos		Medium	2.7 Miles	
					Agriculture			
				DDE		Low	2.7 Miles	
				Historical agricultural use.				
					Agriculture			
				Diazinon		Medium	2.7 Miles	
					Agriculture			
				Unknown Toxicity		Low	2.7 Miles	
					Agriculture			
5	R	Panoche Creek (Silver Creek to Belmont Avenue)	55112000					
				Mercury		Low	18 Miles	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
				Sedimentation/Siltation		Low	18 Miles	
					Agriculture			
					Agriculture-grazing			
					Highway/Road/Bridge Construction			
				Selenium		Low	18 Miles	
					Agriculture			
					Agriculture-grazing			
					Highway/Road/Bridge Construction			
5	R	Pit River	52661080					
				Nutrients		Low	123 Miles	
					Agriculture			
					Agriculture-grazing			
				Organic Enrichment/Low Dissolved Oxygen		Low	123 Miles	
					Agriculture			
					Agriculture-grazing			
				Temperature		Low	123 Miles	
					Agriculture			
					Agriculture-grazing			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
5	R	Putah Creek, Lower	51120000					
				Mercury		Low	28 Miles	
				Impairment due to Mercury is on lower reach below Lake Solano.				
					Resource Extraction			
					Source Unknown			
5	L	Rollins Reservoir	51634033					
				Mercury		Medium	774 Acres	
					Resource Extraction			
5	R	Sacramento River (Keswick Dam to Cottonwood Creek)	52440014					
				Unknown Toxicity		Low	15 Miles	
					Source Unknown			
5	R	Sacramento River (Cottonwood Creek to Red Bluff)	50810000					
				Unknown Toxicity		Low	16 Miles	
					Source Unknown			
5	R	Sacramento River (Red Bluff to Knights Landing)	50420070					
				Unknown Toxicity		Low	82 Miles	
					Source Unknown			
5	R	Sacramento River (Knights Landing to the Delta)	51000000					
				Diazinon		High	16 Miles	2003
					Agriculture			
				Mercury		Medium	16 Miles	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
				Unknown Toxicity		Low	16 Miles	
					Source Unknown			
5	R	Sacramento Slough	51922000					
				Diazinon		Medium	1.7 Miles	
					Agriculture			
					Urban Runoff/Storm Sewers			
				Mercury		Low	1.7 Miles	
					Source Unknown			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
5	R	Salt Slough (upstream from confluence with San Joaquin River)	54120000					
				Boron		Low	17 Miles	
					Agriculture			
				Chlorpyrifos		Low	17 Miles	
					Agriculture			
				Diazinon		Low	17 Miles	
					Agriculture			
				Electrical Conductivity		Low	17 Miles	
					Agriculture			
				Unknown Toxicity		Low	17 Miles	
					Agriculture			
5	R	San Carlos Creek (downstream of New Idria Mine)	55911085					
				Mercury		Low	5.1 Miles	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
					Acid Mine Drainage			
5	R	San Joaquin River (Bear Creek to Mud Slough)	53570000					
				Boron		High	14 Miles	2003
					Agriculture			
				Chlorpyrifos		High	14 Miles	2004
					Agriculture			
				DDT		Low	14 Miles	
					Agriculture			
				Diazinon		High	14 Miles	2004
					Agriculture			
				Electrical Conductivity		High	14 Miles	2003
					Agriculture			
				Group A Pesticides		Low	14 Miles	
					Agriculture			
				Mercury		Medium	14 Miles	
					Resource Extraction			
				Unknown Toxicity		Low	14 Miles	
					Source Unknown			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
5	R	San Joaquin River (Mendota Pool to Bear Creek)	53570000					
				Boron		High	67 Miles	2003
					Agriculture			
				Chlorpyrifos		High	67 Miles	2004
					Agriculture			
				DDT		Low	67 Miles	
					Agriculture			
				Diazinon		High	67 Miles	2004
					Agriculture			
				Electrical Conductivity		High	67 Miles	2003
					Agriculture			
				Group A Pesticides		Low	67 Miles	
					Agriculture			
				Unknown Toxicity		Low	67 Miles	
					Source Unknown			
5	R	San Joaquin River (Merced River to South Delta Boundary)	54400000					
				Boron		High	43 Miles	2003
					Agriculture			
				Chlorpyrifos		High	43 Miles	2004
					Agriculture			
				DDT		Low	43 Miles	
					Agriculture			
				Diazinon		High	43 Miles	2004
					Agriculture			
				Electrical Conductivity		High	43 Miles	2003
					Agriculture			
				Group A Pesticides		Low	43 Miles	
					Agriculture			
				Mercury		Medium	43 Miles	
					Resource Extraction			
				Unknown Toxicity		Low	43 Miles	
					Source Unknown			
5	R	San Joaquin River (Mud Slough to Merced River)	53570000					
				Boron		High	3 Miles	2003
					Agriculture			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Chlorpyrifos	Agriculture	High	3 Miles	2004
				DDT	Agriculture	Low	3 Miles	
				Diazinon	Agriculture	High	3 Miles	2004
				Electrical Conductivity	Agriculture	High	3 Miles	2003
				Group A Pesticides	Agriculture	Low	3 Miles	
				Mercury	Resource Extraction	Medium	3 Miles	
				Selenium	Agriculture	Low	3 Miles	
				Unknown Toxicity	Source Unknown	Low	3 Miles	
5	L	Scotts Flat Reservoir	51720011					
				Mercury	Resource Extraction	Medium	660 Acres	
5	L	Shasta Lake (area where West Squaw Creek enters)	50620010					
				Cadmium	Resource Extraction	Low	20 Acres	
				Copper	Resource Extraction	Low	20 Acres	
				Zinc	Resource Extraction	Low	20 Acres	
5	R	Smith Canal	54400000					
				Organic Enrichment/Low Dissolved Oxygen	Urban Runoff/Storm Sewers	Low	2.4 Miles	
				Organophosphorus Pesticides	Urban Runoff/Storm Sewers	Medium	2.4 Miles	
				Pathogens	Urban Runoff/Storm Sewers Recreational and Tourism Activities (non-boating)	Low	2.4 Miles	

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
5	R	South Cow Creek	50731000					
				Fecal Coliform		Low	7.9 Miles	
					Agriculture			
					Grazing-Related Sources			
					Other			
5	R	Spring Creek, Lower (Iron Mountain Mine to Keswick Reservoir)	52440010					
				Acid Mine Drainage		Low	2.6 Miles	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
				Cadmium		Low	2.6 Miles	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
				Copper		Low	2.6 Miles	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
				Zinc		Low	2.6 Miles	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
5	R	Stanislaus River, Lower	53530000					
				Diazinon		Medium	59 Miles	
					Agriculture			
				Group A Pesticides		Low	59 Miles	
					Agriculture			
				Mercury		Low	59 Miles	
					Resource Extraction			
				Unknown Toxicity		Low	59 Miles	
					Source Unknown			
5	R	Stockton Deep Water Channel, Upper (Port Turning Basin)	54400000					
				Dioxin		Low	3.3 Miles	
				This listing was made by USEPA.				
					Point Source			
				Furan Compounds		Low	3.3 Miles	
					Contaminated Sediments			
				Pathogens		Medium	3.3 Miles	
					Urban Runoff/Storm Sewers			
					Recreational and Tourism Activities (non-boating)			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				PCBs		**Low**	**3.3 Miles**	
				This listing was made by USEPA.				
					Point Source			
5	**R**	**Strong Ranch Slough**	**51921000**					
				Chlorpyrifos		**High**	**6.4 Miles**	**2003**
					Urban Runoff/Storm Sewers			
				Diazinon		**High**	**6.4 Miles**	**2003**
				The agricultural source of diazinon for these waterbodies is from aerial deposition.				
					Agriculture			
					Urban Runoff/Storm Sewers			
5	**R**	**Sulphur Creek (Colusa County)**	**51320024**					
				Mercury		**Medium**	**14 Miles**	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
5	**R**	**Sutter Bypass**	**52030000**					
				Diazinon		**Medium**	**19 Miles**	
					Agriculture			
5	**R**	**Temple Creek**	**53140000**					
				Ammonia		**Low**	**10 Miles**	
					Dairies			
				Electrical Conductivity		**Low**	**10 Miles**	
					Dairies			
5	**R**	**Town Creek**	**50620010**					
				Cadmium		**Low**	**0.98 Miles**	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
				Copper		**Low**	**0.98 Miles**	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
				Lead		**Low**	**0.98 Miles**	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
				Zinc		**Low**	**0.98 Miles**	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
5	**R**	**Tuolumne River, Lower (Don Pedro Reservoir to San Joaquin River)**	**53550000**					
				Diazinon		**Medium**	**60 Miles**	
					Agriculture			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Group A Pesticides		**Low**	**60 Miles**	
					Agriculture			
				Unknown Toxicity		**Low**	**60 Miles**	
					Source Unknown			
5	**R**	**Walker Slough**	**53140000**					
				Pathogens		**Medium**	**2.3 Miles**	
					Urban Runoff/Storm Sewers			
					Recreational and Tourism Activities (non-boating)			
5	**R**	**West Squaw Creek (below Balaklala Mine)**	**50620010**					
				Cadmium		**Low**	**2 Miles**	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
				Copper		**Low**	**2 Miles**	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
				Lead		**Low**	**2 Miles**	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
				Zinc		**Low**	**2 Miles**	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
5	**L**	**Whiskeytown Reservoir (areas near Oak Bottom, Brandy Creek Campgrounds and Whiskeytown)**	**52463010**					
				High Coliform Count		**Low**	**98 Acres**	
					Septage Disposal			
5	**R**	**Willow Creek (Shasta County, below Greenhorn Mine to Clear Creek)**	**52463010**					
				Acid Mine Drainage		**Low**	**4 Miles**	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
				Copper		**Low**	**4 Miles**	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			
				Zinc		**Low**	**4 Miles**	
				All resource extraction sources are abandoned mines.				
					Resource Extraction			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
5	R	Wolf Creek	51632010					
				Fecal Coliform		Low	23 Miles	
					Agriculture			
					Urban Runoff/Storm Sewers			
					Recreational and Tourism Activities (non-boating)			
6	R	Aspen Creek	63210080					
				Metals		Low	0.93 Miles	
				Affected by acid mine drainage from Leviathan Mine. TMDL to be coordinated with Regional Board /CERCLA remediation programs.				
					Mine Tailings			
					Acid Mine Drainage			
					Inactive Mining			
					Natural Sources			
					Nonpoint Source			
6	R	Aurora Canyon Creek	63030040					
				Habitat alterations		Low	8.1 Miles	
				Since creek is not impaired by pollutants, a TMDL may not be required under pending revisions to federal regulations.				
					Range Grazing-Riparian and/or Upland			
6	R	Bear Creek (Placer County)	63520010					
				Sedimentation/Siltation		Medium	3 Miles	
				Creek affected by hydrologic modification for ski resort/snow making pond.				
					Hydromodification			
					Nonpoint Source			
6	R	Big Meadow Creek	63410011					
				Pathogens		Low	1.4 Miles	
					Range Grazing-Riparian and/or Upland			
					Natural Sources			
					Recreational and Tourism Activities (non-boating)			
6	R	Blackwood Creek	63420021					
				Iron		Low	5.9 Miles	
					Erosion/Siltation			
					Natural Sources			
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Nitrogen		**Low**	**5.9 Miles**	
				Nitrogen loading from creek to be addressed during development of Lake Tahoe TMDL, but a more specific TMDL may be needed for Blackwood Creek.				
					Silviculture			
					Resource Extraction			
					Hydromodification			
					Streambank Modification/Destabilization			
					Erosion/Siltation			
					Atmospheric Deposition			
					Natural Sources			
					Nonpoint Source			
				Phosphorus		**Low**	**5.9 Miles**	
				Phosphorus loading from creek to be addressed during development of Lake Tahoe TMDL, but a more specific TMDL for creek may be needed.				
					Grazing-Related Sources			
					Silviculture			
					Resource Extraction			
					Hydromodification			
					Streambank Modification/Destabilization			
					Erosion/Siltation			
					Natural Sources			
					Nonpoint Source			
				Sedimentation/Siltation		**Medium**	**5.9 Miles**	
				Creek affected by past gravel quarry operations and other watershed disturbance including grazing and timber harvest.				
					Range Grazing-Riparian and/or Upland			
					Silviculture			
					Construction/Land Development			
					Surface Runoff			
					Resource Extraction			
					Hydromodification			
					Streambank Modification/Destabilization			
					Erosion/Siltation			
					Atmospheric Deposition			
					Natural Sources			
					Recreational and Tourism Activities (non-boating)			
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
6	R	Bodie Creek	63020031					
				Metals		Medium	11 Miles	
				Affected by drainage from inactive mines, mine tailings in creek.				
					Resource Extraction			
					Mine Tailings			
					Inactive Mining			
					Nonpoint Source			
6	L	Bridgeport Reservoir	63030050					
				Nitrogen		Medium	2614 Acres	
					Grazing-Related Sources			
					Pasture Grazing-Riparian and/or Upland			
					Other Urban Runoff			
					Highway/Road/Bridge Runoff			
					Wastewater - land disposal			
					Flow Regulation/Modification			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Channel Erosion			
					Erosion/Siltation			
					Marinas and Recreational Boating			
					Atmospheric Deposition			
					Internal Nutrient Cycling (primarily lakes)			
					Sediment Resuspension			
					Natural Sources			
					Recreational and Tourism Activities (non-boating)			
				Phosphorus		Medium	2614 Acres	
					Grazing-Related Sources			
					Pasture Grazing-Riparian and/or Upland			
					Other Urban Runoff			
					Highway/Road/Bridge Runoff			
					Wastewater - land disposal			
					Flow Regulation/Modification			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Channel Erosion			
					Erosion/Siltation			
					Marinas and Recreational Boating			
					Atmospheric Deposition			
					Internal Nutrient Cycling (primarily lakes)			
					Natural Sources			
					Recreational and Tourism Activities (non-boating)			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Sedimentation/Siltation		**Medium**	**2614 Acres**	
					Grazing-Related Sources			
					Streambank Modification/Destabilization			
					Erosion/Siltation			
					Sediment Resuspension			
6	**R**	**Bronco Creek**	**63520053**					
				Sedimentation/Siltation		**Medium**	**1.3 Miles**	
				Watershed disturbance in naturally highly erosive watershed.				
					Silviculture			
					Natural Sources			
					Nonpoint Source			
6	**R**	**Bryant Creek**	**63210080**					
				Metals		**Low**	**5.2 Miles**	
				Affected by acid mine drainage from Leviathan Mine. Problem being addressed through RWQCB and CERCLA remediation programs.				
					Mine Tailings			
					Acid Mine Drainage			
					Inactive Mining			
					Nonpoint Source			
6	**R**	**Buckeye Creek**	**63040022**					
				Pathogens		**Low**	**17 Miles**	
					Grazing-Related Sources			
					Pasture Grazing-Riparian and/or Upland			
					Range Grazing-Riparian and/or Upland			
					Natural Sources			
					Recreational and Tourism Activities (non-boating)			
6	**R**	**Carson River, West Fork (Headwaters to Woodfords)**	**63320014**					
				Nitrogen		**Low**	**18 Miles**	
					Silviculture			
					Onsite Wastewater Systems (Septic Tanks)			
					Habitat Modification			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Channel Erosion			
					Erosion/Siltation			
					Atmospheric Deposition			
					Highway Maintenance and Runoff			
					Natural Sources			
					Recreational and Tourism Activities (non-boating)			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Phosphorus		**Low**	**18 Miles**	
				Revision of standard may be considered.				
					Silviculture			
					Habitat Modification			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Channel Erosion			
					Erosion/Siltation			
					Atmospheric Deposition			
					Highway Maintenance and Runoff			
					Natural Sources			
					Recreational and Tourism Activities (non-boating)			
				Sodium		**Low**	**18 Miles**	
					Onsite Wastewater Systems (Septic Tanks)			
					Atmospheric Deposition			
					Highway Maintenance and Runoff			
					Natural Sources			
					Recreational and Tourism Activities (non-boating)			
6	**R**	**Carson River, West Fork (Paynesville to State Line)**	**63310013**					
				Pathogens		**Low**	**3.3 Miles**	
					Pasture Grazing-Riparian and/or Upland			
					Agriculture-storm runoff			
					Agriculture-irrigation tailwater			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
6	R	Carson River, West Fork (Woodfords to Paynesville)	63310012					
				Nitrogen		Low	3.6 Miles	
				Revision of standards may be considered.				
					Pasture Grazing-Riparian and/or Upland			
					Range Grazing-Riparian and/or Upland			
					Agriculture-storm runoff			
					Agriculture-subsurface drainage			
					Agriculture-irrigation tailwater			
					Silviculture			
					Wastewater - land disposal			
					Habitat Modification			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Channel Erosion			
					Erosion/Siltation			
					Atmospheric Deposition			
					Highway Maintenance and Runoff			
					Natural Sources			
					Recreational and Tourism Activities (non-boating)			
				Pathogens		Low	3.6 Miles	
					Pasture Grazing-Riparian and/or Upland			
					Agricultural Return Flows			
					Natural Sources			
					Recreational and Tourism Activities (non-boating)			
				Sodium		Low	3.6 Miles	
					Agriculture-storm runoff			
					Agriculture-irrigation tailwater			
					Agriculture-grazing			
					Wastewater - land disposal			
					Onsite Wastewater Systems (Septic Tanks)			
					Atmospheric Deposition			
					Highway Maintenance and Runoff			
					Natural Sources			
					Recreational and Tourism Activities (non-boating)			
6	W	Cinder Cone Springs	63520010					
				Nutrients		Medium	1 Acres	
				Springs tributary to Truckee River, affected by subsurface drainage from former wastewater disposal area (disposal discontinued 1978). Further monitoring may support delisting.				
					Wastewater - land disposal			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Salinity/TDS/Chlorides		**Medium**	**1 Acres**	
				Subsurface drainage from former wastewater disposal area. Has not been monitored routinely in recent years; further monitoring may support delisting.				
					Wastewater - land disposal			
6	**R**	**Clark Canyon Creek**	**63030041**					
				Habitat alterations		**Low**	**5 Miles**	
				Creek may be placed on list of waters impaired by pollution and not requiring TMDLs under pending changes in federal regulations.				
					Range Grazing-Riparian and/or Upland			
6	**R**	**Clearwater Creek**	**63040051**					
				Sedimentation/Siltation		**Medium**	**12 Miles**	
				Listed on basis of limited information; additional monitoring may support delisting.				
					Range Grazing-Riparian and/or Upland			
					Construction/Land Development			
					Highway Maintenance and Runoff			
6	**R**	**Cottonwood Creek (below LADWP diversion)**	**60330000**					
				Flow alterations		**Low**	**1.8 Miles**	
				Creek may be placed on list of waters impaired by pollution and not requiring TMDLs under pending changes to federal regulations.				
					Water Diversions			
6	**L**	**Crowley Lake**	**60310090**					
				Nitrogen		**Medium**	**4861 Acres**	
				TMDL expected to use data from ongoing Section 319-funded study of nutrient loading and salary-savings funded study of internal nutrient cycling.				
					Grazing-Related Sources			
					Atmospheric Deposition			
					Internal Nutrient Cycling (primarily lakes)			
					Natural Sources			
					Nonpoint Source			
				Phosphorus		**Medium**	**4861 Acres**	
				TMDL expected to use data from ongoing Section 319 -funded study of nutrient loading and salary-savings funded study of internal nutrient cycling.				
					Grazing-Related Sources			
					Erosion/Siltation			
					Internal Nutrient Cycling (primarily lakes)			
					Natural Sources			
					Nonpoint Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
6	L	Donner Lake	63520021					
				Priority Organics		Low	819 Acres	
				PCBs in fish and sediment exceed Maximum Tissue Residue Level criteria; unknown nonpoint sources. Additional monitoring/study necessary to determine sources/cleanup potential for priority organics. TMDLs for organics to be addressed during years 6-13 of 13 years of the TMDL development process, resources permitting.				
					Source Unknown			
6	L	Eagle Lake (Lassen County)	63732000					
				Nitrogen		Low	20704 Acres	
					Agriculture			
					Grazing-Related Sources			
					Silviculture			
					Other Urban Runoff			
					Highway/Road/Bridge Runoff			
					Wastewater			
					Onsite Wastewater Systems (Septic Tanks)			
					Marinas and Recreational Boating			
					Atmospheric Deposition			
					Internal Nutrient Cycling (primarily lakes)			
					Sediment Resuspension			
					Natural Sources			
					Recreational and Tourism Activities (non-boating)			
					Nonpoint Source			
				Phosphorus		Low	20704 Acres	
					Grazing-Related Sources			
					Silviculture			
					Other Urban Runoff			
					Highway/Road/Bridge Runoff			
					Wastewater			
					Onsite Wastewater Systems (Septic Tanks)			
					Marinas and Recreational Boating			
					Atmospheric Deposition			
					Internal Nutrient Cycling (primarily lakes)			
					Sediment Resuspension			
					Natural Sources			
					Recreational and Tourism Activities (non-boating)			
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
6	R	East Walker River, above Bridgeport Reservoir	63030050					
				Pathogens		Low	7.2 Miles	
					Pasture Grazing-Riparian and/or Upland			
					Other Urban Runoff			
					Natural Sources			
					Recreational and Tourism Activities (non-boating)			
6	R	East Walker River, below Bridgeport Reservoir	63030050					
				Nitrogen		Low	8 Miles	
					Grazing-Related Sources			
					Pasture Grazing-Riparian and/or Upland			
					Range Grazing-Riparian and/or Upland			
					Highway/Road/Bridge Runoff			
					Upstream Impoundment			
					Flow Regulation/Modification			
					Streambank Modification/Destabilization			
					Erosion/Siltation			
					Atmospheric Deposition			
					Natural Sources			
				Phosphorus		Low	8 Miles	
					Pasture Grazing-Riparian and/or Upland			
					Range Grazing-Riparian and/or Upland			
					Other Urban Runoff			
					Highway/Road/Bridge Runoff			
					Upstream Impoundment			
					Flow Regulation/Modification			
					Streambank Modification/Destabilization			
					Erosion/Siltation			
					Atmospheric Deposition			
					Natural Sources			
				Sedimentation/Siltation		Low	8 Miles	
					Grazing-Related Sources			
					Highway/Road/Bridge Runoff			
					Urban Runoff--Erosion and Sedimentation			
					Upstream Impoundment			
					Erosion/Siltation			
6	R	General Creek	63420030					
				Iron		Low	9.1 Miles	
					Silviculture			
					Natural Sources			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Phosphorus		**Low**	**9.1 Miles**	
					Erosion/Siltation			
					Atmospheric Deposition			
					Natural Sources			
6	**R**	**Goodale Creek**	**60330112**					
				Sedimentation/Siltation		**Low**	**12 Miles**	
				Potential for delisting following further monitoring.				
					Range Grazing-Riparian and/or Upland			
6	**R**	**Gray Creek (Nevada County)**	**63520052**					
				Sedimentation/Siltation		**Medium**	**2.8 Miles**	
				Sediment from disturbance of naturally highly erosive watershed.				
					Silviculture			
					Natural Sources			
					Nonpoint Source			
6	**R**	**Green Creek**	**63030050**					
				Habitat alterations		**Low**	**16 Miles**	
				Creek listed due to impacts of hydromodification by Dynamo Pond facility. May be placed on separate list of waters impaired by pollution and not requiring TMDLs if pending revisions to TMDL regulations take effect.				
					Range Grazing-Riparian and/or Upland			
					Hydromodification			
6	**R**	**Green Valley Lake Creek**	**62820000**					
				Priority Organics		**Medium**	**3.8 Miles**	
				Priority organics (source unknown) were detected in stream in 1980s; no monitoring since. Stream needs reevaluation to determine need for listing.				
					Source Unknown			
6	**L**	**Haiwee Reservoir**	**62410071**					
				Copper		**High**	**1703 Acres**	**2003**
				Copper problems related to algicide used to prevent taste/odor problems in drinking water supplies. TMDL development in progress. A determination of whether or not this water body is a "water of the United States" will be made by the Regional Water Quality Control Board.				
					Other			
6	**R**	**Heavenly Valley Creek (source to USFS boundary)**	**63410031**					
				Chloride		**Low**	**2 Miles**	
				Chloride standard may be revised.				
					Highway/Road/Bridge Runoff			
					Atmospheric Deposition			
					Natural Sources			
					Source Unknown			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Phosphorus		**Low**	**2 Miles**	
					Erosion/Siltation			
					Atmospheric Deposition			
					Natural Sources			
					Recreational and Tourism Activities (non-boating)			
6	**R**	**Heavenly Valley Creek (USFS boundary to Trout Creek)**	**63410031**					
				Chloride		**Low**	**1.4 Miles**	
					Highway/Road/Bridge Runoff			
					Atmospheric Deposition			
					Natural Sources			
					Source Unknown			
				Sedimentation/Siltation		**Low**	**1.4 Miles**	
					Construction/Land Development			
					Land Development			
					Hydromodification			
					Habitat Modification			
					Recreational and Tourism Activities (non-boating)			
					Nonpoint Source			
6	**S**	**Honey Lake**	**63710060**					
				Arsenic		**Low**	**57756 Acres**	
				Arsenic is ultimately from natural sources, but lake is affected by geothermal discharges. Further study needed to determine need for TMDL.				
					Geothermal Development			
					Flow Regulation/Modification			
					Natural Sources			
					Nonpoint Source			
				Salinity/TDS/Chlorides		**Low**	**57756 Acres**	
				Further study needed to determine extent of impairment and need for TMDL.				
					Agriculture			
					Agricultural Return Flows			
					Geothermal Development			
					Agricultural Water Diversion			
					Sediment Resuspension			
					Natural Sources			
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
6	W	Honey Lake Area Wetlands	63710060					
				Metals		Low	62590 Acres	
				Additional monitoring needed to determine extent of impairment and need for TMDL				
					Agriculture			
					Geothermal Development			
					Natural Sources			
					Nonpoint Source			
6	S	Honey Lake Wildfowl Management Ponds	63720095					
				Flow alterations		Low	665 Acres	
				Ponds may be placed on separate list of waters impaired by pollution and not needing TMDLs under pending changes to federal regulations.				
					Agricultural Water Diversion			
				Metals		Low	665 Acres	
				Further monitoring needed to determine extent of impairment and need for TMDL.				
					Agriculture			
					Geothermal Development			
					Natural Sources			
				Salinity/TDS/Chlorides		Low	665 Acres	
				Further monitoring needed to determine extent of impairment and need for TMDL.				
					Agriculture			
					Geothermal Development			
					Natural Sources			
				Trace Elements		Low	665 Acres	
				Further monitoring needed to determine extent of impairment and need for TMDL.				
					Geothermal Development			
					Nurseries			
6	L	Horseshoe Lake (San Bernardino County)	62820000					
				Sedimentation/Siltation		Medium	31 Acres	
				Further monitoring may permit delisting.				
					Construction/Land Development			
6	R	Hot Springs Canyon Creek	63030042					
				Sedimentation/Siltation		Medium	2.9 Miles	
				Listed on basis of limited data; further monitoring may support delisting.				
					Range Grazing-Riparian and/or Upland			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
6	R	Indian Creek (Alpine County)	63220010					
				Habitat alterations		Low	13 Miles	
				Creek may be placed on list of water bodies impaired by pollution and not requiring TMDLs if pending revisions to regulations take effect.				
					Agriculture			
					Pasture Grazing-Riparian and/or Upland			
					Agriculture-irrigation tailwater			
					Upstream Impoundment			
					Flow Regulation/Modification			
					Agricultural Water Diversion			
				Pathogens		Low	13 Miles	
					Grazing-Related Sources			
					Pasture Grazing-Riparian and/or Upland			
6	L	Indian Creek Reservoir	63220010					
				Phosphorus		High	164 Acres	2002
				Reservoir is eutrophic. Most significant source of nutrient loading is release of phosphorus from sediment. Draft phosphorus TMDL, first released in 2000, is planned for revision and recirculation, with Regional Board consideration in July 2002. Reductions in phosphorus loading are expected to ameliorate other problems associated with eutrophication.				
					Pasture Grazing-Riparian and/or Upland			
					Wastewater			
					Flow Regulation/Modification			
					Erosion/Siltation			
					Internal Nutrient Cycling (primarily lakes)			
6	R	Lassen Creek	63720082					
				Flow alterations		Low	8 Miles	
				Under pending revisions to regulations, creek could be placed on a separate list of waters impaired by pollution rather than pollutants, and no TMDL would be developed.				
					Flow Regulation/Modification			
6	R	Lee Vining Creek	60100035					
				Flow alterations		Low	9 Miles	
				Under pending revisions to regulations, creek could be placed on a separate list of waters impaired by pollution but not requiring TMDLs.				
					Flow Regulation/Modification			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
6	R	Leviathan Creek	63210080					
				Metals		Low	3.2 Miles	
				TMDL development to be coordinated with ongoing Regional Board and CERCLA remediation activities at Leviathan Mine site.				
					Mine Tailings			
					Acid Mine Drainage			
					Inactive Mining			
					Erosion/Siltation			
6	R	Mammoth Creek	60310053					
				Metals		Low	12 Miles	
				Needs monitoring to determine current extent of impairment and need for TMDL.				
					Other Urban Runoff			
					Natural Sources			
					Nonpoint Source			
6	R	Mill Creek (Modoc County)	64130011					
				Sedimentation/Siltation		Low	4.2 Miles	
				Creek needs monitoring to determine current extent of impairment and need for TMDL.				
					Range Grazing-Riparian and/or Upland			
6	R	Mill Creek (Mono County)	60100080					
				Flow alterations		Low	12 Miles	
				Under pending revisions to regulations, creek could be placed on a separate list of water bodies impaired by pollution and not requiring TMDLs.				
					Water Diversions			
6	R	Monitor Creek	63210070					
				Aluminum		Low	4 Miles	
				TMDL to be coordinated with CERCLA remediation.				
					Mill Tailings			
					Mine Tailings			
					Acid Mine Drainage			
					Inactive Mining			
					Natural Sources			
					Nonpoint/Point Source			
				Iron		Low	4 Miles	
				TMDL to be coordinated with CERCLA remediation.				
					Mill Tailings			
					Mine Tailings			
					Acid Mine Drainage			
					Inactive Mining			
					Natural Sources			
					Nonpoint/Point Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Manganese		**Low**	**4 Miles**	
				TMDL to be coordinated with CERCLA remediation.				
					Mill Tailings			
					Mine Tailings			
					Acid Mine Drainage			
					Inactive Mining			
					Natural Sources			
					Nonpoint/Point Source			
				Silver		**Low**	**4 Miles**	
				TMDL to be coordinated with CERCLA remediation.				
					Mill Tailings			
					Mine Tailings			
					Acid Mine Drainage			
					Inactive Mining			
					Natural Sources			
					Nonpoint Source			
				Sulfates		**Low**	**4 Miles**	
				TMDL to be coordinated with CERCLA remediation.				
					Mill Tailings			
					Mine Tailings			
					Acid Mine Drainage			
					Inactive Mining			
					Nonpoint/Point Source			
				Total Dissolved Solids		**Low**	**4 Miles**	
				TMDL to be coordinated with CERCLA remediation.				
					Mill Tailings			
					Mine Tailings			
					Acid Mine Drainage			
					Inactive Mining			
					Natural Sources			
					Nonpoint/Point Source			
6	**R**	**Owens River (Long HA)**	**60310090**					
				Habitat alterations		**Low**	**26 Miles**	
				River may be placed on separate list of waters impaired by pollution and not needing TMDLS under pending changes to federal regulations.				
					Agriculture			
					Grazing-Related Sources			
					Hydromodification			
					Flow Regulation/Modification			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
6	R	Owens River (Lower)	60330000					
				Habitat alterations		Low	53 Miles	
				River may be placed on separate list of waters impaired by pollution and not needing TMDLs under pending changes in federal regulations.				
					Agriculture			
					Hydromodification			
6	R	Owens River (Upper)	60320000					
				Habitat alterations		Low	69 Miles	
				River may be placed on separate list of waters impaired by pollution and not needing TMDLs under pending changes to federal regulations.				
					Agriculture			
					Hydromodification			
6	R	Pine Creek (Lassen County)	63720010					
				Sedimentation/Siltation		Low	55 Miles	
				Creek may be placed on seperate list of waters impaired by pollution and not needing TMDLs under pending changes in federal regulations.				
					Grazing-Related Sources			
					Silviculture			
					Highway/Road/Bridge Construction			
					Hydromodification			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Erosion/Siltation			
6	L	Pleasant Valley Reservoir	60320000					
				Organic Enrichment/Low Dissolved Oxygen		Medium	99 Acres	
					Flow Regulation/Modification			
					Nonpoint Source			
6	R	Robinson Creek (Hwy 395 to Bridgeport Res)	63030050					
				Pathogens		Low	1.8 Miles	
					Pasture Grazing-Riparian and/or Upland			
					Agricultural Return Flows			
					Onsite Wastewater Systems (Septic Tanks)			
					Natural Sources			
					Recreational and Tourism Activities (non-boating)			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
6	R	Robinson Creek (Twin Lakes to Hwy 395)	63030050					
				Pathogens		Low	9.1 Miles	
					Pasture Grazing-Riparian and/or Upland			
					Onsite Wastewater Systems (Septic Tanks)			
					Natural Sources			
					Recreational and Tourism Activities (non-boating)			
6	R	Rough Creek	63020013					
				Habitat alterations		Low	15 Miles	
				Creek may be placed on list of waters impaired by pollution and not needing TMDLs under pending changes to federal regulations.				
					Range Grazing-Riparian and/or Upland			
6	R	Skedaddle Creek	63710054					
				High Coliform Count		Medium	18 Miles	
				USBLM program to mitigate grazing impacts has been implemented. Further study may lead to delisting.				
					Range Grazing-Riparian and/or Upland			
6	R	Squaw Creek	63520011					
				Sedimentation/Siltation		Medium	5.8 Miles	
					Construction/Land Development			
					Other Urban Runoff			
					Hydromodification			
					Drainage/Filling Of Wetlands			
					Highway Maintenance and Runoff			
					Natural Sources			
					Recreational and Tourism Activities (non-boating)			
					Nonpoint Source			
6	R	Susan River	63720095					
				Unknown Toxicity		Low	58 Miles	
					Source Unknown			
6	R	Swauger Creek	63040012					
				Pathogens		Low	14 Miles	
					Pasture Grazing-Riparian and/or Upland			
					Range Grazing-Riparian and/or Upland			
					Onsite Wastewater Systems (Septic Tanks)			
					Natural Sources			
					Recreational and Tourism Activities (non-boating)			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Phosphorus		Low	14 Miles	
					Pasture Grazing-Riparian and/or Upland			
					Range Grazing-Riparian and/or Upland			
					Highway/Road/Bridge Runoff			
					Surface Runoff			
					Streambank Modification/Destabilization			
					Erosion/Siltation			
					Atmospheric Deposition			
					Natural Sources			
					Nonpoint Source			
6	L	Tahoe, Lake	63430010					
				Nitrogen		Medium	85364 Acres	
					Grazing-Related Sources			
					Silviculture			
					Construction/Land Development			
					Land Development			
					Urban Runoff/Storm Sewers			
					Urban Runoff--Non-industrial Permitted			
					Other Urban Runoff			
					Highway/Road/Bridge Runoff			
					Surface Runoff			
					Urban Runoff--Erosion and Sedimentation			
					Hydromodification			
					Habitat Modification			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Drainage/Filling Of Wetlands			
					Channel Erosion			
					Erosion/Siltation			
					Marinas and Recreational Boating			
					Atmospheric Deposition			
					Highway Maintenance and Runoff			
					Internal Nutrient Cycling (primarily lakes)			
					Natural Sources			
					Recreational and Tourism Activities (non-boating)			
					Golf course activities			
					Groundwater Loadings			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Phosphorus		Medium	85364 Acres	
					Grazing-Related Sources			
					Silviculture			
					Highway/Road/Bridge Construction			
					Land Development			
					Urban Runoff/Storm Sewers			
					Urban Runoff--Non-industrial Permitted			
					Other Urban Runoff			
					Highway/Road/Bridge Runoff			
					Urban Runoff--Erosion and Sedimentation			
					Streambank Modification/Destabilization			
					Channel Erosion			
					Erosion/Siltation			
					Atmospheric Deposition			
					Highway Maintenance and Runoff			
					Internal Nutrient Cycling (primarily lakes)			
					Sediment Resuspension			
					Natural Sources			
					Recreational and Tourism Activities (non-boating)			
					Nonpoint Source			
				Sedimentation/Siltation		Medium	85364 Acres	
					Grazing-Related Sources			
					Silviculture			
					Highway/Road/Bridge Construction			
					Land Development			
					Urban Runoff/Storm Sewers			
					Other Urban Runoff			
					Highway/Road/Bridge Runoff			
					Urban Runoff--Erosion and Sedimentation			
					Hydromodification			
					Channelization			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Channel Erosion			
					Erosion/Siltation			
					Atmospheric Deposition			
					Sediment Resuspension			
					Natural Sources			
					Recreational and Tourism Activities (non-boating)			
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
6	R	Tallac Creek (below Hwy 89)	63410041					
				Pathogens		Low	1.3 Miles	
					Grazing-Related Sources			
					Pasture Grazing-Riparian			
6	L	Tinemaha Reservoir	60320000					
				Metals		Medium	984 Acres	
				Metals concern related to use of copper sulfate algicide. Further monitoring and assessment needed to determine extent of impairment.				
					Other			
6	L	Topaz Lake	63110010					
				Sedimentation/Siltation		Medium	928 Acres	
				Additional monitoring and assessment needed to document extent of impairment.				
					Agriculture			
					Streambank Modification/Destabilization			
					Erosion/Siltation			
					Nonpoint Source			
6	R	Trout Creek (above Hwy 50)	63410020					
				Iron		Low	10 Miles	
				Standards revision to be considered				
					Urban Runoff--Non-industrial Permitted			
					Erosion/Siltation			
					Natural Sources			
				Nitrogen		Low	10 Miles	
				Nitrogen loading from creek to be addressed during development of Lake Tahoe TMDL, but a more specific TMDL may be needed for Trout Creek.				
					Pasture Grazing-Riparian and/or Upland			
					Urban Runoff--Non-industrial Permitted			
					Erosion/Siltation			
					Atmospheric Deposition			
				Pathogens		Low	10 Miles	
					Source Unknown			
				Phosphorus		Low	10 Miles	
				Phosphorus loading from creek to be considered during development of Lake Tahoe TMDL, but a more specific TMDL may be needed for Trout Creek.				
					Pasture Grazing-Riparian and/or Upland			
					Urban Runoff--Non-industrial Permitted			
					Erosion/Siltation			
					Atmospheric Deposition			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
6	R	Trout Creek (below Hwy 50)	63410042					
				Iron		Low	0.78 Miles	
					Urban Runoff--Non-industrial Permitted			
					Erosion/Siltation			
					Natural Sources			
				Nitrogen		Low	0.78 Miles	
				Nitrogen loading from creek to be addressed during development of Lake Tahoe TMDL, but a more specific TMDL may be needed for Trout Creek.				
					Urban Runoff--Non-industrial Permitted			
					Erosion/Siltation			
					Atmospheric Deposition			
				Pathogens		Low	0.78 Miles	
					Pasture Grazing-Riparian			
					Natural Sources			
					Recreational and Tourism Activities (non-boating)			
					Transient encampments			
				Phosphorus		Low	0.78 Miles	
				Phosphorus loading from creek to be addressed during development of Lake Tahoe TMDL, but a more specific TMDL may be needed for Trout Creek.				
					Urban Runoff--Non-industrial Permitted			
					Erosion/Siltation			
					Atmospheric Deposition			
6	R	Truckee River	63510010					
				Sedimentation/Siltation		Medium	39 Miles	
				Watershed disturbance including ski resorts, silvicultural activities, urban development, reservoir construction and management; highly erosive subwatersheds.				
					Range Grazing-Riparian and/or Upland			
					Silviculture			
					Construction/Land Development			
					Highway/Road/Bridge Construction			
					Streambank Modification/Destabilization			
					Channel Erosion			
					Erosion/Siltation			
					Natural Sources			
					Recreational and Tourism Activities (non-boating)			
					Snow skiing activities			
					Nonpoint Source			
6	R	Truckee River, Upper (above Christmas Valley)	63410010					
				Iron		Low	4.5 Miles	
					Natural Sources			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Pathogens		**Low**	**4.5 Miles**	
					Grazing-Related Sources			
					Natural Sources			
					Recreational and Tourism Activities (non-boating)			
				Phosphorus		**Low**	**4.5 Miles**	
				Phosphorus loading from river to be addressed during development of Lake Tahoe TMDL, but a more specific TMDL may be needed for the Upper Truckee River.				
					Grazing-Related Sources			
					Silviculture			
					Natural Sources			
6	**R**	**Truckee River, Upper (below Christmas Valley)**	**63410042**					
				Iron		**Low**	**11 Miles**	
					Erosion/Siltation			
					Natural Sources			
					Unknown Nonpoint Source			
				Phosphorus		**Low**	**11 Miles**	
				Phosphorus loading from river to be addressed in development of Lake Tahoe TMDL, but a more specific TMDL may be needed for the Upper Truckee River.				
					Silviculture			
					Construction/Land Development			
					Hydromodification			
					Channelization			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Erosion/Siltation			
					Atmospheric Deposition			
					Highway Maintenance and Runoff			
					Natural Sources			
					Unknown Nonpoint Source			
6	**R**	**Tuttle Creek**	**60330140**					
				Habitat alterations		**Low**	**13 Miles**	
				Creek may be placed on separate list of waters impaired by pollution and not needing TMDLs under pending changes in federal regulations.				
					Range Grazing-Riparian and/or Upland			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
6	L	Twin Lakes (Owens HU)	60310051					
				Nitrogen		Low	26 Acres	
				Monitoring needed to confirm extent of impairment and need for TMDL.				
					Agriculture			
					Grazing-Related Sources			
					Construction/Land Development			
					Land Development			
					Other Urban Runoff			
					Atmospheric Deposition			
				Phosphorus		Low	26 Acres	
				Monitoring needed to confirm degree of impairment and need for TMDL.				
					Agriculture			
					Grazing-Related Sources			
					Construction/Land Development			
					Land Development			
					Other Urban Runoff			
6	R	Ward Creek	63420020					
				Iron		Low	5.7 Miles	
					Silviculture			
					Other Urban Runoff			
					Highway/Road/Bridge Runoff			
					Channel Erosion			
					Erosion/Siltation			
					Natural Sources			
				Nitrogen		Low	5.7 Miles	
				Nitrogen loading from creek to be addressed during development of Lake Tahoe TMDL, but a more specific TMDL may be needed for Ward Creek.				
					Silviculture			
					Other Urban Runoff			
					Highway/Road/Bridge Runoff			
					Channel Erosion			
					Erosion/Siltation			
					Atmospheric Deposition			
					Natural Sources			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Phosphorus		**Low**	**5.7 Miles**	
				Phosphorus loading from creek to be addressed during development of Lake Tahoe TMDL, but a more specific TMDL may be needed for Ward Creek.				
					Silviculture			
					Other Urban Runoff			
					Highway/Road/Bridge Runoff			
					Urban Runoff--Erosion and Sedimentation			
					Channel Erosion			
					Erosion/Siltation			
					Atmospheric Deposition			
					Natural Sources			
				Sedimentation/Siltation		**Medium**	**5.7 Miles**	
				The University of California Davis Tahoe Research Group is currently researching sediment sources in the Ward Creek watershed.				
					Silviculture			
					Land Development			
					Urban Runoff/Storm Sewers			
					Highway/Road/Bridge Runoff			
					Channel Erosion			
					Nonpoint Source			
6	**R**	**West Walker River**	**63110060**					
				Sedimentation/Siltation		**Low**	**49 Miles**	
					Agriculture			
					Pasture Grazing-Riparian and/or Upland			
					Removal of Riparian Vegetation			
					Streambank Modification/Destabilization			
					Channel Erosion			
					Erosion/Siltation			
					Nonpoint Source			
6	**R**	**Wolf Creek (Alpine County)**	**63210031**					
				Sedimentation/Siltation		**Low**	**12 Miles**	
					Range Grazing-Riparian and/or Upland			
					Silviculture			
					Nonpoint Source			
7	**R**	**Alamo River**	**72310000**					
				Pesticides		**Low**	**57 Miles**	
				Pesticides may be contained in agricultural return flows. Elevated fish tissue levels. Toxic bioassay results.				
					Agricultural Return Flows			
				Selenium		**Low**	**57 Miles**	
				Selenium originates from Upper Basin Portion of Colorado River. Elevated fish tissue levels.				
					Agricultural Return Flows			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
7	R	Coachella Valley Storm Channel	71947000					
				Pathogens		Medium	69 Miles	
					Source Unknown			
7	R	Imperial Valley Drains	72310000					
				Pesticides		Low	1222 Miles	
				Elevated fish tissue levels and toxic bioassay results				
					Agricultural Return Flows			
				Sedimentation/Siltation		High	1222 Miles	2004
					Agricultural Return Flows			
				Selenium		Low	1222 Miles	
				Selenium originates from Upper basin Portion of colorado River. Elevated fish tissue levels.				
					Agricultural Return Flows			
7	R	New River (Imperial)	72310000					
				1,2,4-trimethylbenzene		Low	66 Miles	
					Industrial Point Sources			
					Out-of-state source			
				Chloroform		Low	66 Miles	
					Industrial Point Sources			
					Out-of-state source			
				m,p,-Xylenes		Low	66 Miles	
					Industrial Point Sources			
					Out-of-state source			
				Nutrients		Low	66 Miles	
				Regional Board proposes to establish TMDL in cooperation with U.S. EPA and Mexico.				
					Major Municipal Point Source-dry and/or wet weather discharge			
					Agricultural Return Flows			
					Out-of-state source			
				Organic Enrichment/Low Dissolved Oxygen		Medium	66 Miles	
					Wastewater			
					Inappropriate Waste Disposal/Wildcat Dumping			
					Out-of-state source			
					Unknown point source			
				o-Xylenes		Low	66 Miles	
					Industrial Point Sources			
					Out-of-state source			
				p-Cymene		Low	66 Miles	
					Industrial Point Sources			
					Out-of-state source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED		PROPOSED TMDL COMPLETION
				p-Dichlorobenzene (DCB)		**Low**	**66**	**Miles**	
					Industrial Point Sources				
					Out-of-state source				
				Pesticides		**Low**	**66**	**Miles**	
					Agricultural Return Flows				
					Out-of-state source				
				Sedimentation/Siltation		**High**	**66**	**Miles**	**2002**
					Agricultural Return Flows				
				Toluene		**Low**	**66**	**Miles**	
					Industrial Point Sources				
					Out-of-state source				
				Trash		**Medium**	**66**	**Miles**	
					Out-of-state source				
7	**R**	**Palo Verde Outfall Drain**	**71540000**						
				Pathogens		**High**	**7.4**	**Miles**	**2003**
					Source Unknown				
7	**S**	**Salton Sea**	**72800000**						
				Nutrients		**High**	**233340**	**Acres**	**2004**
					Major Industrial Point Source				
					Agricultural Return Flows				
					Out-of-state source				
				Salinity		**Low**	**233340**	**Acres**	
				TMDL development will not be effective in addressing this problem, which will require an engineering solution with federal, local, and state cooperation.					
					Agricultural Return Flows				
					Out-of-state source				
					Point Source				
				Selenium		**Medium**	**233340**	**Acres**	
					Agricultural Return Flows				
8	**B**	**Anaheim Bay**	**80111000**						
				Copper		**Low**	**402**	**Acres**	
				This listing was made by USEPA.					
					Source Unknown				
				Dieldrin (tissue)		**Low**	**402**	**Acres**	
				This listing was made by USEPA.					
					Source Unknown				
				Nickel		**Low**	**402**	**Acres**	
				This listing was made by USEPA.					
					Source Unknown				

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				PCBs (tissue)		**Low**	**402 Acres**	
				This listing was made by USEPA.				
					Source Unknown			
8	**L**	**Big Bear Lake**	**80171000**					
				Copper		**Medium**	**2865 Acres**	
					Resource Extraction			
				Mercury		**Medium**	**2865 Acres**	
					Resource Extraction			
				Metals		**Medium**	**2865 Acres**	
					Resource Extraction			
				Noxious aquatic plants		**High**	**2865 Acres**	**2004**
					Construction/Land Development			
					Unknown point source			
				Nutrients		**High**	**2865 Acres**	**2004**
					Construction/Land Development			
					Snow skiing activities			
				Sedimentation/Siltation		**High**	**2865 Acres**	**2004**
					Construction/Land Development			
					Snow skiing activities			
					Unknown Nonpoint Source			
8	**C**	**Bolsa Chica State Beach**	**80111000**					
				Copper		**Low**	**2.6 Miles**	
				This listing was made by USEPA.				
					Source Unknown			
				Nickel		**Low**	**2.6 Miles**	
				This listing was made by USEPA.				
					Source Unknown			
8	**R**	**Buck Gully Creek**	**80111000**					
				Fecal Coliform		**Low**	**0.3 Miles**	
				Listing is downstream of Pacific Coast Highway.				
					Source Unknown			
				Total Coliform		**Low**	**0.3 Miles**	
				Listing is downstream of Pacific Coast Highway.				
					Source Unknown			
8	**L**	**Canyon Lake (Railroad Canyon Reservoir)**	**80211000**					
				Nutrients		**Low**	**453 Acres**	
					Nonpoint Source			
				Pathogens		**Low**	**453 Acres**	
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
8	R	Chino Creek Reach 1	80121000					
				Nutrients		Medium	7.8 Miles	
					Agriculture			
					Dairies			
				Pathogens		High	7.8 Miles	2004
					Agriculture			
					Dairies			
					Urban Runoff/Storm Sewers			
8	R	Chino Creek Reach 2	80121000					
				High Coliform Count		Medium	2.5 Miles	
					Unknown Nonpoint Source			
8	R	Cucamonga Creek, Valley Reach	80121000					
				High Coliform Count		High	9.6 Miles	2004
					Unknown Nonpoint Source			
8	L	Elsinore, Lake	80231000					
				Nutrients		High	2431 Acres	2003
					Unknown Nonpoint Source			
				Organic Enrichment/Low Dissolved Oxygen		High	2431 Acres	2004
					Unknown Nonpoint Source			
				Sedimentation/Siltation		High	2431 Acres	2003
					Urban Runoff/Storm Sewers			
				Unknown Toxicity		High	2431 Acres	2004
					Unknown Nonpoint Source			
8	L	Fulmor, Lake	80221000					
				Pathogens		Low	4.2 Acres	
					Unknown Nonpoint Source			
8	R	Grout Creek	80171000					
				Metals		Medium	3.5 Miles	
					Unknown Nonpoint Source			
				Nutrients		High	3.5 Miles	2004
					Unknown Nonpoint Source			
8	C	Huntington Beach State Park	80111000					
				Enterococci		Low	5.8 Miles	
				Impaired 50 yards around drain at Magnolia.				
					Source Unknown			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
8	B	Huntington Harbour	80111000					
				Copper		Low	221 Acres	
				This listing was made by USEPA.				
					Source Unknown			
				Dieldrin (tissue)		Low	221 Acres	
				This listing was made by USEPA.				
					Source Unknown			
				Nickel		Low	221 Acres	
				This listing was made by USEPA.				
					Source Unknown			
				Pathogens		Low	221 Acres	
					Urban Runoff/Storm Sewers			
				PCBs (tissue)		Low	221 Acres	
				This listing was made by USEPA.				
					Source Unknown			
8	R	Knickerbocker Creek	80171000					
				Metals		Medium	2 Miles	
					Unknown Nonpoint Source			
				Pathogens		High	2 Miles	2004
					Unknown Nonpoint Source			
8	R	Los Trancos Creek (Crystal Cove Creek)	80111000					
				Fecal Coliform		Low	0.19 Miles	
				Listing is downstream of Pacific Coast Highway.				
					Source Unknown			
				Total Coliform		Low	0.19 Miles	
				Listing is downstream of Pacific Coast Highway.				
					Source Unknown			
8	R	Lytle Creek	80141000					
				Pathogens		Low	41 Miles	
					Unknown Nonpoint Source			
8	R	Mill Creek (Prado Area)	80121000					
				Nutrients		Medium	1.6 Miles	
					Agriculture			
					Dairies			
				Pathogens		High	1.6 Miles	2004
					Dairies			
				Suspended solids		Medium	1.6 Miles	
					Dairies			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
8	R	Mill Creek Reach 1	80156000					
				Pathogens		Low	12 Miles	
					Unknown Nonpoint Source			
8	R	Mill Creek Reach 2	80158000					
				Pathogens		Low	12 Miles	
					Unknown Nonpoint Source			
8	R	Mountain Home Creek	80158000					
				Pathogens		Low	3.7 Miles	
					Unknown Nonpoint Source			
8	R	Mountain Home Creek, East Fork	80158000					
				Pathogens		Low	5.1 Miles	
					Unknown Nonpoint Source			
8	B	Newport Bay, Lower	80114000					
				Metals		Medium	767 Acres	
					Urban Runoff/Storm Sewers			
					Contaminated Sediments			
					Boatyards			
				Pesticides		High	767 Acres	2003
					Agriculture			
					Contaminated Sediments			
				Priority Organics		Medium	767 Acres	
					Contaminated Sediments			
					Unknown Nonpoint Source			
8	E	Newport Bay, Upper (Ecological Reserve)	80111000					
				Metals		Medium	653 Acres	
					Urban Runoff/Storm Sewers			
				Pesticides		High	653 Acres	2003
					Agriculture			
					Unknown Nonpoint Source			
8	L	Prado Park Lake	80121000					
				Nutrients		Low	90 Acres	
					Nonpoint Source			
				Pathogens		High	90 Acres	2004
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
8	R	Rathbone (Rathbun) Creek	80171000					
				Nutrients		High	4.7 Miles	2004
					Snow skiing activities			
					Unknown Nonpoint Source			
				Sedimentation/Siltation		High	4.7 Miles	2004
					Snow skiing activities			
					Unknown Nonpoint Source			
8	R	San Diego Creek Reach 1	80111000					
				Fecal Coliform		Low	7.8 Miles	
					Urban Runoff/Storm Sewers			
					Other Urban Runoff			
				Pesticides		High	7.8 Miles	2003
					Unknown Nonpoint Source			
8	R	San Diego Creek Reach 2	80111000					
				Metals		Medium	6.3 Miles	
					Urban Runoff/Storm Sewers			
				Unknown Toxicity		Low	6.3 Miles	
					Unknown Nonpoint Source			
8	R	Santa Ana River, Reach 3	80121000					
				Pathogens		High	26 Miles	2004
					Dairies			
8	R	Santa Ana River, Reach 4	80127000					
				Pathogens		Low	14 Miles	
					Nonpoint Source			
8	R	Santiago Creek, Reach 4	80112000					
				Salinity/TDS/Chlorides		Low	9.8 Miles	
					Source Unknown			
8	C	Seal Beach	80111000					
				Enterococci		Low	0.53 Miles	
				Impaired 50 yards around drain at 1st Street.				
					Source Unknown			
8	R	Silverado Creek	80112000					
				Pathogens		Low	11 Miles	
					Unknown Nonpoint Source			
				Salinity/TDS/Chlorides		Low	11 Miles	
					Unknown Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED		PROPOSED TMDL COMPLETION
8	R	Summit Creek	80171000						
				Nutrients		High	1.5	Miles	2004
					Construction/Land Development				
9	R	Agua Hedionda Creek	90431000						
				Total Dissolved Solids		Low	7	Miles	
					Urban Runoff/Storm Sewers				
					Unknown Nonpoint Source				
					Unknown point source				
9	E	Agua Hedionda Lagoon	90431000						
				Bacteria Indicators		Low	6.8	Acres	
					Nonpoint/Point Source				
				Sedimentation/Siltation		Low	6.8	Acres	
					Nonpoint/Point Source				
9	R	Aliso Creek	90113000						
				Bacteria Indicators		Medium	19	Miles	
					Urban Runoff/Storm Sewers				
					Unknown point source				
					Nonpoint/Point Source				
				Phosphorus		Low	19	Miles	
				Impairment located at lower 4 miles.					
					Urban Runoff/Storm Sewers				
					Unknown Nonpoint Source				
					Unknown point source				
				Toxicity		Low	19	Miles	
					Urban Runoff/Storm Sewers				
					Unknown Nonpoint Source				
					Unknown point source				
9	E	Aliso Creek (mouth)	90113000						
				Bacteria Indicators		Medium	0.29	Acres	
					Nonpoint/Point Source				
9	E	Buena Vista Lagoon	90421000						
				Bacteria Indicators		Low	202	Acres	
					Nonpoint/Point Source				
				Nutrients		Low	202	Acres	
				Estimated size of impairment is 150 acres located in upper portion of lagoon.					
					Nonpoint/Point Source				
				Sedimentation/Siltation		Medium	202	Acres	
					Nonpoint/Point Source				

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
9	R	Chollas Creek	90822000					
				Bacteria Indicators		Medium	1.2 Miles	
					Nonpoint/Point Source			
				Cadmium		High	1.2 Miles	2004
					Nonpoint/Point Source			
				Copper		High	1.2 Miles	2004
					Nonpoint/Point Source			
				Diazinon		High	1.2 Miles	2002
					Nonpoint/Point Source			
				Lead		High	1.2 Miles	2004
					Nonpoint/Point Source			
				Zinc		High	1.2 Miles	2004
					Nonpoint/Point Source			
9	R	Cloverdale Creek	90532000					
				Phosphorus		Low	1.2 Miles	
					Urban Runoff/Storm Sewers			
					Unknown Nonpoint Source			
					Unknown point source			
				Total Dissolved Solids		Low	1.2 Miles	
					Urban Runoff/Storm Sewers			
					Unknown Nonpoint Source			
					Unknown point source			
9	B	Dana Point Harbor	90114000					
				Bacteria Indicators		Medium	119 Acres	
				Impairment located at Baby Beach.				
					Urban Runoff/Storm Sewers			
					Marinas and Recreational Boating			
					Unknown Nonpoint Source			
					Unknown point source			
9	E	Famosa Slough and Channel	90711000					
				Eutrophic		Low	32 Acres	
					Nonpoint Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
9	R	Felicita Creek	90523000					
				Total Dissolved Solids		Low	0.92 Miles	
					Agricultural Return Flows			
					Urban Runoff/Storm Sewers			
					Flow Regulation/Modification			
					Unknown Nonpoint Source			
					Unknown point source			
9	R	Forester Creek	90712000					
				Fecal Coliform		Medium	6.4 Miles	
				Impairment Located at lower 1 mile.				
					Urban Runoff/Storm Sewers			
					Spills			
					Unknown Nonpoint Source			
					Unknown point source			
				pH		Low	6.4 Miles	
				Impairment Located at upper 3 miles.				
					Industrial Point Sources			
					Habitat Modification			
					Spills			
					Unknown Nonpoint Source			
					Unknown point source			
				Total Dissolved Solids		Low	6.4 Miles	
				Impairment Located at lower 1 mile.				
					Agricultural Return Flows			
					Urban Runoff/Storm Sewers			
					Flow Regulation/Modification			
					Unknown Nonpoint Source			
					Unknown point source			
9	R	Green Valley Creek	90511000					
				Sulfates		Low	1.2 Miles	
					Urban Runoff/Storm Sewers			
					Natural Sources			
					Unknown Nonpoint Source			
					Unknown point source			
9	L	Guajome Lake	90311000					
				Eutrophic		Low	33 Acres	
					Nonpoint/Point Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
9	L	Hodges, Lake	90521000					
				Color		Low	1104 Acres	
					Urban Runoff/Storm Sewers			
					Unknown Nonpoint Source			
					Unknown point source			
				Nitrogen		Low	1104 Acres	
					Agriculture			
					Dairies			
					Urban Runoff/Storm Sewers			
					Unknown Nonpoint Source			
					Unknown point source			
				Phosphorus		Low	1104 Acres	
					Agriculture			
					Dairies			
					Urban Runoff/Storm Sewers			
					Unknown Nonpoint Source			
					Unknown point source			
				Total Dissolved Solids		Low	1104 Acres	
					Agricultural Return Flows			
					Urban Runoff/Storm Sewers			
					Flow Regulation/Modification			
					Natural Sources			
					Unknown Nonpoint Source			
					Unknown point source			
9	R	Kit Carson Creek	90521000					
				Total Dissolved Solids		Low	0.99 Miles	
					Agricultural Return Flows			
					Urban Runoff/Storm Sewers			
					Flow Regulation/Modification			
					Unknown Nonpoint Source			
					Unknown point source			
9	E	Loma Alta Slough	90410000					
				Bacteria Indicators		Low	8.2 Acres	
					Nonpoint Source			
				Eutrophic		Low	8.2 Acres	
					Nonpoint Source			
9	E	Los Penasquitos Lagoon	90610000					
				Sedimentation/Siltation		Low	469 Acres	
					Nonpoint/Point Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
9	B	Mission Bay	90640000					
				Bacteria Indicators		Medium	2032 Acres	
				Impairment located along entire bay shoreline.				
					Nonpoint/Point Source			
				Eutrophic		Low	2032 Acres	
				Estimated area of impairment of 0.5 acres located at mouth of Rose Creek and 0.5 acres located at mouth of Tecolote Creek.				
					Nonpoint/Point Source			
				Lead		Low	2032 Acres	
				Estimated area of impairment of 0.5 acres located at mouth of Rose Creek and 0.5 acres located at mouth of Tecolote Creek.				
					Nonpoint/Point Source			
9	R	Murrieta Creek	90252000					
				Phosphorus		Low	12 Miles	
					Urban Runoff/Storm Sewers			
					Unknown Nonpoint Source			
					Unknown point source			
9	C	Pacific Ocean Shoreline, Aliso HSA	90113000					
				Bacteria Indicators		Medium	0.65 Miles	
				Impairment located at Laguna Beach at Lagunita Place / Blue Lagoon Place, Aliso Beach.				
					Nonpoint/Point Source			
9	C	Pacific Ocean Shoreline, Buena Vista Creek HA	90421000					
				Bacteria Indicators		Low	1.2 Miles	
				Impairment located at Buena Vista Creek, Carlsbad City Beach at Carlsbad Village Drive, Carlsbad State Beach at Pine Avenue.				
					Nonpoint/Point Source			
9	C	Pacific Ocean Shoreline, Dana Point HSA	90114000					
				Bacteria Indicators		Medium	2 Miles	
				Impairment located at Aliso Beach at West Street, Aliso Beach at Table Rock Drive, 1000 Steps Beach at Pacific Coast Hwy (Hospital, 9th Ave), Salt Creek (large outlet), Salt Creek Beach at Salt Creek service road, Salt Creek Beach at Dana Strand Road.				
					Nonpoint/Point Source			
9	C	Pacific Ocean Shoreline, Escondido Creek HA	90461000					
				Bacteria Indicators		Low	0.44 Miles	
				Impairment located at San Elijo Lagoon outlet.				
					Nonpoint/Point Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
9	C	**Pacific Ocean Shoreline, Laguna Beach HSA**	90112000					
				Bacteria Indicators		**Medium**	**1.8 Miles**	
				Impairment located at Main Laguna Beach, Laguna Beach at Ocean Avenue, Laguna Beach at Laguna Avenue, Laguna Beach at Cleo Street, Arch Cove at Bluebird Canyon Road, Laguna Beach at Dumond Drive.				
					Nonpoint/Point Source			
9	C	**Pacific Ocean Shoreline, Loma Alta HA**	90410000					
				Bacteria Indicators		**Low**	**1.1 Miles**	
				Impairment located at Loma Alta Creek Mouth.				
					Nonpoint/Point Source			
9	C	**Pacific Ocean Shoreline, Lower San Juan HSA**	90120000					
				Bacteria Indicators		**Medium**	**1.2 Miles**	
				Impairment located at North Beach Creek, San Juan Creek (large outlet), Capistrano Beach, South Capistrano Beach at Beach Road.				
					Nonpoint/Point Source			
9	C	**Pacific Ocean Shoreline, Miramar Reservoir HA**	90610000					
				Bacteria Indicators		**Low**	**0.39 Miles**	
				Impairment located at Torrey Pines State Beach at Del Mar (Anderson Canyon).				
					Urban Runoff/Storm Sewers			
					Unknown Nonpoint Source			
					Unknown point source			
9	C	**Pacific Ocean Shoreline, San Clemente HA**	90130000					
				Bacteria Indicators		**Medium**	**3.7 Miles**	
				Impairment located at Poche Beach (large outlet), Ole Hanson Beach Club Beach at Pico Drain, San Clemente City Beach at El Portal St. Stairs, San Clemente City Beach at Mariposa St., San Clemente City Beach at Linda Lane, San Clemente City Beach at South Linda Lane, San Clemente City Beach at Lifeguard Headquarters, Under San Clemente Municipal Pier, San Clemente City Beach at Trafalgar Canyon (Trafalgar Ln.), San Clemente State Beach at Riviera Beach, San Clemente State Beach at Cypress Shores.				
					Nonpoint/Point Source			
9	C	**Pacific Ocean Shoreline, San Diego HU**	90711000					
				Bacteria Indicators		**Medium**	**0.37 Miles**	
				Impairment located at San Diego River Mouth (aka Dog Beach).				
					Nonpoint/Point Source			
9	C	**Pacific Ocean Shoreline, San Diequito HU**	90511000					
				Bacteria Indicators		**Low**	**0.86 Miles**	
				Impairment located at San Dieguito Lagoon Mouth, Solana Beach.				
					Nonpoint/Point Source			

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
9	C	Pacific Ocean Shoreline, San Joaquin Hills HSA	90111000					
				Bacteria Indicators		Low	0.63 Miles	
				Impairment located at Cameo Cove at Irvine Cove Dr./Riviera Way, Heisler Park-North				
					Urban Runoff/Storm Sewers			
					Unknown Nonpoint Source			
					Unknown point source			
9	C	Pacific Ocean Shoreline, San Luis Rey HU	90311000					
				Bacteria Indicators		Low	0.49 Miles	
				Impairment located at San Luis Rey River Mouth.				
					Nonpoint/Point Source			
9	C	Pacific Ocean Shoreline, San Marcos HA	90451000					
				Bacteria Indicators		Low	0.5 Miles	
				Impairment located at Moonlight State Beach.				
					Nonpoint/Point Source			
9	C	Pacific Ocean Shoreline, Scripps HA	90630000					
				Bacteria Indicators		Medium	3.9 Miles	
				Impairment located at La Jolla Shores Beach at El Paseo Grande, La Jolla Shores Beach at Caminito Del Oro, La Jolla Shores Beach at Vallecitos, La Jolla Shores Beach at Ave de la Playa, Casa Beach (Childrens Pool), South Casa Beach at Coast Blvd., Whispering Sands Beach at Ravina St., Windansea Beach at Vista de la Playa, Windansea Beach at Bonair St., Windansea Beach at Playa del Norte, Windansea Beach at Palomar Ave., Tourmaline Surf Park, Pacific Beach at Grand Ave.				
					Nonpoint/Point Source			
9	C	Pacific Ocean Shoreline, Tijuana HU	91111000					
				Bacteria Indicators		Low	3 Miles	
				Impairment located from the border, extending north along the shore.				
					Nonpoint/Point Source			
9	R	Pine Valley Creek (Upper)	91141000					
				Enterococci		Medium	2.9 Miles	
					Grazing-Related Sources			
					Concentrated Animal Feeding Operations (permitted, point source)			
					Transient encampments			
9	R	Prima Deshecha Creek	90130000					
				Phosphorus		Low	1.2 Miles	
					Urban Runoff/Storm Sewers			
					Unknown Nonpoint Source			
					Unknown point source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED		PROPOSED TMDL COMPLETION
				Turbidity		Low	1.2	Miles	
					Urban Runoff/Storm Sewers				
					Unknown Nonpoint Source				
					Unknown point source				
9	R	Rainbow Creek	90222000						
				Nitrogen		High	5	Miles	2003
					Agricultural Return Flows				
					Other Urban Runoff				
					Nurseries				
					Onsite Wastewater Systems (Septic Tanks)				
					Nonpoint/Point Source				
				Phosphorus		High	5	Miles	2003
					Agricultural Return Flows				
					Other Urban Runoff				
					Nurseries				
					Onsite Wastewater Systems (Septic Tanks)				
					Nonpoint/Point Source				
9	B	San Diego Bay Shoreline, 32nd St San Diego Naval Station	90822000						
				Benthic Community Effects		Medium	103	Acres	
					Nonpoint/Point Source				
				Sediment Toxicity		Medium	103	Acres	
					Nonpoint/Point Source				
9	B	San Diego Bay Shoreline, between Sampson and 28th Streets	90822000						
				Copper		High	55	Acres	2003
					Nonpoint/Point Source				
				Mercury		High	55	Acres	2003
					Nonpoint/Point Source				
				PAHs		High	55	Acres	2003
					Nonpoint/Point Source				
				PCBs		High	55	Acres	2003
					Nonpoint/Point Source				
				Zinc		High	55	Acres	2003
					Nonpoint/Point Source				

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
9	C	San Diego Bay Shoreline, Chula Vista Marina	90912000					
				Bacteria Indicators		Low	0.41 Miles	
					Urban Runoff/Storm Sewers Marinas and Recreational Boating Boatyards Boat Discharges/Vessel Wastes			
9	B	San Diego Bay Shoreline, Downtown Anchorage	90821000					
				Benthic Community Effects		Medium	7.4 Acres	
					Nonpoint/Point Source			
				Sediment Toxicity		Medium	7.4 Acres	
					Nonpoint/Point Source			
9	C	San Diego Bay Shoreline, G Street Pier	90821000					
				Bacteria Indicators		Low	0.42 Miles	
					Urban Runoff/Storm Sewers Unknown Nonpoint Source Unknown point source			
9	B	San Diego Bay Shoreline, near Chollas Creek	90822000					
				Benthic Community Effects		Medium	15 Acres	
					Nonpoint/Point Source			
				Sediment Toxicity		Medium	15 Acres	
					Nonpoint/Point Source			
9	B	San Diego Bay Shoreline, near Coronado Bridge	90822000					
				Benthic Community Effects		Medium	37 Acres	
					Nonpoint/Point Source			
				Sediment Toxicity		Medium	37 Acres	
				Includes Crosby Street/Cesar Chavez Park area, that will receive additional monitoring.				
					Nonpoint/Point Source			
9	B	San Diego Bay Shoreline, near sub base	90810000					
				Benthic Community Effects		Medium	16 Acres	
					Nonpoint/Point Source			
				Sediment Toxicity		Medium	16 Acres	
					Nonpoint/Point Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
9	B	San Diego Bay Shoreline, near Switzer Creek	90821000					
				Chlordane		Medium	5.5 Acres	
					Urban Runoff/Storm Sewers			
					Other			
					Boatyards			
					Nonpoint/Point Source			
				Lindane		Medium	5.5 Acres	
					Urban Runoff/Storm Sewers			
					Other			
					Boatyards			
					Nonpoint/Point Source			
				PAHs		Medium	5.5 Acres	
					Urban Runoff/Storm Sewers			
					Other			
					Boatyards			
					Nonpoint/Point Source			
9	B	San Diego Bay Shoreline, North of 24th Street Marine Terminal	90832000					
				Benthic Community Effects		Medium	9.5 Acres	
					Nonpoint/Point Source			
				Sediment Toxicity		Medium	9.5 Acres	
					Nonpoint/Point Source			
9	B	San Diego Bay Shoreline, Seventh Street Channel	90831000					
				Benthic Community Effects		Medium	9 Acres	
					Nonpoint/Point Source			
				Sediment Toxicity		Medium	9 Acres	
					Nonpoint/Point Source			
9	C	San Diego Bay Shoreline, Shelter Island Shoreline Park	90810000					
				Bacteria Indicators		Low	0.42 Miles	
					Unknown Nonpoint Source			
					Unknown point source			
9	C	San Diego Bay Shoreline, Tidelands Park	91010000					
				Bacteria Indicators		Low	0.38 Miles	
					Unknown Nonpoint Source			
					Unknown point source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
9	B	San Diego Bay Shoreline, Vicinity of B St and Broadway Piers	90821000					
				Bacteria Indicators		Low	9.9 Acres	
				Estimated size of impairment is 0.4 miles around the shoreline of the bay.				
					Urban Runoff/Storm Sewers			
					Unknown Nonpoint Source			
					Unknown point source			
				Benthic Community Effects		Medium	9.9 Acres	
					Nonpoint/Point Source			
				Sediment Toxicity		Medium	9.9 Acres	
					Nonpoint/Point Source			
9	B	San Diego Bay, Shelter Island Yacht Basin	90810000					
				Copper, Dissolved		High	153 Acres	2003
					Nonpoint/Point Source			
9	R	San Diego River (Lower)	90711000					
				Fecal Coliform		Low	12 Miles	
				Lower 6 miles.				
					Urban Runoff/Storm Sewers			
					Wastewater			
					Nonpoint/Point Source			
				Low Dissolved Oxygen		Low	12 Miles	
				Impairment transcends adjacent Calwater wtareshed 90712.				
					Urban Runoff/Storm Sewers			
					Unknown Nonpoint Source			
					Unknown point source			
				Phosphorus		Low	12 Miles	
				Impairment transcends adjacent Calwater watershed 90712.				
					Urban Runoff/Storm Sewers			
					Unknown Nonpoint Source			
					Unknown point source			
				Total Dissolved Solids		Low	12 Miles	
				Impairment transcends adjacent Calwater watershed 90712.				
					Urban Runoff/Storm Sewers			
					Flow Regulation/Modification			
					Natural Sources			
					Unknown Nonpoint Source			
					Unknown point source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
9	E	San Elijo Lagoon	90461000					
				Bacteria Indicators		Low	566 Acres	
				Estimated size of impairment is 150 acres.				
					Nonpoint/Point Source			
				Eutrophic		Low	566 Acres	
				Estimated size of impairment is 330 acres.				
					Nonpoint/Point Source			
				Sedimentation/Siltation		Medium	566 Acres	
				Estimated size of impairment is 150 acres.				
					Nonpoint/Point Source			
9	R	San Juan Creek	90120000					
				Bacteria Indicators		Medium	1 Miles	
					Nonpoint/Point Source			
9	E	San Juan Creek (mouth)	90120000					
				Bacteria Indicators		Medium	6.3 Acres	
					Nonpoint/Point Source			
9	R	San Luis Rey River	90311000					
				Chloride		Low	19 Miles	
				Impairment located at lower 13 miles.				
					Urban Runoff/Storm Sewers			
					Unknown Nonpoint Source			
					Unknown point source			
				Total Dissolved Solids		Low	19 Miles	
					Industrial Point Sources			
					Agriculture-storm runoff			
					Urban Runoff/Storm Sewers			
					Surface Mining			
					Flow Regulation/Modification			
					Natural Sources			
					Golf course activities			
					Unknown Nonpoint Source			
					Unknown point source			
9	R	Sandia Creek	90222000					
				Total Dissolved Solids		Low	1.5 Miles	
					Urban Runoff/Storm Sewers			
					Flow Regulation/Modification			
					Natural Sources			
					Unknown Nonpoint Source			
					Unknown point source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
9	E	Santa Margarita Lagoon	90211000					
				Eutrophic		Low	28 Acres	
					Nonpoint/Point Source			
9	R	Santa Margarita River (Upper)	90222000					
				Phosphorus		Low	18 Miles	
					Urban Runoff/Storm Sewers			
					Unknown Nonpoint Source			
					Unknown point source			
9	R	Segunda Deshecha Creek	90130000					
				Phosphorus		Low	0.92 Miles	
					Urban Runoff/Storm Sewers			
					Unknown Nonpoint Source			
					Unknown point source			
				Turbidity		Low	0.92 Miles	
					Construction/Land Development			
					Urban Runoff/Storm Sewers			
					Channelization			
					Flow Regulation/Modification			
					Unknown Nonpoint Source			
					Unknown point source			
9	L	Sutherland Reservoir	90553000					
				Color		Low	561 Acres	
					Urban Runoff/Storm Sewers			
					Unknown Nonpoint Source			
					Unknown point source			
9	R	Tecolote Creek	90650000					
				Bacteria Indicators		Medium	6.6 Miles	
					Nonpoint/Point Source			
				Cadmium		Low	6.6 Miles	
					Nonpoint/Point Source			
				Copper		Low	6.6 Miles	
					Nonpoint/Point Source			
				Lead		Low	6.6 Miles	
					Nonpoint/Point Source			
				Toxicity		Low	6.6 Miles	
					Nonpoint/Point Source			
				Zinc		Low	6.6 Miles	
					Nonpoint/Point Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
9	R	Tijuana River	91111000					
				Bacteria Indicators		Low	5.8 Miles	
					Nonpoint/Point Source			
				Eutrophic		Low	5.8 Miles	
					Nonpoint/Point Source			
				Low Dissolved Oxygen		Low	5.8 Miles	
					Nonpoint/Point Source			
				Pesticides		Low	5.8 Miles	
					Nonpoint/Point Source			
				Solids		Low	5.8 Miles	
					Nonpoint/Point Source			
				Synthetic Organics		Low	5.8 Miles	
					Nonpoint/Point Source			
				Trace Elements		Low	5.8 Miles	
					Nonpoint/Point Source			
				Trash		Low	5.8 Miles	
					Nonpoint/Point Source			
9	E	Tijuana River Estuary	91111000					
				Bacteria Indicators		Low	1319 Acres	
				Estimated size of impairment is 150 acres.				
					Nonpoint/Point Source			
				Eutrophic		Low	1319 Acres	
				Estimated size of impairment is 1 acre.				
					Nonpoint/Point Source			
				Lead		Low	1319 Acres	
				Estimated size of impairment is 1 acre.				
					Nonpoint/Point Source			
				Low Dissolved Oxygen		Low	1319 Acres	
					Urban Runoff/Storm Sewers			
					Wastewater			
					Unknown Nonpoint Source			
					Unknown point source			
				Nickel		Low	1319 Acres	
				Estimated size of impairment is 1 acre.				
					Nonpoint/Point Source			
				Pesticides		Low	1319 Acres	
				Estimated size of impairment is 1 acre.				
					Nonpoint/Point Source			

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

Approved by USEPA: July 2003

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Thallium		**Low**	**1319 Acres**	
				Estimated size of impairment is 1 acre.				
					Nonpoint/Point Source			
				Trash		**Low**	**1319 Acres**	
				Estimated size of impairment is 1 acre.				
					Nonpoint/Point Source			

ABBREVIATIONS

REGIONAL WATER QUALITY CONTROL BOARDS

1 North Coast
2 San Francisco Bay
3 Central Coast
4 Los Angeles
5 Central Valley
6 Lahontan
7 Colorado River Basin
8 Santa Ana
9 San Diego

WATER BODY TYPE

B = Bays and Harbors
C = Coastal Shorelines/Beaches
E = Estuaries
L = Lakes/Reserviors
R = Rivers and Streams
S = Saline Lakes
T = Wetlands, Tidal
W= Wetlands, Freshwater

CALWATER WATERSHED

"Calwater Watershed" is the State Water Resources Control Board hydrological subunit area or an even smaller area delineation.

GROUP A PESTICIDES OR CHEM A

aldrin, dieldrin, chlordane, endrin, heptachlor, heptachlor epoxide, hexachlorocyclohexane (including lindane), endosulfan, and toxaphene

SON NUMBER: PPSON-05-02 November 6, 2003

STRATEGIC ENVIRONMENTAL RESEARCH AND DEVELOPMENT PROGRAM
STATEMENT OF NEED FOR FY 05
POLLUTION PREVENTION NEW START

ALTERNATIVES FOR PERCHLORATES IN INCENDIARY MIX AND PYROTECHNIC FORMULATIONS FOR PROJECTILES

1. OBJECTIVE OF PROPOSED WORK

The objective of this Statement of Need (SON) is to develop environmentally benign, perchlorate-free incendiary and pyrotechnic mix technologies for projectiles. Proposals for both near-term alternatives and for longer-term development efforts are acceptable. The focus of this SON is to eliminate potential future perchlorate soil, surface water and groundwater contamination from training and testing of munitions as well as from production and disposal of these munitions. Proposed technologies must be capable of meeting or exceeding current DoD-required safety and performance criteria. This includes, but is not limited to toxicity, stability, sensitivity, ignitability, hygroscopicity, candle power, and burn time. Human health and ecological considerations during the lifecycle of the incendiary mix and during ingredient manufacture must be addressed.

As a secondary objective, the proposed alternative must still be visually scoreable but should reduce the propensity for hot spots and brush fires on training ranges. Current formulations have an average heat value of 2Kcal/gram.

In addition, the following guidelines must also be considered:

- The production of the alternative pyrotechnic system must have the potential to be more environmentally benign than the current perchlorate-based production processes.
- The presence of unburned residues, such as may be found in test and impact areas must be environmentally benign.
- The combustion products must be environmentally benign.
- Anticipated future tracer cost should be competitive with current systems.
- Proposals offering alternatives that reduce the propensity of the device to cause brush fires will be judged favorably.

2. EXPECTED PAYOFF OF PROPOSED WORK

The benefit of this work will be the reduction or elimination of soil, surface and groundwater contamination due to perchlorate oxidizers used in projectile systems, and increased training opportunities, especially during conditions susceptible to fire starting conditions.

3. BACKGROUND

Perchlorates are used as an oxidizing component in some of the incendiary mix formulations and flash compositions used in projectiles. These formulations are used as markers to produce an incandescent flash (and smoke) to mark the impact point, as ignition sources for flammable liquids, and as igniters to initiate explosive trains on impact. Some of the more commonly used mixes are:

- IM-28 (40% barium nitrate; 10% potassium perchlorate; 50% magnesium/aluminum alloy) is an incendiary flash composition used in the .50 caliber M8API, .50 caliber M20APE-Tracer (T) and the Mk 257 Mod 0 cartridges. Incendiary flash performance requirements may be found in MIL-C-3066C, 3.14. Test procedures are defined in TECP 700-700, Vol. III.
- RS-41 (49% magnesium/aluminum alloy; 49% potassium perchlorate; 2% calcium resinate) is used in the 20mm PGU 28/B and the PGU-28A/B SAPHEI. RS41 is used as the nose incendiary and initiates the explosive train when the projectile impacts a target. Per MIL-I-85756, the Heat of Explosion (HOE) for RS-41 shall be between 1900 and 2500 calories /gram.
- 40mm Flash Composition (64% Potassium Perchlorate; 22.5% Aluminum Powder; 10% Sulfur; 3.5% Antimony Sulfide) is used in the 40mm, M918, Target Practice round. The flash composition is initiated by the M55 stab detonator upon projectile impact with the target and emits flash and smoke to simulate high explosive (HE) function.

Sample usage rates for military include the following:

- Navy: Approximately 3.5 million rounds of .50 caliber M8API and .50 caliber M20API-T allocated per year for training on Navy ranges.
- Camp Pendleton: Approximately 1.1 million rounds of .50 caliber M8API and .50 caliber M20API-T allocated per year for training at Camp Pendleton ranges.
- Army: Approximately 3 million rounds of 40mm M918 TP allocated per year for training on Army ranges.

Perchlorates are extremely soluble in water, mobile in subsurface aqueous systems and may readily contaminate surface and ground waters in and around manufacturing, processing, and testing facilities if released. Perchlorates are chemically stable and may persist for decades under typical ground water and surface water conditions.

In early 1997, the California's Department of Health Services (DHS) Drinking Water Program first found inorganic perchlorate in some drinking water wells in northern California. Since then, inorganic perchlorates have been discovered in the ground waters and surface waters in several states, including northern and southern California, Nevada, Arizona, Utah, and Texas. The majority of the locations is in California, and may be associated with formerly active facilities that manufactured, tested, or demilitarized solid rocket fuels and other ordnance items for the Defense energetic materials community.

It has been estimated the perchlorate contamination of groundwater impacts 12 million people in the states of Nevada, California, and Arizona. Perchlorate contamination is of great concern because of its ability to disrupt the endocrine system by inhibiting iodide anion uptake by the thyroid. The mounting weight of the evidence of the extent of perchlorate contamination and the potential human health effects, have prompted EPA to propose the addition of perchlorate to its Contaminant Candidate List. State regulators have also acted, with the California Department of Health Services adopting an action level for perchlorate in drinking water of 18 ≥g/liter, or ppb. The member countries of the European Community have adopted a maximum admissible guide level of 20 ≥g/liter for sodium perchlorate for drinking water, corresponding to approximately 16 ≥g/liter for ammonium perchlorate.

Perchlorate contamination can occur during several phases of the munition lifecycle. It can occur during the manufacturing of ingredients, the mixing of formulations, the assembly of products, the use of the product during testing or training, or during the demilitarization of the product. The development of alternative formulations without perchlorates can address all modes of contamination for a specific ordnance item life cycle.

Related SERDP-Funded Projects

SERDP has a significant investment in energetics projects. Proposers are encouraged to familiarize themselves with the projects to avoid proposing duplicative efforts. Information about these projects may be found on the SERDP's website (**http://www.serdp.org**) listed under "Research Projects". Pollution prevention projects may be accessed directly by going to **http://www.serdp.org/research/Prevention.html**

4. ESTIMATED COST AND DURATION OF PROPOSED WORK

The cost and time to meet the requirements of this SON are at the discretion of the proposer. The proposer should incorporate the appropriate time schedule and cost requirements to accomplish the scope of work proposed. SERDP staff will evaluate the cost and duration of the project plan in light of the scope of work proposed. SERDP projects normally run from two to four years in length and vary considerably in cost consistent with the scope of the effort. Proposers are encouraged to and may submit smaller proposals that offer technical or cost advantages that only address one or more portions of the SON.

Proposers with innovative approaches to the SON, that entail high technical risk and/or have minimal supporting data, may submit a proposal for a limited amount of funding (less than $100,000 for a single year) to develop the data necessary to provide for risk reduction or/or proof of concept. Such proposals, if successful, may be eligible for follow-on funding.

The government reserves the right to fund more than one proposal either to meet this requirement fully or to pursue more than one innovative approach.

5. POINT OF CONTACT

Mr. Charles J. Pellerin
Program Manager for Pollution Prevention
Strategic Environmental Research and Development Program (SERDP)
901 North Stuart Street, Suite 303
Arlington, VA 22203
Phone: (703) 696-2128
FAX: (703) 696-2114
E-Mail: charles.pellerin@osd.mil

References:

1. Military and Civilian Pyrotechnics, By Dr. Herbert Ellern, Chemical Publishing Company Inc., New York, 1968

For Submission Instructions, go to http://www.serdp.org/funding/funding.html

State of California
Regional Water Quality Control Board
San Diego Region

EXECUTIVE OFFICER SUMMARY REPORT
August 13, 2003

ITEM: 7

SUBJECT: Modification to Waste Discharge Requirements: Northrop Grumman Space Technology and Mission Systems Corporation
Capistrano Test Site
Orange County (change in owner)
(Tentative Addendum No. 1 to Order No. 94-78)
(Jeremy Haas)

PURPOSE: To formally transfer responsibility of Order No. 94-78 to Northrop Grumman Space Technology and Mission Systems Corporation.

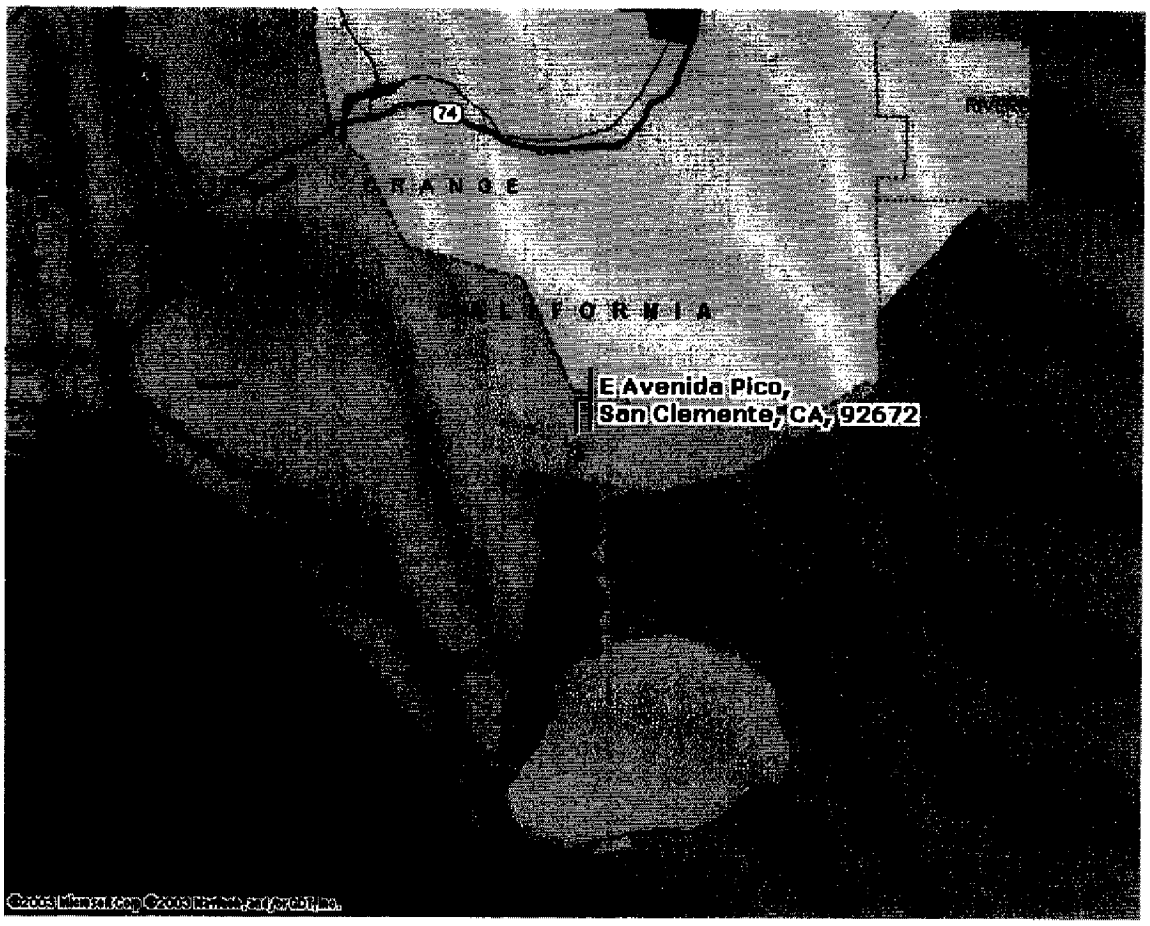
PUBLIC NOTICE: The Regional Board Agenda Notice was mailed on July 24, 2003 and has been posted on the Regional Board web page. This notification satisfies the requirements pursuant to State Government Code Section 11125 for a 10-day notice.

DISCUSSION: Order No. 94-78, adopted on October 13, 1994, specifies requirements for Northrop Grumman Space Technology and Mission Systems Corporation (NGST) for the disposal of treated domestic sewage from the Capistrano Test Site. Septic tank effluent is discharged to an aeration pond and the treated water from the aeration pond is disposed of by spray irrigation at the Capistrano Test Site which is located in the San Juan Hydrologic Unit.

A letter from Richard K. Asher, dated January 31, 2003, notified this Regional Board that ownership of the Capsitrano Test Site was transferred from TRW to the Northrop Grumman Space Technology and Mission Systems Corporation.

	Tentative Addendum No. 1 to Order No. 94-78 would, if adopted, identify Northrop Grumman Space Technology and Mission Systems Corporation as the discharger responsible for compliance with Order No. 94-78.
LEGAL CONCERNS:	None
SUPPORTING DOCUMENTS:	1. Location Map 2. Regional Board Tentative Addendum No. 1 to Order No. 94-78 and transmittal letter. 3. Letter regarding change in ownership dated January 31, 2003 from Richard K. Asher.
COMPLIANCE RECORD:	The Semiannual Monitoring Reports submitted from 1994 to 2002 had no significant noncompliance issues.
RECOMMENDATION:	Adoption of Tentative Addendum No. 1 to Order No. 94-78 is recommended.

SUPPORTING DOCUMENT 1
NORTHROP GRUMMAN SPACE TECHNOLOGY AND MISSION SYSTEMS CORPORATION



California Regional Water Quality Control Board
San Diego Region

Winston H. Hickox
Secretary for Environmental Protection

Internet Address: http://www.swrcb.ca.gov/rwqcb9
9174 Sky Park Court, Suite 100, San Diego, California 92123-4340
Phone (858) 467-2952 • FAX (858) 571-6972

Gray Davis
Governor

July 22, 2003

CERTIFIED MAIL
7002 2410 0000 4398 2428

In reply refer to:
WPN:02-0034.01,.02:haasj

Mr. Richard K. Asher
Environmental Coordinator
NGST/Capistrano Test Site
Post Office Box 10
San Clemente, California 92674

Dear Mr. Asher:

SUBJECT: TENTATIVE ADDENDUM NO. 1 TO ORDER NO. 94-78 FOR NORTHROP GRUMMAN SPACE TECHNOLOGY AND MISSION SYSTEMS CORPORATION, CAPISTRANO TEST SITE, ORANGE COUNTY

This will acknowledge your letter dated January 31, 2003. It is our understanding that ownership of the Capistrano Test Site was transferred to Northrop Grumman Space Technology and Mission Systems Corporation (NGST) on December 13, 2002.

My staff has prepared tentative Addendum No. 1, which, if adopted, will formally transfer responsibility of Order No. 94-78 to NGST.

Enclosed for your review and comment is a copy of tentative Addendum No. 1. Please submit any written comments no later than August 6, 2003 so that your comments and responses can be provided to the Regional Board members prior to the day of the meeting.

The Regional Board will consider adoption of this tentative addendum at its August 13, 2003 Regional Board meeting. The August 13, 2003 Regional Board meeting will be open to public participation and will begin promptly at 9:00 a.m. at the following address:

San Diego Regional Water Quality Control Board
9174 Sky Park Court
Suite 100
San Diego, California

You and/or someone from your staff are encouraged to be present at the Regional Board meeting in the event your participation is needed.

The heading portion of this letter includes a Regional Board code number noted after "In reply refer to:" In order to assist us in the processing of your correspondence please include this code number in the heading or subject line portion of all correspondence and reports to the Regional Board pertaining to this matter.

If you have any questions regarding tentative Addendum No. 1, please contact Jeremy Haas of my staff at (858) 467-2735.

Sincerely,

Robert Morris

Robert W. Morris
Senior Water Resource Control Engineer

RWM:jh:sth

Enclosures: (1) Tentative Addendum No. 1

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

TENTATIVE ADDENDUM NO. 1 TO ORDER NO. 94-78

AN ADDENDUM TRANSFERRING RESPONSIBILITY TO

NORTHROP GRUMMAN SPACE TECHNOLOGY AND MISSION SYSTEMS CORPORATION, CAPISTRANO TEST SITE, ORANGE COUNTY

The California Regional Water Quality Control Board, San Diego Region (hereinafter Regional Board), finds that:

1. On October 13, 1994, this Regional Board adopted Order No. 94-78, "Waste Discharge Requirements for the Disposal of Treated Domestic Sewage at TRW, Capistrano Test Site, Orange County."

2. A letter from Mr. Richard K. Asher, Environmental Coordinator for NGST/Capistrano Test Site, dated January 31, 2003, notified this Regional Board that ownership of the Capistrano Test Site was transferred from TRW to Northrop Gumman Space Technology and Mission Systems Corporation (NGST) on December 13, 2002.

3. The Regional Board has notified all known interested parties of its intent to modify Order No. 94-78 to reflect the transfer of responsibility.

4. The Regional Board, in a public hearing, heard and considered all comments pertaining to the modification of Order No. 94-78.

5. This facility is an existing facility and as such is exempt from the provisions of the California Environmental Quality Act, in accordance with Title 14, California Code of Regulations, Article 19, Section 15301.

IT IS HEREBY ORDERED THAT, Order No. 94-78 is modified as follows:

1. Order No. 94-78 shall henceforth be referred to as Waste Discharge Requirements for Northrop Gumman Space Technology and Mission Systems Corporation, Capistrano Test Site.

2. The waste discharge requirements contained in Order No. 94-78 shall be applicable to Northrop Gumman Space Technology and Mission Systems Corporation, Capistrano Test Site.

3. The discharger, as it appears in Order No. 94-78, shall hereinafter be construed to refer to Northrop Gumman Space Technology and Mission Systems Corporation.

I, John H. Robertus, Executive Officer, do hereby certify the foregoing is a full, true, and correct copy of an Addendum adopted by the California Regional Water Quality Control Board, San Diego Region, on August 13, 2003.

TENTATIVE
JOHN H. ROBERTUS
Executive Officer

JP

RWM

02-0034.01 8PL

NORTHROP GRUMMAN

Space Technology

Production & Supply Chain Management
Integration Test & Launch Directorate
Capistrano Test Site
P.O. Box 10
San Clemente, Ca. 92674
949.361.7000

2003 FEB 19 A 11:42
SAN DIEGO REGIONAL WATER QUALITY CONTROL BOARD

1/31/03

California Regional Water Quality Control Board
San Diego Region
9771 Clairemont Mesa Boulevard, Suite B
San Diego, CA 92124-1331

Attn: Mr. John Phillips

Subject: Semi-Annual Monitoring Report for Order No. 94-78

Dear Mr. Phillips:

Enclosed is a copy of the effluent monitoring report for the July 1, 2002 through December 31, 2002 reporting period.

Due to lack of rain, a decreased level of activity and associated reduction in employee population, the total discharge from the aeration pond was 176 gallons (maintenance operations).

I also want to make you aware of the Northrop Grumman acquisition of TRW as of December 13, 2002. If your agency requires any specific documentation regarding the change of ownership please forward the appropriate forms and/or format to me and I will complete, otherwise this shall serve as formal notification. The new company name is: Northrop Grumman Space Technology and Mission Systems Corporation.

If you have any questions, concerns or additional information is needed, please contact me at (949) 361-7106.

Sincerely,

Richard K. Asher, CHMM
Environmental Coordinator
NGST/Capistrano Test Site

enclosure

US Army Corps of Engineers®

Tools for Regional Sediment Management

by Jennifer M. Wozencraft, Lynn Hardegree, Lynn M. Bocamazo, Julie D. Rosati, and Jack E. Davis

PURPOSE: This Coastal and Hydraulic Engineering Technical Note (CHETN) describes tools that have been adapted to assist with Regional Sediment Management (RSM) activities at the U.S. Army Engineer Districts, Mobile and New York. Geographic Information Systems (GIS) designed for RSM in the Mobile District, and numerical models that have been adapted for regional studies within the New York District are discussed.

BACKGROUND: Rosati et al. (2001) contains background information on RSM goals and procedures. Some of this information is briefly reproduced for continuity herein.

RSM refers to the effective utilization of littoral, estuarine, and riverine sediment resources in an environmentally effective and economical manner. RSM strives to maintain or enhance the natural exchange of sediment within the boundaries of the physical system. RSM changes the focus of engineering activities within the coastal, estuarine, and riverine systems from the local, or project-specific scale, to a broader scale that is defined by the natural sediment processes and may include the entire watershed. Implementation of RSM recognizes that the physical system and embedded ecosystems are modified and respond beyond the formal dimensions and time frames of individual projects. The larger spatial and longer temporal perspectives of RSM, as well as the broad range of disciplines with a stake in RSM projects, require partnerships with and co-leadership of RSM initiatives by the stakeholders. Decisions concerning the timing and scope of projects that move or utilize sediment must be made within an understanding of the regional system.

The Corps' National RSM Demonstration Program began in the Mobile District in October 1999. Separately, the grassroots movement for RSM grew with Corps Districts pursuing RSM initiatives with State and local partnerships. In late 2000, the National RSM Demonstration Program expanded to include five additional demonstration sites, in U.S. Army Engineer Districts, Jacksonville, Philadelphia, New York, Detroit, and the South Pacific Division. The National Demonstration Program has initially been focused on coastal sediment management, as discussed in this CHETN, although RSM encompasses the entire watershed

GEOGRAPHICAL INFORMATION SYSTEMS FOR RSM: The Spatial Data Branch, Operations Division, of the Mobile District, created a GIS to address the data management and data analysis requirements of the RSM Demonstration Program undertaken by the District. The resulting GIS provides those interested in and working towards RSM an interface to hydrographic, topographic, photogrammetric, and historic dredge material data for the RSM Demonstration Region, as well as custom applications designed to facilitate engineering analyses. The RSM GIS serves as the link between engineering analyses and regional numerical models. To date, development of the RSM GIS has included: input of spatial data for the RSM

region, use of built-in ArcView applications to enhance data manipulation and display, and creation of custom applications to extend the utility of ArcView for RSM specific goals. This section will give an overview of the effort to create the RSM GIS including data preparation for inclusion in the GIS, data display using ArcView, creation of custom applications for RSM, and other capabilities currently under development.

Spatial Data Input: Spatial data that are currently included in the RSM GIS include: hydrographic and topographic survey data, aerial and oblique photography, dredge material records, digital nautical charts, and generic GIS information.

Hydrographic and topographic survey data. Hydrographic and topographic survey data are required for the RSM Demonstration Program in two forms. First, a unique data set must be created for each survey collected in the region. Second, the data sets must be merged into a single most recent, or baseline data set that covers the entire region. The RSM GIS data sets include three types of hydrographic and topographic data: singlebeam echosounder data, multibeam echosounder data, and airborne Light Detection and Ranging (LIDAR) bathymetry and topography.

The most extensive data set used to create the RSM baseline data set was obtained from National Geophysical Data Center (NGDC). These data are the data that appear on National Oceanographic and Atmospheric Administration (NOAA) nautical charts and are the result of several years of hydrographic surveying. The NGDC data are referenced to mean lower low water (mllw) based on NOAA specifications that require transfer of tidal datum based on comparisons of simultaneous tide measurements collected at a gauge near the survey site and an established gauge (MapTech 2000). In most areas, the distance between adjacent points ranges from 300 m near shore to 1,500 m farther offshore. Exceptions are the navigation channels at Mobile Pass, AL, Pensacola Pass, FL, and the Panama City Entrance Channel, FL. In these areas the data density approaches 30 m.

The Mobile District's Irvington Site Office provided the second type of data included in the RSM baseline data set. The data take the form of navigation channel condition surveys collected using a single-beam echosounder. This type of data was included in the baseline for Mobile Pass and Perdido Pass, both located in Alabama. These data were originally referenced to mllw using tidal gauges at the passes. The survey coverage includes only the authorized navigation channel, with data points collected in profile lines spaced approximately 100 m apart along the length of the navigation channel. Data spacing along the profile lines is sub-meter. These data were collected in the spring of 2000.

The final type of data included in the RSM baseline is that collected by the Corps SHOALS (Scanning Hydrographic Operational Airborne Lidar Survey) system (Lillycrop, Parson, and Irish 1996). These data were collected at a density of 4 m horizontally for project condition surveys at East Pass, Pensacola Pass, Panama City, and Perdido Pass. The project condition surveys were collected for the Mobile District. Survey coverage included the navigation channel, ebb and flood shoals, and adjacent shorelines and offshore areas. For these surveys, depth data were collected relative to the water surface and were referenced to tidal gauges in each of the inlets. The tidal gauges were set relative to NOAA tidal benchmarks in the area.

In addition to the SHOALS project condition surveys, SHOALS shoreline surveys were also included in the RSM baseline data set. SHOALS data have been collected for the entire coastline of the RSM demonstration region. The Florida Department of Environmental Protection (FLDEP) commissioned SHOALS data extending from the Panama City Entrance Channel to Apalachicola Bay, FL, to support coastal erosion monitoring. The data were collected relative to a short baseline of NOAA benchmarks relative to National Geodetic Vertical Datum 1929 using kinematic GPS. The remaining coastline was surveyed by SHOALS as part of the RSM baseline initiative. These data were collected relative to the water surface and were referenced to tidal benchmarks in the area by interpolation between the benchmarks. These last two data sets were collected at a density of 8 m. The surveys followed the coastline, covering 300 m of inshore dry beach and 800 m of offshore bathymetry.

Each of the data sets previously listed were converted to the same horizontal and vertical datums. The horizontal datum chosen by the user is Universal Trans Mercator (UTM) projection defined by the North American Datum 1983 (NAD83). The vertical datum chosen by the user is North American Vertical Datum 1988 (NAVD88).

The baseline data set represents the most recent data for each part of the demonstration region. These data supercede all other data for that area. For example, near East Pass, FL, the baseline data set includes NGDC data, the RSM SHOALS shoreline data set (collected in 2000), and a SHOALS project condition survey (collected in 1997). The NGDC data is superceded by the more recent SHOALS surveys. So, the NGDC data retained for the RSM baseline data set only covers the offshore areas beyond the extent of the SHOALS surveys. The SHOALS project condition survey of 1997 includes data for the flood and ebb shoals, adjacent beaches and inlet throat at East Pass. The RSM SHOALS shoreline data set collected in 2000 covers an area along the shoreline extending from 300 m onshore to 800 m offshore. The 2000 data set supercedes the 1997 data set in this alongshore swath. The 1997 data for the flood and ebb shoals and inlet throat that lie outside of this swath are retained for the baseline data set.

A graphical representation of the data retained in the RSM baseline data set near East Pass, FL, is shown in Figure 1. The triangles shown in Figure 1 represent individual NGDC data points, while the 4- to 8-m density SHOALS data sets are represented by filled polygons.

Aerial and oblique photography. Both aerial and oblique photos are included in the RSM GIS. All aerial photography currently included in the RSM GIS was provided to the Spatial Data Branch ortho-rectified and of various geographic projections (See Figure 2). The individual images were tiled together (creating a mosaic) using the Image Analysis extension of ArcView. Mosaics were then imported into ArcINFO, converted into grids, and reprojected to the desired projection of the RSM GIS project. The projected grids were converted back into image files and compressed using Multiresolution Seamless Image Database (MrSID) software.

Oblique photographs, along with corresponding descriptions, were provided to the Spatial Data Branch in hard copy form. The photos were scanned and saved in JPEG file interchange formats. Photo descriptions were typed and saved as text files. Through the *Historical Photos* application inside the RSM GIS, oblique photos are viewed and printed with corresponding descriptive data.

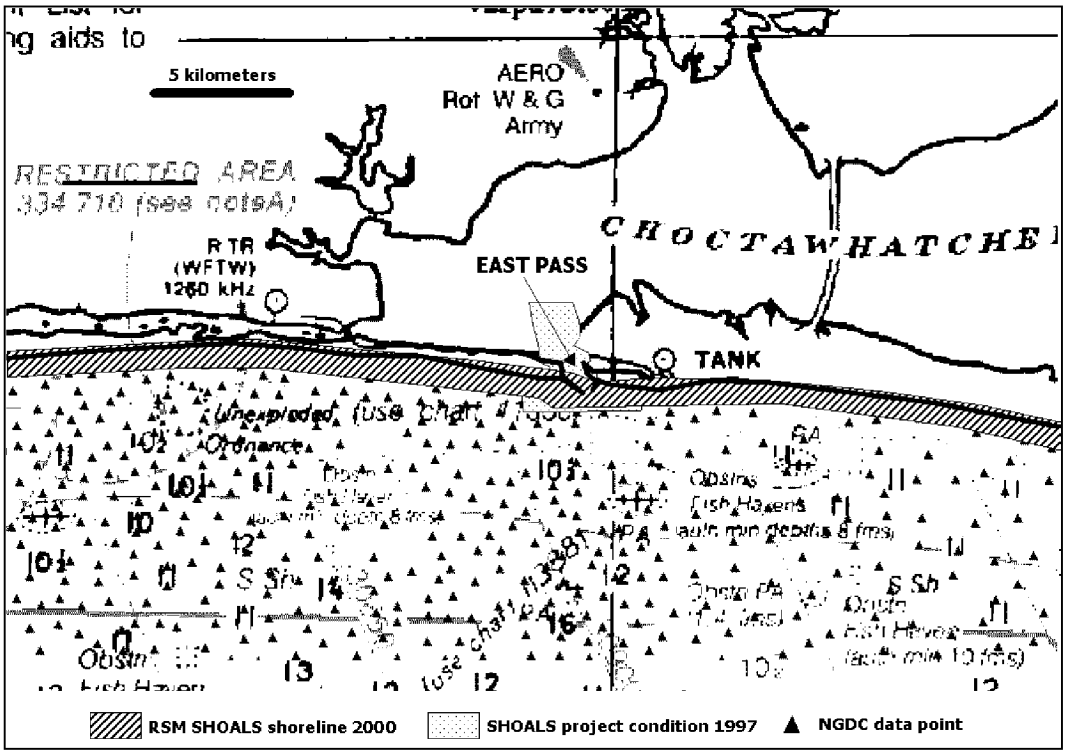


Figure 1. East Pass, FL. Graphical representation of data retained RSM baseline data set. Triangles represent actual NGDC data points SHOALS 4- to 8-m density data sets are represented by filled polygons

Figure 2. Aerial photo mosaic built for the area near Perdido Pass, AL

Dredged material records. Historical dredged material records are stored in a customized database. The database stores information regarding dredging history for each of the nine Federal navigation projects in the region. Every known dredging event is included in the RSM GIS dredge material database, along with associated removal sites, dredge material

quantities, placement sites, dredge contractors, and costs associated with the dredging contract. This information was collected from the Mobile District's Operations Division's Irvington and Panama City Site Offices. The original form of the information was as 3- x 5-in. note cards.

Digital nautical charts. NOAA nautical charts serve as the background for all other graphic entities built into the RSM GIS. These nautical charts were obtained from MapTech-distributed CD's. Three steps were required to prepare the digital nautical charts for inclusion in the RSM GIS. First, the charts were reprojected from MapTech's proprietary .kap format into a UTM83 projection using the *Chart Reproject* DOS utility available through the NOAA Web page. Second, the .kap files and their associated .bsb files were imported into ArcView and converted into the Tagged Image File Format (TIFF) with corresponding world files. This process was achieved using the Chart Reproject extension to ArcView, also provided by NOAA. Finally, the TIFF charts were cleaned to remove extraneous graphics and text as well as colorized to produce an accurate depiction of a nautical chart. This last step was achieved using the Paint Shop Pro image editor.

Generic GIS data. The U.S. Census Bureau releases extracts from the Census Topologically Integrated Geographic Encoding and Referencing (TIGER) database. The database is built on a county-by-county basis. For each county, TIGER/Line files include roads, railroads, hydrography, transportation information, power lines, pipelines, municipal boundaries, landmarks (schools, churches, parks and cemeteries), and key geographic locations such as shopping centers and factories (U.S. Census Bureau 2000). These data are released in GIS format and are directly importable into the RSM GIS, provided that they are in the proper projection. In the case of the RSM GIS, generic GIS data was projected into UTM83 through the Projection Utility of ArcView.

Data Manipulation and Display Using ArcView: ArcView and its extensions provide a great deal of data manipulation capability. This section outlines the use of built-in ArcView functionality for the creation of new coastal entities like the mean high water line and bathymetric contours.

Shorelines. Shorelines were created directly in ArcView. The shoreline was determined from the position of the debris line on the ortho-rectified aerial photographs. The debris line often denotes the location of mean high water (mhw), which is the desired shoreline for most coastal applications. The shoreline was delineated using heads-up digitizing in ArcView. The position of the debris line on the ortho-rectified aerial photographs was marked approximately every 15.24 m (50 ft). Through the X tools extension in ArcView, a linear interpolation was performed between each point to create the mhw shoreline.

Triangulated irregular network. Using an ArcView extension called 3D Analyst, a triangulated irregular network (TIN) was created from each of the hydrographic and topographic data sets included in the RSM GIS, including the baseline data set. TINs allow RSM data users to use these data sets as surfaces, rather than as two-dimensional data points with an elevation attribute. The surfaces allow for more accurate volume computations between data layers and are included as a data layer in the GIS.

Grids. 3D Analyst was also used to create a grid of each data set. A grid is a set of regularly spaced data points created from a set of irregularly spaced data points, like the topographic and hydrographic data sets. In the RSM GIS, grids were created from TINs to accurately represent elevation changes about the surface. Grids are used to facilitate calculations between data sets and volume computations. At each XY grid point an elevation is interpolated based on the elevation of the TIN at that same XY grid point. Each grid has been assigned a color scale based on elevation of the grid points. This colorizing of the grid points has the effect of creating color-filled contours for each data set. The grids are included as a data layer in the GIS.

Contours. Linear contours are also included as a layer in the RSM GIS. The contours were created using 3D Analyst. The contours are spaced at 1.5-m intervals. The contours are drawn based on the elevations given by the grid surfaces.

Creating Custom Applications for ArcView: Several custom applications have been written to extend the capability of ArcView to meet RSM specific goals. These applications are generally written in AVENUE script and Visual Basic and take advantage of ArcView and ArcView extension functionality. AVENUE is ESRI's programming language.

Oblique photo tool. Aerial photography and oblique photography often contain valuable qualitative information regarding the condition of beaches, dunes, offshore shoals, and other coastal features. Oblique photography, generally taken with a standard camera from the beach itself, from nearshore buildings, or sometimes from the air, cannot be integrated into a GIS because it lacks positioning information. Aerial photography can be integrated with a GIS if necessary rectification information is available such as camera angles, which are related to aircraft roll and pitch. However, especially with older aerial photography, often the only information available is the contact print itself.

To include these valuable photos in the GIS, even though no positioning information is available, an oblique photo tool was created that hotlinks these photos to the areas in which they were taken. For example, several photos have been collected at East Pass, FL, that cannot be rectified for input into the GIS. The oblique photo tool allows the RSM GIS user to select a location. Available photography for that location is displayed with relevant information.

An example of the oblique photo tool is shown in Figure 3. In the dialog, a small, or thumbnail version of a photo taken at East Pass, FL, is displayed. By clicking the *Full Size* button, users can access a larger version of the photo. All relevant information stored in the photo database is displayed to the right of the photo. This includes the date of the photo, the file the photo is stored in, and a caption describing the photo.

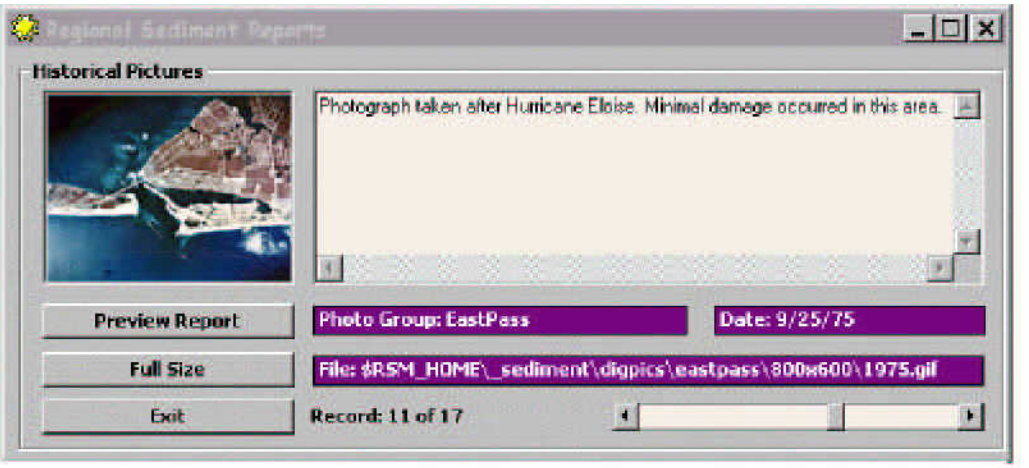


Figure 3. Custom oblique photo viewing tool built for the RSM GIS. The left side of the dialog shows a thumbnail view of a photo taken at East Pass, FL, while the right size contains the photo location, date, and a caption stored for the photo

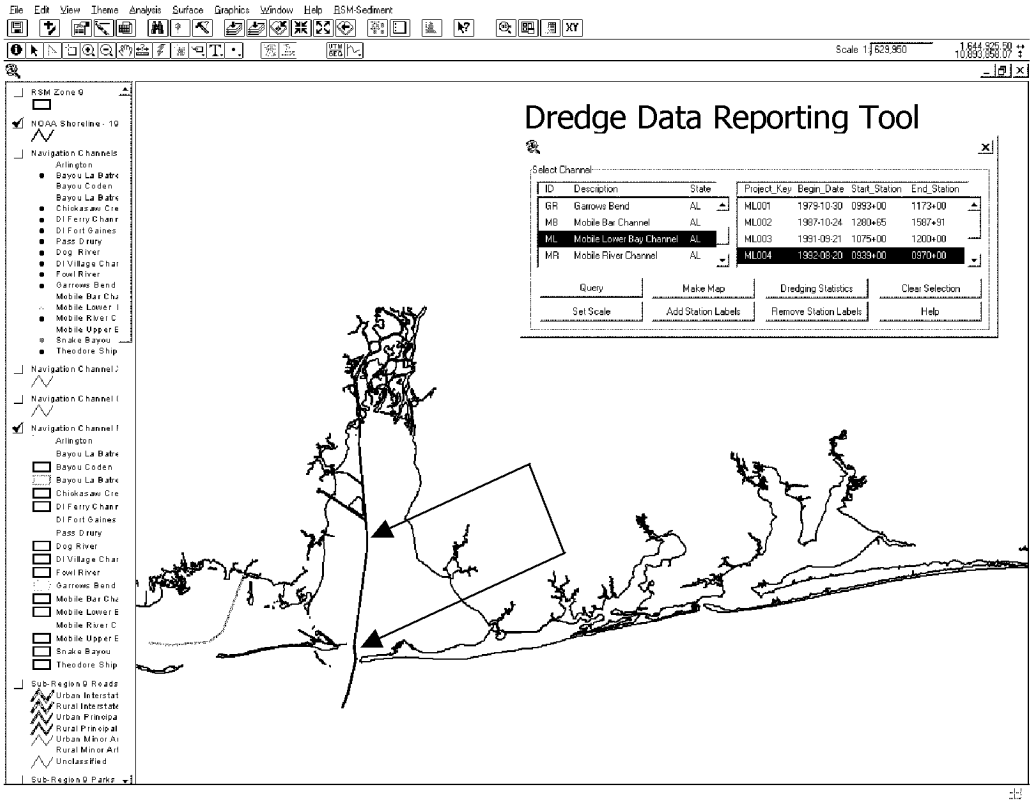
Dredge data reporting tool. The dredge material database is accessed through the dredge data reporting tool. The reporting tool calls up all known dredging events from the dredge material database. The user may access a *Dredging Report* by selecting an event from the scroll-down list. The user may also select a particular navigation channel from the spatial domain of the RSM GIS and view reports for every event within that particular channel.

An example of a dredge data report is shown in Figure 4. Figure 4a shows the spatial domain of the RSM GIS near Mobile Pass, AL. Visible in the domain are the shoreline and navigation channels in this area. The dredging event highlighted in the dredge data reporting tool (shown blacked out) is linked to the channel section highlighted in the main window of Figure 4a (denoted by arrows). The dredge data reporting tool then uses data extracted from the dredge material database to fill a dredging report. A portion of a dredging report is shown in Figure 4b.

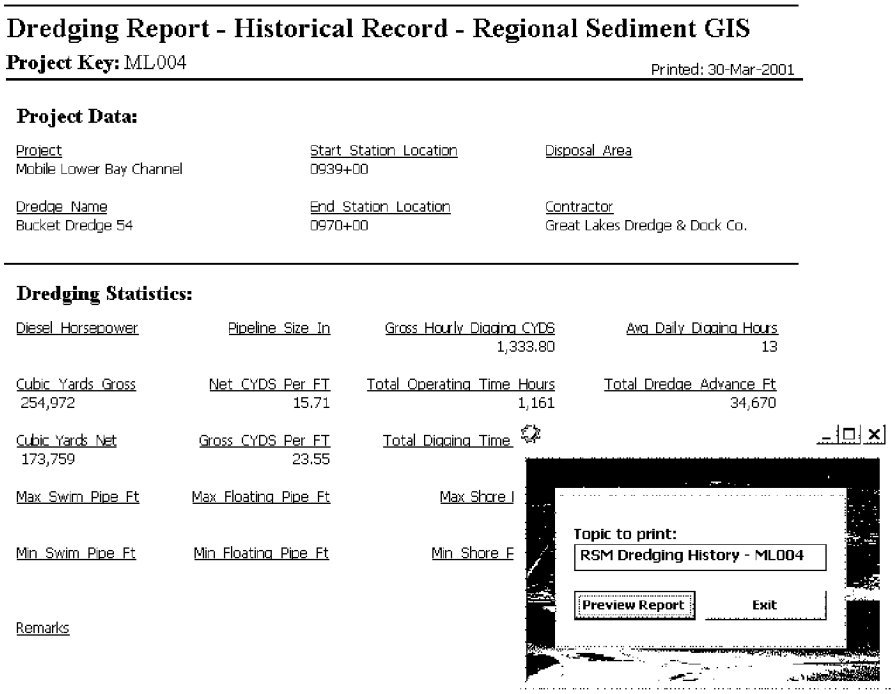
Profile tool. Beach profiles have been collected as part of the coastal monitoring for the State of Florida for many years. Part of the baselining effort for the RSM Demonstration Program included the collection of beach profiles along the entire coast of Alabama. To compare this data with higher-density data sets, like SHOALS or multibeam data sets, users must be able to view profiles extracted from the higher density data sets at locations where historical profiles were collected.

The profile tool allows the user to extract profiles from the higher density data sets. The profiles may be extracted along hand drawn line objects. The profile tool creates a set of elevations along a line based on the grid surfaces included in the GIS.

An example profile tool is shown in Figure 5. Figure 5a shows the spatial domain of the RSM GIS near East Pass, FL. Visible in the domain are the shoreline in this area, the grid surface for a SHOALS data set collected in at East Pass in 1996, and a solid line for which a profile will be



a. RSM GIS spatial domain near Mobile Pass, AL. This view includes the shoreline and navigation channels in this area



Dredging Report - Historical Record - Regional Sediment GIS

Project Key: ML004 Printed: 30-Mar-2001

Project Data:

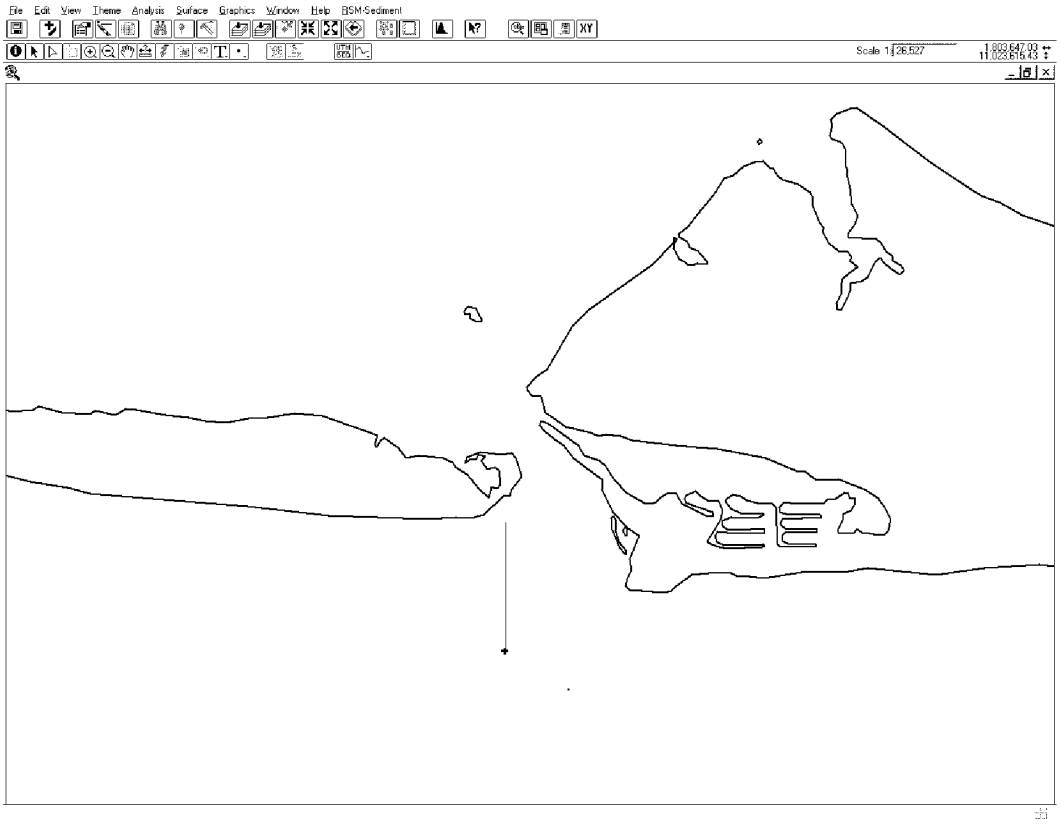
Project	Start Station Location	Disposal Area
Mobile Lower Bay Channel	0939+00	
Dredge Name	**End Station Location**	**Contractor**
Bucket Dredge 54	0970+00	Great Lakes Dredge & Dock Co.

Dredging Statistics:

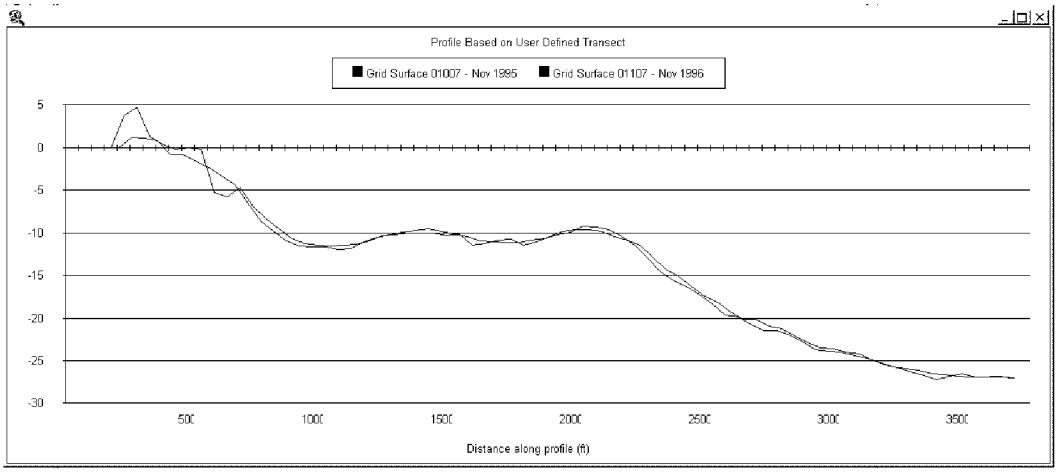
Diesel Horsepower	Pipeline Size In	Gross Hourly Digging CYDS	Avg Daily Digging Hours
		1,333.80	13
Cubic Yards Gross	**Net CYDS Per FT**	**Total Operating Time Hours**	**Total Dredge Advance Ft**
254,972	15.71	1,161	34,670
Cubic Yards Net	**Gross CYDS Per FT**	**Total Digging Time**	
173,759	23.55		
Max Swim Pipe Ft	Max Floating Pipe Ft	Max Shore I	
Min Swim Pipe Ft	Min Floating Pipe Ft	Min Shore F	
Remarks			

b. A portion of the dredging report filled with data from the dredge material database

Figure 4. Dredging Report tool created for RSM GIS



a. Spatial domain of the RSM GIS near East Pass, FL. This view includes the shoreline in this area, the grid created for the 1996 SHOALS data set, and a line where a profile is desired



b. Profile viewing window, where a profile is displayed for the November 1995 SHOALS survey and the 1996 SHOALS survey

Figure 5. Profile tool created for RSM GIS

extracted. Figure 5b shows the profile viewing window, where a profile is shown for both the November 1995 SHOALS data set and the 1996 SHOALS data set.

Compute volumes tool. The compute volumes tool gives RSM engineers and scientists the capability to compute volumes between data sets. The volumes are computed based on the grids created from the original data sets. The user may compute a volume by drawing an area (polygon) for which a volume is desired. At each grid point, an elevation difference is calculated between the two data sets. The volume is determined by integrating the differences over the areas they represent. The volume for the designated area is reported in a pop-up window. The differences are stored as a data layer in the RSM GIS.

An example showing the computed differences is shown in Figure 6. This view shows the spatial domain for the RSM GIS near East Pass, FL. Visible in the domain are the shoreline and the difference grid computed during a volume calculation. The difference grid is shown in the lower central portion of the view. The black and dark gray grid cells are areas of positive difference, or accretion. The lighter gray areas are areas of negative difference, or erosion.

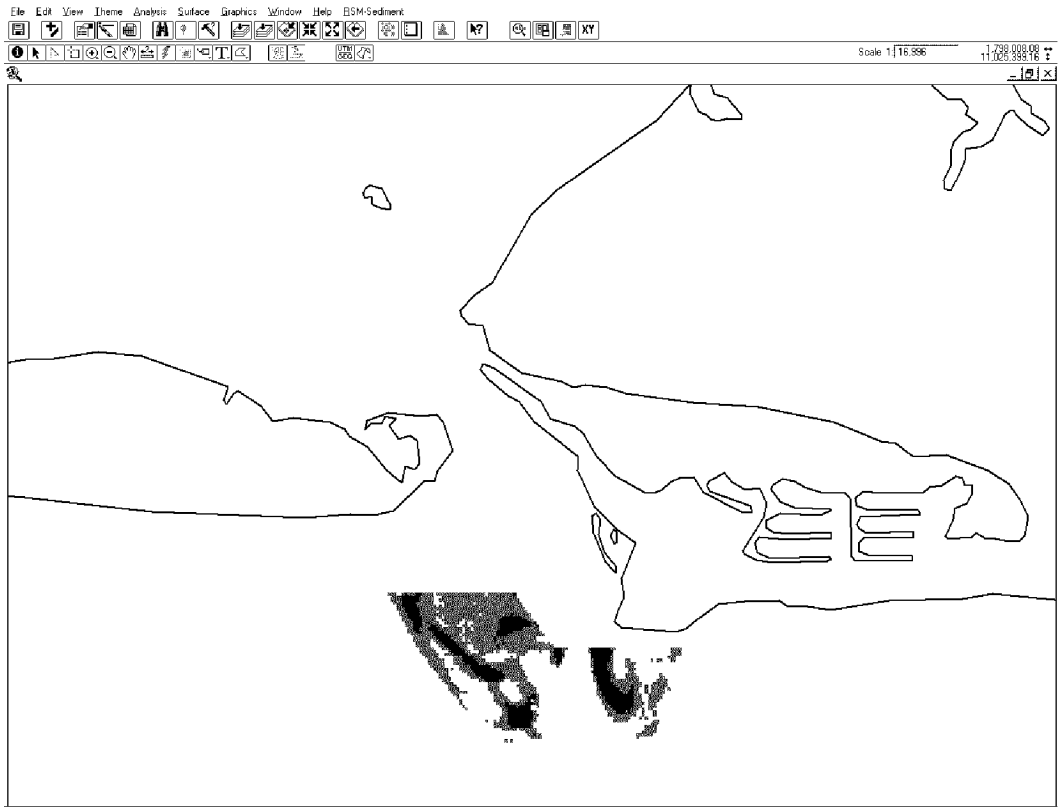


Figure 6. Volume tool created for RSM GIS. This figure shows the spatial domain for the RSM GIS near East Pass, FL. The view includes the shoreline and the difference grid computed during a volume calculation. The black and dark gray grid cells are areas of positive difference, or accretion. The lighter gray grid cells are areas of negative difference, or erosion

Additional RSM tools. Five additional tools created specifically for the RSM are the RSM theme tool, a dynamic search tool, a coordinate conversion tool, and two printing tools. The theme tool allows users to select a group of themes, or data layers, to add to a view at a single time. For instance, all the themes in the area surrounding East Pass, FL, may be added as a single group. The dynamic search tool allows the user to search for a specific feature within a single theme. The coordinate conversion tool allows the user to convert between UTM and geographic coordinates. The printing tools allow the user to automatically print the current view or select feature attributes to output to the printer.

Conclusions: The RSM GIS provides engineers and scientists with tools to both visualize spatial data and perform engineering analyses. Data visualization improves understanding of potential sediment transport pathways. Engineering analyses provide exact quantities of change in shoreline position and sand volumes. These two pieces of information are required to calibrate the numerical models upon which regional sediment management concepts depend.

NUMERICAL MODELS FOR RSM: RSM requires identifying and quantifying pathways and patterns of sediment movement, and using best management practices to preserve sediment and financial resources. Regional numerical models are tools to aid decision-makers in alternative selection for future activities to minimize or improve impacts on all elements of the littoral system. An understanding of regional geomorphology and prediction of long-term regional climatic changes and their impacts on the watershed and coastal processes are also necessary for determining the best RSM practices.

This section gives a general overview of the regional setting on the south shore of Long Island, NY, and of the numerical models that can be used in the evaluation of regional sediment management. With the exception of one model, the ADvanced CIRCulation Multi-Dimensional Hydrodynamic Model (ADCIRC), these models were developed for local, project-level application, and they have been extended to the regional scale as an interim prediction tool until regional models are developed. Examples of how these models are being used at the New York District are discussed.

The south shore of Long Island faces the Atlantic Ocean. Net transport of material is to the west, toward New York Harbor, but there are strong seasonal and localized reversals of transport, especially at the inlets. The Long Island south shoreline consists of 152.88 km (95 miles) of barrier island, eroding headlands on the eastern 98.78 km (30 miles), and productive estuarine bays. There are six Federal navigation inlets on the south shore. The area has farms and parklands, and the cities of Long Beach and New York. The shoreline over the last 100 years has been impacted by both storms, which caused barrier island breaching and overwash, and human activities such as inlet stabilization and groin construction.

On south shore of Long Island, the Corps maintains six navigation channels that are each dredged every 2 to 3 years, from 152,911 cu m (200,000 cu yd) per operation at Rockaway Inlet to 764,554.9 cu m (1 million cubic yards) at Fire Island Inlet. There are a number of storm protection projects in various stages of study, including the 133.57-km (83-mile) Fire Island Inlet to Montauk Point project. The entire shoreline is covered by Federally authorized storm protection projects. Since 1995, intensive data collection efforts and an Ecosystem Restoration

program for the bays have been undertaken. Over the last 40 years, an average of approximately 229,366.5 cu m (300,000 cu yd) of material has been placed annually in the area between Fire Island Inlet and Montauk Point.

The geography of Long Island consists of headlands supplying sediment to barrier islands, which is transported to navigation inlets. The need to maintain longshore transport of material, and the need to provide material for storm damage protection projects, created a need for regional studies. The navigation inlets, shoreline protection projects, and the ecosystem concerns are interconnected. Other agencies are also concerned about regional impacts. The U.S. Environmental Protection Agency and U.S. Fish and Wildlife Service have asked the New York District to examine the cumulative impacts of the beach-fill placement and dredging activities. There are also concerns about endangered species and prevention of overwash fan development. The task now facing the New York District is to connect the project areas into a regional system using the coastal processes tools and models available.

For regional numerical modeling on Long Island, regional sediment budgets, a regional ocean circulation model, regional shoreline change models, circulation models for inlets and bays, and a regional wave model, with nested grids at the inlets, have been implemented. A requirement for the validity of the regional models is accurate input data. The New York District has been able to collect repeated high quality bathymetry of some of the inlets, long-range profiles, and aerial photography. Through an authorized data collection program in collaboration with the Coastal Inlets Research Program (CIRP), the District collected a very large data set of wave, wind, current, and water level data. Also in conjunction with these studies, the District assembled a long-term history of the shoreline and the bays, which is used to check the reasonableness of the models. Models are needed to answer the questions of wave energy and height, shoreline evolution, ocean and bay hydrodynamics, inlet sedimentation patterns and effects on adjacent beaches, and the stability of the barrier islands.

The District has used the following numerical models to develop regional understanding of natural processes, and as tools for evaluating engineering alternatives: sediment budgets and the Sediment Budget Analysis System (SBAS) (Rosati and Kraus 1999, 2001), Steady Wave (STWAVE) (Smith, Resio, and Zundel 1999), a GENEralized model for SImulating Shoreline change (GENESIS) (Hanson and Kraus 1989; Gravens, Kraus, and Hanson 1991), the ADvanced CIRCulation Multi-Dimensional Hydrodynamic Model (ADCIRC) (Luettich, Westerink, and Scheffner 1994), an inlet stability analysis (based on Escoffier 1940; van de Kreeke 1992), the Reservoir model (Kraus 2000), and the Cascade model (Larson, in preparation). A discussion of each of the models follows.

Sediment Budgets and SBAS: A regional sediment budget is an accounting of gains and losses within a littoral system for a specific period of time, over both local and regional scales. Sediment budgets can range from conceptual to very detailed, depending on the quantity and quality of the littoral system change data available. Sediment budgets can be used to measure the impacts of engineering actions along a regional coastal area, as well as measure the effects of natural processes such as long-term erosion and barrier island breaching.

Rosati, Gravens, and Smith (1999) developed a regional sediment budget for the Fire Island Inlet to Montauk Point study area. The area was divided into five morphologic zones, and evaluated over a number of time periods. The net longshore transport rates for various conditions, and uncertainties in sources and sinks such as bluff erosion, were integrated into the budgets developed for historical and existing conditions. A regional sediment budget for all of Long Island is being developed as a part of a RSM demonstration project. This Fire Island to Montauk Point sediment budget will be used to evaluate storm protection alternatives for that project. The Sediment Budget Analysis System (SBAS) (Rosati and Kraus 1999, 2001) is a PC-based system for formulating sediment budgets, and has been applied at Shinnecock Inlet, including all the sources and sinks and the sediment pathways. SBAS can be as general or specific as needed.

Steady Wave (STWAVE): STWAVE is a steady-state spectral wave model. It is a nearshore wave transformation model used to describe changes in wave parameters such as wave height, period, direction and spectral shape, between the offshore and the nearshore. STWAVE simulates many wave transformation characteristics, including breaking, refraction and shoaling, diffraction, wave-current interaction, and wave growth due to wind input. The nearshore wave output from STWAVE is used to develop estimates of sediment transport, and then with GENESIS, shoreline change. An STWAVE wave grid has been developed for the 133.57-km (83-mile) Fire Island Inlet to Montauk Point reformulation study (Gravens, Rosati, and Wise 1999). The wave grid was developed from recent bathymetry, applied using WIS (Wave Information Study) wave data, and verified using nearshore and offshore wave gauge data. Three computational grids were used for this nearshore model. Accounting for changes in bathymetry and coastal features, variations of net sediment transport over the domain were developed. The model was applied to evaluate the changes in transport caused by dredging offshore borrow sites.

The LISHORE project has implemented STWAVE regionally along the Long Island coast (Grosskopf et al. 2001). LISHORE is supporting wave gauges that provide validation data for numerical modeling and real-time documentation of wave conditions. The model is configured on a coarse resolution grid (1 nautical mile) along the entire island that provides boundary wave spectra for the finer, nested grids with resolution of 50 to 100 m at Shinnecock and Jones Inlet. The application of STWAVE along the entire regional domain provides insight into wave-driven processes at a variety of spatial scales, which are critical to defining the regional sediment budget and impacts of engineering on that budget.

GENESIS: GENESIS is a one-contour-line beach evolution model. GENESIS calculates longshore sand transport rates and resulting planform shape of the modeled coast at short time intervals over a prescribed simulation period. The effects of coastal structures and other planform changes to the beach can be evaluated by the model. For the Fire Island to Montauk Point study, the GENESIS model was configured for application to three analysis reaches within the study area, each from 24.14 to 48.28 km (15 to 30 miles) long. The area includes three inlets, as well as a field of 16 groins at Westhampton. Project alternatives for the Fire Island to Montauk Point study, such as widened beaches, and the addition or removal of coastal structures, will be evaluated, based on the configured GENESIS model. Having a regional shoreline change model will provide answers to questions of the regional impacts of the project alternatives.

ADCIRC: ADCIRC is a two-dimensional, depth-integrated finite-element hydrodynamic model developed with the capability of operating over a wide range of grid element sizes. Fine resolution can be defined for accurate calculation of flow-through channels and around coastal structures. The New York District has applied ADCIRC in large- and small-scale studies. A regional tidal circulation grid has been developed that includes the Atlantic Ocean, Long Island Sound and New York Harbor, and the six inlets and the associated bays located on the south shore of Long Island. Resolution is increased from the ocean toward the coast, with greatest node density in the bays and inlets. The regional propagation of the tidal wave around Long Island was modeled using ADCIRC. Differences in water-surface elevations play a key role in the circulation of water through the south shore estuary system, which in turn impacts inlet hydrodynamics and inlet sediment transport patterns.

Because of concerns regarding borrow area sources for a shoreline protection project just west of Shinnecock Inlet, in coordination with the CIRP, a model was developed to predict impacts of using the flood shoal as a borrow source (Militello and Kraus 2001). Fine detail was implemented in the ADCIRC model mesh for the Shinnecock study area, for resolution of the channels, jetties, and shoals. Sixteen alternative configurations of flood shoal mining were modeled. ADCIRC has robust wetting and drying algorithms to simulate the inundation and exposure of the flood shoal. Based on the impacts calculated by the model, a final recommended plan for the flood shoal mining was developed. By having this tool, the District was able to show the local land trustees how changes in the bathymetry would change the current patterns. Without this tool the District would not have been able to recommend using the flood shoal as a borrow source.

Inlet Stability Analysis: A multiple inlet stability analysis was used for the evaluation of barrier island breaching, to determine whether a stabilized inlet or a newly formed inlet would remain open after a breaching event (Headland et al. 1999). The condition of the inlet/bay system can have great impacts on local and regional sediment transport, including displacement of barrier island sediments, burial of bay habitat, interruption of littoral drift, and increased shoaling or closure of inlet navigation channels. The analysis was based on inlet closure theory as described by Escoffier (1940) and van de Kreeke (1992). For each of the barrier-bay systems, closure surfaces considering the areas of the inlet and the breach, and corresponding flow velocities were developed. The overlapping of the two equilibrium flow curves, is plotted separately to determine if both the inlet and the breach will close, if the inlet will close, if the breach will close or both will remain open. Empirical data of historical breaches on Long Island, especially breach cross-sectional area, were very important to this analysis.

Reservoir Model: The Reservoir model (Kraus 2000) is a mathematical model for calculating the volume and sand-bypassing rate at ebb-tidal shoals. The analytical solution for volume changes and bypassing rates depends on the ratio of input longshore sand transport rates and the equilibrium volume of morphological features of the ebb shoal, the bypassing bar and the attachment bar. The model gives explicit expressions for the time delays in sand bypassing associated with creation and growth of inlet features. The Reservoir model was applied at Shinnecock Inlet to evaluate consequences of mining the flood shoal (Militello and Kraus 2001). An extended generalized model that is solved numerically also includes the flood shoal, the inlet entrance channel, and the exchange of sediment between these and other sand bodies.

Cascade: The Cascade model is an emerging numerical simulation model aimed to bridge the gap between a sediment budget over a regional extent and the application of GENESIS over the individual reaches comprising the region. GENESIS cannot directly span over inlets. Within Cascade, sediment storage and bypassing are represented at the inlets between reaches through the Reservoir model. Cascade explicitly represents sediment-transporting motion on different spatial and temporal scales, cascading sediment transport processes to and from regional to local scales. The regional and local contours are represented, as are the ebb shoals for calculation of waves and longshore sediment transport.

Conclusions: Regional applications of numerical models can help define the littoral system and can be used to evaluate natural and engineering impacts to the system. Regional numerical modeling can be initiated by gathering all available accurate data on waves, shoreline change, engineering activities, natural events such as breaching, sediment type, and circulation patterns. The next step is to develop a conceptual sediment budget. From that base, SBAS can be applied to develop flexible, spatially variable sediment budgets, to determine areas where more data are needed. If there is adequate funding, and good regional data including wave and tidal information, the models described in this section can assist in RSM responsibilities and objectives.

ADDITIONAL INFORMATION: This CHETN was written by Mme. Jennifer M. Wozencraft, Lynn Hardegree, Lynn M. Bocamazo, Julie D. Rosati, and Dr. Jack E. Davis. Ms. Wozencraft and Ms. Hardegree work for the Mobile District, and Ms. Bocamazo works for the New York District. Ms. Rosati and Dr. Davis work at the U.S. Army Research and Development Center (ERDC), Coastal and Hydraulics Laboratory. The research was jointly supported by the Coastal Inlets Research Program, Inlet Channels and Adjacent Shorelines Work Unit, and by the Coastal Sedimentation and Dredging Program, Regional-Scale Modeling Morphology Change and Sediment Transport Work Unit. Questions about this CHETN can be addressed to Ms. Rosati (601-634-3005, Fax 601-634-4314, e-mail: *Julie.D.Rosati@erdc.usace.army.mil*). Note that references to commercially available products does not constitute endorsement by the U.S. Army Corps of Engineers.

This CHETN should be cited as follows:

> Wozencraft, J. M., Hardegree, L., Bocamazo, L. M., Rosati, J. D., and Davis, J. E. (2001). "Tools for regional sediment management," ERDC/CHL CHETN-XIV-2, U.S. Army Engineer Research and Development Center, Vicksburg, MS. (*http://chl.wes.army.mil/library/publications/chetn*)

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SEBASTIAN INLET MANAGEMENT STUDY
IMPLEMENTATION PLAN

CERTIFICATE OF ADOPTION

WHEREAS, the Department of Environmental Protection ("Department"), in conjunction with the Sebastian Inlet Tax District Commission, Brevard County and Indian River County, established a Technical Review Committee ("TRC") to review information and make recommendations as to the adequacy of supporting studies and reports, under the provisions of Section 161.161, Florida Statutes, for the purposes of evaluating the erosive impact of Sebastian Inlet on adjacent beaches, and

WHEREAS the Department has developed an implementation plan to meet the Requirements of Chapter 161, Florida Statutes, and

WHEREAS the implementation plan is consistent with the Department's program objectives under Chapter 161, Florida Statutes,

The Department does hereby adopt the following implementation actions:

1) **Continue to bypass suitable sediment to the downdrift beaches.** Periodic maintenance dredging activities, including dredging of the channel and sand trap, will be conducted with placement of all beach compatible material on the downdrift beaches. Supplemental material from alternative sources will be used to meet, or exceed, an average annual placement objective of 70,000 cubic yards ("cy"). As a first priority, material should be placed on the beach in areas of greatest need based upon a plan approved by the Department. Areas of placement may be further refined based upon results from long term monitoring of the inlet and adjacent beaches. The bypassing objective of 70,000 cy is adopted as an interim measure and will be formally validated or redefined in subsequent revisions of the plan, based on a comprehensive monitoring plan, within 5 years of adoption of the Inlet Management Plan.

2) Restore the downdrift beaches designated by the Department as experiencing critical erosion. Downdrift beach restoration will be pursued in conjunction with implementation of shore protection activities under the Indian River County Beach Preservation Plan (IRCBPP) and be considered an integral part of both plans. The restoration of these beaches as stated in the IRCBPP, will be considered to meet state objectives for restoration of any possible adverse effects of the inlet. The activities under both plans will jointly maintain the restored shorelines.

3) **Evaluate possible alternatives to facilitate sediment bypassing.** Specific alternatives to be investigated include modifications to the

trapping capacity of the sand trap, structural changes to the south jetty to minimize backpassing of material into the inlet, and identification and use of possible sources of trapped littoral sediments (i.e. floodshoal and north shore) for bypassing to the downdrift beaches.

4) **Implement a comprehensive beach and offshore monitoring program.** Monitor inlet shoals and shoreline change, identify beach placement locations for future bypassing efforts and revalidate the sediment budget The program will be coordinated with monitoring activities associated with the Indian River County shore protection projects.

This plan is based on the findings and recommendations of the Sebastian Inlet Technical Review Committee and comments provided by public agencies and the citizenry of Brevard and Indian River counties. Each implementation action contained in this plan is subject to further evaluation, and subsequent authorization, as part of the Department's environmental permitting and authorization process.

It is the intent of the Department to assist in the implementation of the plan through the provision of funds granted under the Florida Beach Erosion Control Program. The Department's financial obligations shall be contingent upon sufficient legislative appropriations. The level of state funding shall be determined based upon the activity being conducted and Department policy. The Department may choose not to participate financially if the proposed method for implementation is not cost effective or fails to meet the intent of Section 161.142, Florida Statutes.

Nothing in this plan precludes the evaluation and potential adoption of other alternatives or strategies for management at Sebastian Inlet.

APPROVED FOR ADOPTION

Kirby B. Green, Deputy Secretary
Department of Environmental Protection

16 Mar 00
Date

SEBASTIAN INLET MANAGEMENT STUDY
SUMMARY OF FINDINGS REPORT
and
RECOMMENDED IMPLEMENTATION PLAN

Introduction

The Department of Environmental Protection, in conjunction with the Sebastian Inlet Tax District Commission, Brevard County and Indian River County, established a Technical Review Committee ("TRC") to review information and make recommendations as to the adequacy of supporting studies and reports for adoption of an Inlet Management Plan pursuant to Section 161.161, Florida Statutes. The TRC reviewed the 1988 Sebastian Inlet District Comprehensive Management Plan, as amended, and the 1997 Survey-Based Sediment Budget Analysis for Sebastian Inlet.

The findings and recommendations of the TRC have been evaluated by the staff of the Office of Beaches and Coastal as they relate to the Office's statutory responsibilities and program objectives. As a result of that evaluation, the Office has developed a recommended implementation plan to meet those responsibilities and objectives. Adoption of the plan will enable governmental entities to seek financial assistance from the Department for the conduct of management activities authorized in the plan.

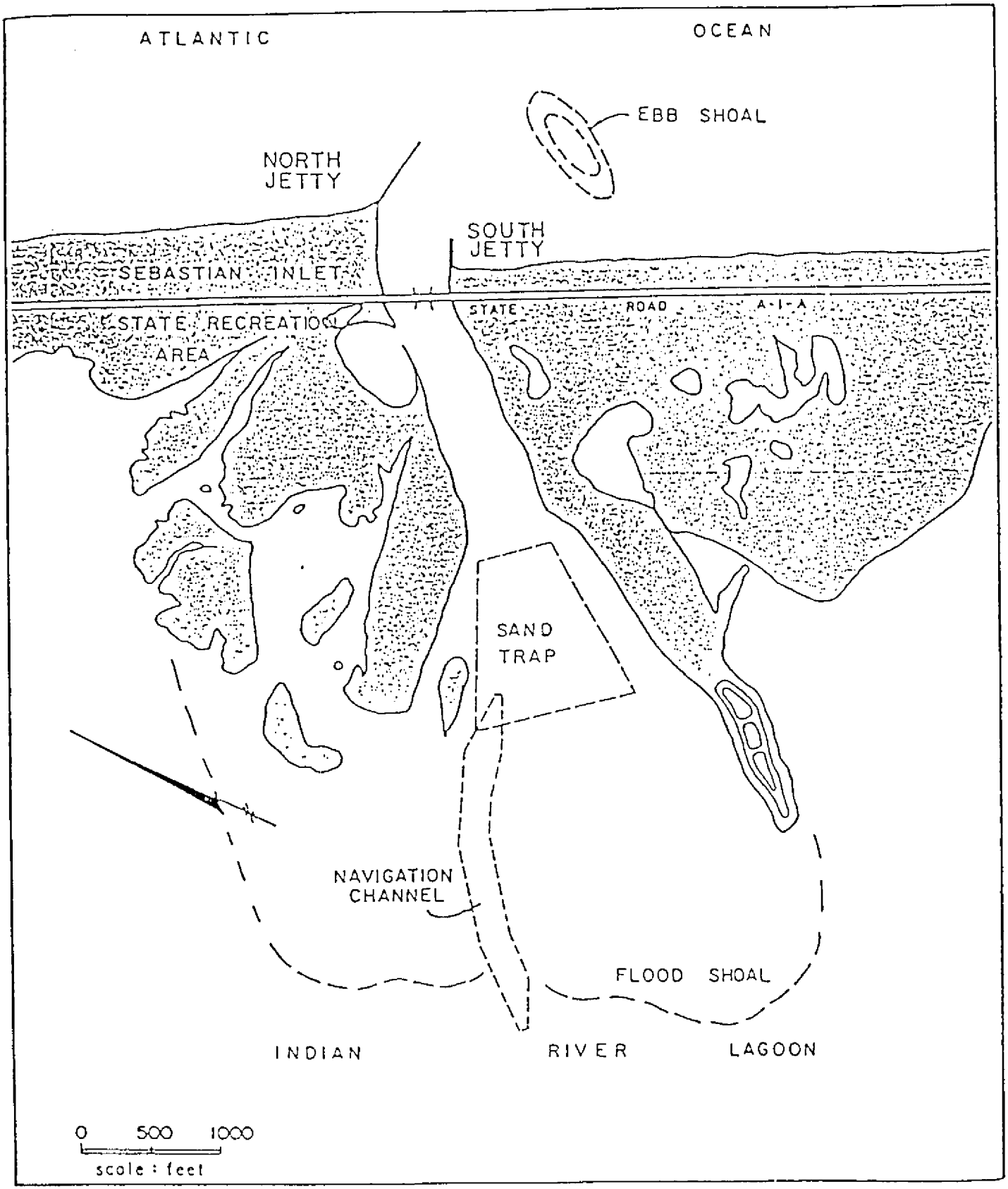
This report contains a brief history of Sebastian Inlet, a summary of the TRC's findings, and recommendations, and the recommended implementation plan.

History of Sebastian Inlet

Sebastian Inlet forms the border between Brevard and Indian Counties. The first attempt to cut a man-made inlet in the Sebastian area was made in 1886, but a hurricane closed the inlet. Since that time, numerous efforts to establish and stabilize the inlet for navigation have occurred over the years resulting in the construction of jetties and a sand trap. The current structural configuration consists of a north jetty approximately 1600 feet in length, and a southern jetty of approximately 1200 feet. The sand trap has a design capacity of 180-190,00 cubic yards (cy).

The inlet channel, sand trap and associated structures are maintained by the Sebastian Inlet Tax District Commission. Maintenance dredging of the channel and sand trap occur periodically, with placement of suitable material on the downdrift beaches located south of the inlet.

Previous studies of the inlet suggest the need to bypass between 70,000 and 75,000 cy of material annually to offset the impacts of the inlet, In an effort to meet the bypassing


ATLANTIC
OCEAN
EBB SHOAL
NORTH JETTY
SOUTH JETTY
SEBASTIAN INLET
STATE ROAD A-1-A
STATE RECREATION AREA
SAND TRAP
NAVIGATION CHANNEL
FLOOD SHOAL
INDIAN RIVER LAGOON
0 500 1000
scale : feet

objective, the District places material from an upland source on the downdrift beaches when sufficient material is not available from the sand trap.

Technical Review Committee Findings and Recommendations

1. Annual Bypassing Volume - Several reference sources reported annual bypassing volumes. There is some variation in the reported bypassing volumes, but most of them consistently report values of 70-75,000 cy/yr. The TRC agreed that a minimum of 70,000 cy/yr should be adopted in the inlet management plan with further refinement to be made following adoption of the Inlet Management Plan (IMP).

2. Flood Shoal - The TRC agreed that further study of long-term effects of the flood shoal on the inlet-related sediment budget should be performed. The position of the TRC was that existing studies do not provide sufficient information to answer questions regarding sand losses to the flood shoal. However, it was agreed that the IMP should move forward for adoption before additional studies are considered.

3. Historic Impacts - The consensus position of the TRC is that identification of the long-term impacts associated with the inlet in terms of impoundment of sand and sediment volume deficit to downdrift areas is incomplete and should be given priority in the implementation phase of the IMP. The TRC acknowledged that there is a high degree of interest from areas downdrift of the inlet with regard to the long-term impact of the inlet. The TRC agreed that there is a lack of sufficient information currently available to establish the long-term inlet impact The TRC agreed that the long-term impact determination would require further study following adoption of the IMP.

4. Area of Inlet Influence - This item is closely linked to item three above. The TRC position is that there is variation in existing numbers and that there is a lack of sufficient analysis and information existing to establish a consensus position on the area of influence. The TRC agreed that this item should be given high priority for determination following adoption of the IMP.

5. Methods of Calculating Sand Budget - The consensus position of the TRC was that continued refinement of the sand budget formulation methodology is desired.

6. Sources of Supplemental Fill - Supplemental sand fill is sand that is placed in addition to the annual sand bypassing needed to maintain the annual sand budget. The supplemental sand would be placed in order to restore eroded beaches downdrift of the inlet. Indian River County is initiating sand search activities for supplemental sand for restoration work with a focus on offshore sand sources. The TRC agreed that cooperative sand search studies should be conducted for the supplemental sand following adoption of the IMP.

7. Sand Bypassing and Placement - Sand bypassing has been performed at Sebastian nlet by either dredging of sand from the Inlet's sand trap and transfer by pipeline or by truck haul to downdrift beaches within the Sebastian Inlet State Recreation Area. The bypassing is per-formed generally on a 2-year cycle rather than on an annual basis, so that larger sand volumes can be transferred in a more economical manner, Currently, the inlet sand trap has a 180-190,000 cy capacity and is dredged when the sand volume reaches 150,000 cy. The TRC agreed that any further consideration of modifications to the inlet sand trap should be a subject of future study. Sand placement utilizing material from the sand trap starts at a distance of 3,000 feet south of the inlet and extends southward. The TRC agreed that sand placement should be in the downdrift area of greatest need within the area of influence of the inlet and be placed in an environmentally sensitive manner.

8. Environmental - The TRC identified and discussed a number of environmental issues relevant to sand management and sand bypassing at Sebastian Inlet. Environmental concerns discussed by the TRC included impacts to nearshore hardbottom areas, nesting marine turtles, dune vegetation, sea grasses, beach mouse habitat, and turbidity impacts. The TRC acknowledged that further environmental studies would likely be required in relation to larger mitigative fill projects or other components of the IMP in the permitting process for those projects, The TRC agreed that no further environmental studies should be required prior to adoption of the IMP.

9. Structural - Technical studies conducted to analyze structural improvements at Sebastian Inlet, particularly studies conducted by the University of Florida for the District, included recommendations to extend the south jetty. A jetty extension would prevent bypassed sand placed on the downdrift beaches from being transported back into the inlet and promote more efficient bypassing. A north jetty extension was also addressed in the studies. The TRC does not support a north jetty extension.

10. Public Resources – The Sebastian Inlet area is heavily used for a number of recreational and public interest activities, including boating, fishing, surfing, etc. The TRC concurred that all public resources associated with the inlet should not be addressed by the TRC or be included in the IMP, but be considered prior to implementation of any IMP components.

Recommended Implementation Plan

The Office of Beaches and Coastal Systems recommends the following implementation plan be adopted to meet the requirements of Chapter 161, Florida Statutes:

1. Continue to bypass suitable sediment to the downdrift beaches. Periodic maintenance dredging activities, including dredging of the channel and sand trap, will be conducted with placement of all beach compatible material on the

downdrift beaches. Supplemental material from alternative sources will be used to meet, or exceed, an average annual placement objective of 70,000 cy. As a first priority, material should be placed on the beach in areas of greatest need based upon a plan approved by the Department. Areas of placement may be further refined based upon results from long term monitoring of the inlet and adjacent beaches. The bypassing objective of 70,000 cy is adopted as an interim measure and will be formally validated or redefined in subsequent revisions of the plan, based on a comprehensive monitoring plan, within 5 years of adoption of the Inlet Management Plan.

2. **Restore the downdrift beaches designated by the Department as experiencing critical erosion.** Downdrift beach restoration will be pursued in conjunction with implementation of shore protection activities under the Indian River County Beach Preservation Plan (IRCBPP) and be considered an integral part of both plans. The restoration of these beaches, as stated in the IRCBPP, will be considered, to meet state objectives for restoration of any possible adverse effects of the inlet. The activities under both plans will jointly maintain the restored shorelines.

3. **Evaluate possible alternatives to facilitate sediment bypassing.** Specific alternatives to be investigated include modifications to the trapping capacity of the sand trap, structural changes to the south jetty to minimize backpassing of material into the inlet, and identification and use of possible sources of trapped littoral sediments (i.e. floodshoal and north shore) for bypassing to the downdrift beaches.

4. **Implement a comprehensive beach and offshore monitoring program.** **Monitor** inlet shoals and shoreline change, identify beach placement locations for future bypassing efforts and revalidate the sediment budget. The program will be coordinated with monitoring activities associated with the Indian River County shore protection projects.

This plan is based on the findings and recommendations of the Sebastian Inlet Technical Review Committee and comments provided by public agencies and the citizenry of Brevard and Indian River counties. Each implementation action contained in this plan is subject to further evaluation, and subsequent authorization, as part of the Department's environmental permitting and authorization process.

It is the intent of the Department to assist in the implementation of the plan through the provision of funds granted under the Florida Beach Erosion Control Program. The Department's financial obligations shall be subject to Department approval and sufficient legislative appropriations. The level of state funding shall be determined based upon the activity being conducted and Department policy. The Department may choose not to participate financially if the proposed method for implementation is not cost effective or fails to meet the intent of Section 16 1.142, Florida Statutes.

Nothing in this plan precludes the evaluation and potential adoption of other alternatives or strategies for management at Sebastian Inlet.

RCRA Corrective Action Environmental Indicator Forms Addendum

SMP Review Completed by: Jennifer Downey, Ron Leach, Ray Saracino	Date: April 18, 2000
RWQCB Review Completed by: Ray Saracino and Frank Dellechaie	Date: January 18, 2000

	"X" all that apply:	
Facility Name: USMC Camp Pendleton (include a.k.a) Street Address: City, State: MCB Camp Pendleton, CA 92055 EPA ID#: CA2 170 023 533	NPL Site?	X
	BRAC Site?	
	GPRA Baseline?	X
	EJ Site?	
	Near-bankrupt?	

Facility Contact Name: Jayne Joy, Program Manager
Company: USMC Camp Pendleton
Street Address: PO Box 555008
City, State: MCB Camp Pendleton, CA 92055-5008
Phone: (760) 725-9751
E-mail:

Agencies Involved in Remedial Oversight (Mark an "x" at the left of the boxes that apply:)

X	DTSC Site Mitigation - Region 4	X	Federal CERCLA	X	RWQCB - Region 9
	DTSC Permit Unit - Region __		Federal RCRA		Other (specify)

Project Manager Interviewed: Sheryl Lauth
Agency: USEPA-CERCLA
Phone: (415) 744-2387
email: lauth.sheryl@epa.gov

Project Manager Interviewed: John Odermatt, and Jody Ebsen
Agency: RWQCB, San Diego
Phone: (858)637-5595
email: oderj@rb9.swrcb.ca.gov; ebsej@rb9.swrcb.ca.gov

Site Summary:

USMC Camp Pendleton (USMC) is the primary amphibious training center on the west coast and is also used as an ammunition depot. The base conducted fuel handling for vehicles and helicopters, various mechanical repair operations that utilized fuels and solvents, and incineration operations. The site is listed on the federal Superfund National Priority List (NPL). Sheryl Lauth is the Superfund remedial project manager. Manny Alonzo is the California Department of Toxic Substances Control Site Mitigation Program (SMP) project manager. John Odermatt is the California Regional Water Quality Control Board (RWQCB) project manager.

The base has a Federal Facility Agreement (FFA) between the DTSC, RWQCB, USEPA and the U.S. Navy that is dated October 1990. The facility had an operating Resource Conservation and Recovery Act (RCRA) permit that was effective up through June 27, 1990. The base consists of 125,000 acres, much of which is very remote. Many areas are closed to traffic because of war game activities and because of the risk from unexploded ordinance (UXO). The base had hundreds of underground storage tanks (USTs), and leakage was the cause of the majority of hydrocarbon contamination. Fuel, polychlorinated biphenyls (PCBs), pesticides, herbicides, solvents, and metals are the major contaminants of concern in soils. There are 45 Comprehensive Environmental Response Compensation and Liability Act (CERCLA) sites on the base that have been identified as requiring further investigations. CERCLA Records of Decision (RODs) have been approved for Operable Units (OU) 1, 2 and 3. The remedial activities for OU3 are currently underway. Removal actions have been completed at Sites 3, and Site 6 and were documented in the OU2 ROD. Contaminated soils were moved to the former base landfill, the Box Canyon landfill, Site 7, which has been designated as a CAMU for all contaminated soils at the base. A ROD amendment is expected for OU3 because the DOD has closed the landfill to remediation waste. There are multiple endangered species resident on the base, including the gnat catcher, least Belle's vireo and pacific pocket mouse. There are also endangered habitats and rare plant areas. The Santa Margarita River runs through the base.

The fourth and fifth Operable Units are for all Installation Restoration (IR) sites with contaminated ground water on base. Remediation in Operable Units 4 and 5 has not begun. The ground water is encountered from 5 to 70 feet below ground surface at most locations on base. volatile organic compounds (VOCs), methyl-tert-buty-ether (MTBE), total petroleum hydrocarbons (TPH), and benzene, toluene, ethyl-benzene and xylene (BTEX) are the major contaminants of concern in ground water. There are dual phase removal systems operating in certain areas of UST releases. Otherwise, there are no other active ground water remedies in operation. The most recent ground water monitoring reports indicate the presence of several feet of free TPH product in areas of UST leakage with up to thousands of parts per billion of VOCs within the CERCLA remediation areas. All drinking water on base is produced from the four ground water basins located within the base.

There are 233 UST sites that are known to be contaminated and are in various stages of investigation and remediation. Approximately 538 USTs have been removed under the oversight of the RWQCB. Releases from USTs have significantly impacted ground water. Contaminated

ground water is known to be impacting one surface water body (Las Flores Creek). Contaminants of concern include BTEX, MTBE and TPH. Several UST locations have had several feet of free floating product.

CA 725 Current Human Exposures Under Control

Current Human Exposures Under Control Determination ("x" appropriate box)		If determination is **NO or IN**, the likelihood of achieving EIs by 2005 is ("x" appropriate box):	
	YES	X	Likely by 2003 (insert year)
X	NO		Unlikely
	IN (Insufficient information)		Difficult to determine
	No determination was made		

If determination is **YES**, it falls under the following categories: ("x" all that apply)		If determination is **NO or IN**, it falls under the following categories: ("x" all that apply)	
	Final stages of C/A		Early stages of C/A
	Stabilization measures implemented		Indoor air issues
	No groundwater contamination		Abandoned, near-bankrupt
	Undergoing redevelopment	X	Technical limitations Please specify (complex hydrogeology, contaminants, large area): *large area*
	Other:		Uncooperative
			Administrative delays
			Other:

For sites with **NO or IN** determinations, provide a description of the next steps which will be taken to achieve the Current Human Exposures EI:

The review team recommends that USMC address the potential for people to be exposed to areas of surface soil contamination. In addition, we recommend that USMC adopt basewide provisions to control exposures to construction workers from contaminated soils and groundwater.

CA750 Migration of Contaminated Groundwater Under Control

Migration of Contaminated Groundwater Under Control ("x" appropriate box)	
	YES
X	NO
	IN (Insufficient information)
	No determination was made

If determination is **NO or IN**, the likelihood of achieving EIs by 2005 is ("x" appropriate box):	
	Likely by__ (insert year)
	Unlikely
X	Difficult to determine

If determination is **YES**, it falls under the following categories ("x" all that apply):	
	Final stages of C/A
	Stabilization measures implemented
	No groundwater contamination
	Undergoing redevelopment
	Other:

If determination is **NO or IN**, it falls under the following categories ("x" all that apply):	
	Early stages of C/A
	GW/SW issues
	Abandoned, near-bankrupt
X	Technical limitations, Please specify (complex hydrogeology, contaminants, large area): *dispute over natural attenuation of ground water as a remedy*
	Uncooperative
	Administrative delays
	Other:

For sites with **NO or IN** determinations, provide a description of the next steps which will be taken to achieve the Migration of Contaminated Groundwater Under Control EI:

A ROD for OUs 4 and 5 (groundwater) is anticipated to be signed in 2003. Although this issue has been disputed, it is anticipated that the OU 4 ROD will include some form of containment for the plumes which are located in drinking water basins. Implementation of this ROD is anticipated by 2004. To eventually meet the GPRA goals, the base must complete the characterization of ground water contamination, investigate the full spectrum of remedies, and implement the approved agency remedy for the OU 4 and OU 5 sites. It may be difficult for the base to achieve the GPRA goals by 2005. We recognize that there are 233 leaking UST sites and that the USMC is addressing them in a prioritized sequence.

EPA/ROD/R09-99/046
1999

EPA Superfund
Record of Decision:

CAMP PENDLETON MARINE CORPS BASE
EPA ID: CA2170023533
OU 03
CAMP PENDLETON, CA
02/11/1999

SFUND RECORDS
3050-00163

SFUND RECORDS
46612

Marine Corps Base Camp Pendleton, California Record of Decision Operable Unit 3

Final
11 February 1999

SOUTHWEST DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
1220 PACIFIC HIGHWAY
SAN DIEGO, CALIFORNIA

INTERNA
TECHNIC
COMPO
2790 MOSSIDE E
MONROEVILLE, I
771529-IT-NPR-0

MARINE CORPS BASE
CAMP PENDLETON, CALIFORNIA
RECORD OF DECISION
OPERABLE UNIT 3

FINAL
11 FEBRUARY 1999

Table of Contents

List of Tables xi

List of Figures xi

List of Appendices xiii

List of Abbreviations/Acronyms xv

1.0 Declaration 1-1

1.1 Site Name and Location 1-1

1.2 Statement of Basis and Purpose 1-3

1.3 Assessment of Operable Unit 3 Sites 1-3

1.4 Description of the Selected Remedy 1-4

1.4.1 Description of Selected Remedy for Sites 1A, 1D, 1E, 1F, and 2A 1-4

1.4.2 Description of Selected Remedy for Site 7 1-5

1.4.3 Description of Selected Remedy for Sites 1B, 1C, 1I, 2C, 2D, 2F, 2G, 10, 16, 17, 18, 27, 32, 34, 35, 36, 37, 38, 39, 40, 41, and 42 1-5

1.5 Statutory Determinations for Sites 1A, 1D, 1E, 1F, 2A, and 7 1-6

1.6 Declaration Statement - No Action Necessary for Protection for Sites 1B, 1C, 1I, 2C, 2D, 2F, 2G, 10, 16, 17, 18, 27, 32, 34, 35, 36, 37, 38, 39, 40, 4 1, and 42 . . . 1-6

2.0 Decision Summary 2-1

2.1 Site Name, Location, and Description 2-1

2.2 Highlights of Community Participation 2-1

2.3 Scope and Role of Operable Unit 3 2-2

2.4 Remedial Action Selected for Sites 1A, 1D, 1E, 1F, and 2A 2-2

2.4.1 Site 1 - Refuse Burning Grounds 2-3

2.4.1.1 Site Name, Location, and Description - Sites 1A, 1D, 1E, and 1F . . 2-3

2.4.1.2 Site History and Enforcement Activities - Sites 1A, 1D, 1E, and 1F 2-4

2.4.1.3 Summary of Site Characteristics 2-4

2.4.1.3.1 Site 1A - Refuse Burning Ground in 14 Area 2-5

2.4.1.3.2 Site 1D - Refuse Burning Ground in 20 Area 2-8

2.4.1.3.3 Site 1E - Refuse Burning Ground in 32 Area 2-10

2.4.1.3.4 Site 1F - Refuse Burning Ground in 43 Area 2-13

2.4.1.4 Summary of Site Risks 2-14

2.4.1.4.1 Site 1A -Refuse Burning Ground in 14 Area 2-19

2.4.1.4.2 Site 1D - Refuse Burning Ground in 20 Area 2-24

2.4.1.4.3 Site 1E - Refuse Burning Ground in 32 Area 2-26
2.4.1.4.4 Site 1F - Refuse Burning Ground in 43 Area 2-28
2.4.2 Site 2A - Grease Disposal Pit in 14 Area 2-31
2.4.2.1 Site Name, Location, and Description 2-31
2.4.2.2 Site History and Enforcement Activities 2-32
2.4.2.3 Summary of Site Characteristics 2-32
2.4.2.3.1 Geology and Hydrogeology 2-33
2.4.2.3.2 Soil Results 2-33
2.4.2.4 Summary of Risks Associated with Site 2A 2-34
2.4.2.4.1 Human Health Risk Characterization 2-34
2.4.2.4.2 Ecological Risk Assessment 2-35
2.4.3 Description of Alternatives - Sites 1A, 1D, 1E, 1F, and 2A 2-37
2.4.3.1 Alternative 1: No Action 2-37
2.4.3.2 Alternative 2: Excavation/Removal and On-Base Disposal. 2-38
2.4.3.3 Alternative 3: Excavation/Removal and Off-Base Disposal 2-39
2.4.4 Summary of Comparative Analysis of Alternatives - Sites 1A, 1D, 1E, 1F, and 2A 2-39
2.4.4.1 Threshold Criteria 2-40
2.4.4.1.1 Overall Protection of Human Health and the Environment 2-40
2.4.4.1.2 Compliance with ARARs. 2-40
2.4.4.2 Primary Balancing Criteria 2-41
2.4.4.2.1 Long-Term Effectiveness and Permanence 2-41
2.4.4.2.2 Reduction of Toxicity, Mobility, and Volume Through Treatment 2-41
2.4.4.2.3 Short-Term Effectiveness 2-41
2.4.4.2.4 Implementability 2-42
2.4.4.2.5 Cost 2-42
2.4.4.3 Modifying Criteria 2-43
2.4.4.3.1 State Acceptance 2-43
2.4.4.3.2 Community Acceptance 2-43
2.4.5 Selected Remedy for OU3 Sites 1A, 1D, 1E, 1F, and 2A. 2-43

2.4.6 Statutory Determinations 2-46
2.4.6.1 Protection of Human Health and the Environment 2-47
2.4.6.2 Compliance with Applicable or Relevant and Appropriate Requirements 2-47
2.4.6.3 Cost-Effectiveness 2-47
2.4.6.4 Use of Permanent Solutions and Alternative Treatment Technologies to the Extent Practicable 2-47
2.5 Remedial Action Selected for Site 7 - Box Canyon Landfill 2-48
2.5.1 Site Name, Location, and Description - Site 7 2-48
2.5.2 Site History and Enforcement Activities 2-49
2.5.3 Summary of Site Characteristics 2-49
2.5.3.1 Geology and Hydrogeology 2-50
2.5.3.2 Soil Results 2-53
2.5.3.3 Groundwater Results 2-53
2.5.3.4 Ambient Air and Soil Gas Results 2-55
2.5.4 Summary of Site Risks - Site 7 2-56
2.5.4.1 Human Health Risk Characterization 2-56
2.5.4.2 Ecological Risk Assessment 2-57
2.5.5 Description of Alternatives - Site 7 2-57
2.5.6 Summary of Comparative Analysis of Alternatives - Site 7 2-58
2.5.6.1 Overall Protection of Human Health and the Environment and Compliance with ARARs 2-58
2.5.6.2 Long-Tenn Effectiveness and Permanence 2-58
2.5.6.3 Reduction of Toxicity, Mobility, and Volume Through Treatment 2-59
2.5.6.4 Short-Term Effectiveness 2-59
2.5.6.5 Implementability 2-59
2.5.6.6 Cost 2-59
2.5.6.7 State Acceptance 2-60
2.5.6.8 Community Acceptance 2-60
2.5.7 Selected Remedy for Site 7 2-60
2.5.8 Statutory Determinations 2-63
2.5.8.1 Protection of Human Health and the Environment 2-63

2.5.8.2 Compliance with Applicable or Relevant and Appropriate Requirements 2-63
2.5.8.3 Cost-Effectiveness 2-63
2.5.8.4 Use of Permanent Solutions and Alternative Treatment Technologies to the Extent Practicable 2-64
2.6 No Action Selected for Sites 1B, 1C, 1G, 1I, 2C, 2D, 2F, 2G, 10, 16, 17, 18, 27, 32. 34, 35, 36, 37, 38, 39, 40, 41, and 42 2-64
2.6.1 Site 1B - Refuse Burning Ground in 11 Area 2-65
2.6.1.1 Site Name, Location, and Description 2-65
2.6.1.2 Site History and Enforcement Activities 2-65
2.6.1.3 Summary of Site Characteristics 2-65
2.6.1.3.1 Geology and Hydrogeology 2-66
2.6.1.3.2 Soil Results 2-66
2.6.1.4 Summary of Risks Associated with Site 1B 2-66
2.6.1.4.1 Human Health Risk Characterization 2-67
2.6.1.4.2 Ecological Risk Assessment 2-67
2.6.1.5 Description of the No Action Alternative 2-68
2.6.2 Site 1C - Refuse Burning Ground in 13 Area 2-68
2.6.2.1 Site Name, Location, and Description 2-68
2.6.2.2 Site History and Enforcement Activities 2-69
2.6.2.3 Summary of Site Characteristics 2-69
2.6.2.3.1 Geology and Hydrogeology 2-70
2.6.2.3.2 Soil Results 2-70
2.6.2.4 Summary of Risks Associated with Site 1C 2-71
2.6.2.4.1 Human Health Risk Characterization 2-71
2.6.2.4.2 Ecological Risk Assessment 2-72
2.6.2.5 Description of the No Action Alternative 2-72
2.6.3 Site 1I - Refuse Burning Ground in 63 Area 2-72
2.6.3.1 Site Name, Location, and Description 2-72
2.6.3.2 Site History and Enforcement Activities 2-73
2.6.3.3 Summary of Site Characteristics 2-74

2.6.3.3.1 Geology and Hydrogeology 2-74
2.6.3.3.2 Soil Results 2-74
2.6.3.4 Summary of Risks Associated with Site 11 2-75
2.6.3.4.1 Human Health Risk Characterization 2-75
2.6.3.4.2 Ecological Risk Assessment 2-76
2.6.3.5 Description of the No Action Alternative 2-76
2.6.4 Site 2C - Grease Disposal Pit in 33 Area 2-77
2.6.4.1 Site Name, Location, and Description 2-77
2.6.4.2 Site History and Enforcement Activities 2-78
2.6.4.3 Summary of Site Characteristics 2-78
2.6.4.3.1 Geology and Hydrogeology 2-78
2.6.4.3.2 Soil Results 2-79
2.6.4.4 Summary of Risks Associated with Site 2C 2-81
2.6.4.4.1 Human Health Risk Characterization 2-81
2.6.4.4.2 Ecological Risk Assessment 2-82
2.6.4.5 Description of the No Action Alternative 2-83
2.6.5 Site 2D - Grease Disposal Pit in 43 Area 2-83
2.6.5.1 Site Name, Location, and Description 2-83
2.6.5.2 Site History and Enforcement Activities 2-84
2.6.5.3 Summary of Site Characteristics 2-84
2.6.5.3.1 Geology and Hydrogeology 2-84
2.6.5.3.2 Soil Results 2-85
2.6.5.3.3 Groundwater Results 2-85
2.6.5.3.4 Ecological Results 2-85
2.6.5.3.5 Summary 2-86
2.6.5.4 Summary of Risks Associated with Site 2D 2-86
2.6.5.4.1 Human Health Risk Characterization 2-86
2.6.5.4.2 Ecological Risk Assessment 2-88
2.6.5.5 Description of the No Action Alternative 2-88
2.6.6 Site 2F - Grease Disposal Pit in 62 Area 2-89
2.6.6.1 Site Name, Location, and Description 2-89

2.6.6.2 Site History and Enforcement Activities 2-90
2.6.6.3 Summary of Site Characteristics 2-90
2.6.6.3.1 Geology and Hydrogeology 2-90
2.6.6.3.2 Soil Results 2-91
2.6.6.4 Summary of Risks Associated with Site 2F 2-92
2.6.6.4.1 Human Health Risk Characterization 2-92
2.6.6.4.2 Ecological Risk Assessment 2-93
2.6.6.5 Description of the No Action Alternative 2-94
2.6.7 Site 2G - Grease Disposal Pit in 31 Area 2-94
2.6.7.1 Site Name, Location, and Description 2-94
2.6.7.2 Site History and Enforcement Activities 2-95
2.6.7.3 Summary of Site Characteristics 2-95
2.6.7.3.1 Geology and Hydrogeology 2-95
2.6.7.3.2 Soil Results 2-96
2.6.7.3.3 Groundwater Results 2-96
2.6.7.3.4 Summary 2-96
2.6.7.4 Summary of Risks Associated with Site 2G 2-96
2.6.7.4.1 Human Health Risk Characterization 2-97
2.6.7.4.2 Ecological Risk Assessment 2-97
2.6.7.5 Description of the No Action Alternative 2-98
2.6.8 Site 10 - 26 Area Sewage Sludge Composting Yard 2-99
2.6.8.1 Site Name, Location, and Description 2-99
2.6.8.2 Site History and Enforcement Activities 2-100
2.6.8.3 Summary of Site Characteristics 2-100
2.6.8.3.1 Geology and Hydrogeology 2-101
2.6.8.3.2 Soil Results 2-102
2.6.8.3.3 Groundwater Results 2-103
2.6.8.3.4 Biota Results 2-104
2.6.8.3.5 Summary 2-104
2.6.8.4 Summary of Risks Associated with Site 10 2-104
2.6.8.4.1 Human Health Risk Characterization 2-104

2.6.8.4.2 Ecological Risk Assessment 2-106
2.6.8.5 Description of the No Action Alternative 2-107
2.6.9 Site 16 - 22 Area Buildings 22151 and 22187 Ditch Confluence and Ditch 2-108
2.6.9.1 Site Name, Location, and Description 2-108
2.6.9.2 Site History and Enforcement Activities 2-109
2.6.9.3 Summary of Site Characteristics 2-110
2.6.9.3.1 Geology and Hydrogeology 2-110
2.6.9.3.2 Soil Results 2-111
2.6.9.3.3 Groundwater Results 2-113
2.6.9.3.4 Surface-Water and Sediment Results 2-113
2.6.9.3.5 Biota Results 2-113
2.6.9.4 Summary of Risks Associated with Site 16 2-114
2.6.9.4.1 Human Health Risk Characterization 2-114
2.6.9.4.2 Ecological Risk Assessment 2-115
2.6.9.5 Description of the No Action Alternative 2-118
2.6.10 Site 17 - 22 Area Building 22187 Marsh and Ditch 2-118
2.6.10.1 Site Name, Location, and Description 2-118
2.6.10.2 Site History and Enforcement Activities 2-119
2.6.10.3 Summary of Site Characteristics 2-120
2.6.10.3.1 Geology and Hydrogeology 2-120
2.6.10.3.2 Surface-Water and Sediment Results 2-121
2.6.10.4 Summary of Risks Associated with Site 17 2-121
2.6.10.5 Description of the No Action Alternative 2-123
2.6.11 Site 18 - 13/16 Area Building 1687 Spill and Ditch 2-123
2.6.11.1 Site Name, Location, and Description 2-123
2.6.11.2 Site History and Enforcement Activities 2-124
2.6.11.3 Summary of Site Characteristics 2-124
2.6.11.3.1 Geology and Hydrogeology 2-124
2.6.11.3.2 Soil Results 2-125
2.6.11.4 Summary of Risks Associated with Site 18 2-125
2.6.11.4.1 Human Health Risk Characterization 2-126

2.6.11.4.2 Ecological Risk Assessment 2-127
2.6.11.5 Description of the No Action Alternative 2-127
2.6.12 Site 27 - 22 Area Ditches Behind Building 22210 2-128
2.6.12.1 Site Name, Location, and Description 2-128
2.6.12.2 Site History and Enforcement Activities 2-129
2.6.12.3 Summary of Site Characteristics 2-129
2.6.12.3.1 Geology and Hydrogeology 2-130
2.6.12.3.2 Surface-Water and Sediment Results 2-130
2.6.12.3.3 Biota Results 2-131
2.6.12.4 Summary of Risks Associated with Site 27 2-131
2.6.12.4.1 Human Health Risk Characterization 2-131
2.6.12.4.2 Ecological Risk Assessment 2-131
2.6.12.5 Description of the No Action Alternative 2-133
2.6.13 Site 32 - Drum Storage Area and Drainage Between Buildings 41303
and 41366 2-133
2.6.13.1 Site Name, Location, and Description 2-133
2.6.13.2 Site History and Enforcement Activities 2-134
2.6.13.3 Summary of Site Characteristics 2-135
2.6.13.3.1 Geology and Hydrogeology 2-135
2.6.13.3.2 Soil Results 2-136
2.6.13.3.3 Groundwater Results 2-136
2.6.13.3.4 Summary 2-136
2.6.13.4 Summary of Risks Associated with Site 32 2-137
2.6.13.4.1 Human Health Risk Characterization 2-137
2.6.13.4.2 Ecological Risk Assessment 2-138
2.6.13.5 Description of the No Action Alternative 2-139
2.6.14 Site 34 - Combat Engineers Maintenance Facility, Buildings 62580-62583 2-139
2.6.14.1 Site Name, Location, and Description 2-139
2.6.14.2 Site History and Enforcement Activities 2-140
2.6.14.3 Summary of Site Characteristics 2-141
2.6.14.3.1 Geology and Hydrogeology 2-141

2.6.14.3.2 Soil Results 2-141
2.6.14.3.3 Groundwater Results 2-142
2.6.14.3.4 Summary 2-142
2.6.14.4 Summary of Risks Associated with Site 34 2-143
2.6.14.4.1 Human Health Risk Characterization 2-143
2.6.14.4.2 Ecological Risk Assessment 2-145
2.6.14.5 Description of the No Action Alternative 2-146
2.6.15 Site 35 - Former Sewage Treatment Plant Facility in 25 Area 2-146
2.6.15.1 Site Name, Location, and Description 2-146
2.6.15.2 Site History and Enforcement Activities 2-147
2.6.15.3 Summary of Site Characteristics 2-148
2.6.15.3.1 Geology and Hydrogeology 2-148
2.6.15.3.2 Soil Results 2-149
2.6.15.3.3 Groundwater Results 2-150
2.6.15.4 Summary of Risks Associated with Site 35 2-151
2.6.15.4.1 Human Health Risk Characterization 2-151
2.6.15.4.2 Ecological Risk Assessment 2-151
2.6.15.5 Description of the No Action Alternative 2-152
2.6.16 Site 36 - Debris Pile Area Behind Ponds at Sewage Treatment Plant 11 2-153
2.6.16.1 Site Name, Location, and Description 2-153
2.6.16.2 Site History, Enforcement Activities, and Site Characteristics 2-153
2.6.16.3 Summary of Risks Associated with Site 36 2-154
2.6.16.4 Description of the No Action Alternative 2-154
2.6.17 Site 37 - Pesticide- and POL-Handling Areas at San Clemente Ranch 2-154
2.6.17.1 Site Name, Location, and Description 2-154
2.6.17.2 Site History and Enforcement Activities 2-155
2.6.17.3 Summary of Site Characteristics 2-156
2.6.17.3.1 Geology and Hydrogeology 2-156
2.6.17.3.2 Soil Results 2-156
2.6.17.3.3 Groundwater Results 2-157
2.6.17.3.4 Summary 2-158

2.6.17.4 Summary of Risks Associated with Site 37 2-158
2.6.17.4.1 Human Health Risk Characterization 2-158
2.6.17.4.2 Ecological Risk Assessment 2-160
2.6.17.5 Description of the No Action Alternative 2-160
2.6.18 Sites 38, 39, 41, and 42 2-161
2.6.18.1 Site Name, Location, Description, and History 2-161
2.6.18.2 Summary of Site Characteristics 2-162
26.18.3 Summary of Risks Associated with Sites 38, 39, 41, and 42 2-162
2.6.18.4 Description of the No Action Alternative 2-163
2.6.19 Site 40 - 13 Area Sewer Line, Building 13103 2-163
2.6.19.1 Site Name, Location, and Description 2-163
2.6.19.2 Site History and Enforcement Activities 2-164
2.6.19.3 Summary of Site Characteristics 2-165
2.6.19.3.1 Geology and Hydrogeology 2-165
2.6.19.3.2 Analytical Results 2-165
2.6.19.4 Summary of Risks Associated with Site 40 2-165
2.6.19.4.1 Human Health Risk Characterization 2-166
2.6.19.4.2 Ecological Risk Assessment 2-166
2.6.19.5 Description of the No Action Alternative 2-167
3.0 Responsiveness Summary 3-1
4.0 References 4-1

List of Tables

Table	Title
2-1	Remedial Action Goals for Soil at Sites 1A, 1D, 1E, 1F, and 2A

List of Figures

Figure	Title
1-1	Location Map
1-2	Locations of Base Areas and Operable Unit 3 Sites
2-1	Site 1A - Refuse Burning Ground in 14 Area, Summary of Soil and Groundwater Analytical Results
2-2	Site 1D - Refuse Burning Ground in 20 Area, Summary of Soil and Groundwater Analytical Results
2-3	Site 1E - Refuse Burning Ground in 32 Area, Summary of Soil Analytical Results
2-4	Site 1F- Refuse Burning Ground in 43 Area, Summary of Soil and Groundwater Analytical Results
2-5	Site 2A - Grease Disposal Pit in 14 Area, Summary of Soil Analytical Results
2-6	Site 1A - Refuse Burning Ground in 14 Area, Excavation Area
2-7	Site 1D - Refuse Burning Ground in 20 Area, Excavation Area
2-8	Site 1E - Refuse Burning Ground in 20 Area, Excavation Area
2-9	Site 1F - Refuse Burning Ground in 43 Area, Excavation Area
2-10	Site 2A - Grease Disposal Pit in 14 Area, Excavation Area
2-11	Site 7 - Box Canyon Landfill Soil and Groundwater Sample Locations and Summary of Groundwater Analytical Results
2-12	Site 7 - Evapotranspiration Cover System Profile
2-13	Site 1B - Refuse Burning Ground in 11 Area, Summary of Soil Analytical Results

2-14	Site 1C - Refuse Burning Ground in 13 Area, Summary of Soil Analytical Results
2-15	Site 11 - Refuse Burning Ground in 63 Area, Summary of Soil Analytical Results
2-16	Site 2C - Grease Disposal Pit in 33 Area, Summary of Soil Analytical Results
2-17	Site 2D - Grease Disposal Pit in 43 Area, Summary of Soil and Groundwater Analytical Results
2-18	Site 2F - Grease Disposal Pit in 62 Area, Summary of Soil Analytical Results
2-19	Site 2G - Grease Disposal Pit in 31 Area, Summary of Soil and Groundwater Analytical Results
2-20	Site 10 - 26 Area Sewage Sludge Composting Yard, Summary of Soil and Groundwater Analytical Results for Human Health
2-21	Site 10 - 26 Area Sewage Sludge Composting Yard, Summary of Soil Analytical Results with Ecological Hazard Quotients ≥ 1.0
2-22	Site 16 - 22 Area Buildings 22151 and 22187 Ditch Confluence and Ditch, Summary of Soil Analytical Results for Human Health
2-23	Site 16 - 22 Area Buildings 22151 and 22187 Ditch Confluence and Ditch, Summary of Soil, Sediment, and Surface-Water Analytical Results with Ecological Hazard Quotients ≥ 1.0
2-24	Site 17 - 22 Area Building 22187 Marsh and Ditch, Summary of Surface-Water and Sediment Analytical Results with Ecological Hazard Quotients ≥ 1.0
2-25	Site 18 - 13/16 Area Building 1687 Spill and Ditch, Summary of Soil Analytical Results
2-26	Site 27 - 22 Area Ditches Behind Building 22210, Summary of Surface-Water and Sediment Analytical Results with Ecological Hazard Quotients ≥ 1.0
2-27	Site 32 - Drum Storage Area and Drainage Between Buildings 41303 and 41366, Summary of Soil and Groundwater Analytical Results
2-28	Site 34 - Combat Engineers Maintenance Facility, Building 62580-62583, Summary of Soil and Groundwater Analytical Results

List of Figures (continued)

2-29	Site 34 - Combat Engineers Maintenance Facility, Buildings 62580-62583, Summary of Soil Analytical Results with Hazard Quotients ≥ 1.0
2-30	Site 35 - Former Sewage Treatment Plant Facility in 25 Area, Summary of Soil and Groundwater Analytical Results
2-31	Site 36 - Debris Pile Area Behind Ponds at Sewage Treatment Plant 11, Summary of Soil Analytical Results
2-32	Site 37 - Pesticide- and POL-Handling Areas at San Clemente Ranch, Summary of Soil and Groundwater Analytical Results
2-33	Site 38 - 52 Area Sewer Line, Building 52188. Summary of Soil Analytical Results
2-34	Site 39 - 41 Area Sewer Line, Buildings 41300 and 41346, Summary of Soil Analytical Results
2-35	Sites 41 and 42 - 13 Area Sewer Lines, Summary of Soil Analytical Results
2-36	Site 40 - 13 Area Sewer Line, Building 13103, Summary of Soil Analytical Results

List of Appendices

Appendix A	Transcript of the Public Meeting
Appendix B	Applicable or Relevant and Appropriate Requirements
Appendix C	Administrative Record Index

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List of Abbreviations/Acronyms

APCD	Air Pollution Control District
AC/S,ES	Assistant Chief of Staff, Environmental Security
ARAR	Applicable or Relevant and Appropriate Requirement
AWQC	Aquatic Water-Quality Criteria
Cal/EPA	California Environmental Protection Agency
Cal/OSHA	California Occupational Safety and Health Administration
CAMU	Corrective Action Management Unit
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
COC	Chemical of Concern
COEC	Chemical of Ecological Concern
COPC	Chemical of Potential Concern
COPEC	Chemical of Potential Ecological Concern
CRDL	Contract Required Detection Limit
DCA	Dichloroethane
DCE	Dichloroethene
DDD	Dichlorodiphenyldichloroethene
DDE	Dichlorodiphenylethene
DDT	Dichlorodiphenyltrichloroethene
DI WET	Deionized Water Waste Extraction Test
DLM	Designated Level Methodology
DTSC	Department of Toxic Substances Control
EcoRA	Ecological Risk Assessment
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U.S. Environmental Protection Agency
FFA	Federal Facility Agreement
FID	Flame-Ionization Detector
FS	Feasibility Study
HEAST	Health Effects Assessment Summary Tables

HHRA	Human Health Risk Assessment
HI	Hazard Index
HpCDD	Heptachlorodibenzo-dioxins
HpCDF	Heptachlodibenzofuran
HQ	Hazard Quotient
HxCDD	Hexachlorodibenzo-p-dioxins
IAS	Initial Assessment Study
IDL	Instrument Detection Limit
ILCR	Incremental Lifetime Cancer Risk
IRIS	Integrated Risk Information System
IRP	Installation Restoration Program
Jacobs	Jacobs Engineering Group Inc.
LUFT	Leaking Underground Fuel Tank
MCAS	Marine Corp Air Station
MCB	Marine Corps Base
MCL	Maximum Contaminant Level (Federal or State)
MCTSSA	Marine Corps Tactical System Support Activity
mg/dl	Milligrams per Deciliter
mg/kg	Milligrams per Kilogram
mg/kg-day	Milligrams per Kilogram per Day
mg/l	Milligrams per Liter
msl	Mean Sea Level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEESA	Naval Energy and Environmental Support Activity (currently NFESC)
NOAEL	No Observed Adverse Effect Level
NPL	National Priorities List
OU	Operable Unit

PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethene
PCP	Pentachlorophenol
PLE	Preliminary Limit of Exposure
POL	Petroleum, Oil, and Lubricants
PPE	Personal Protective Equipment
ppm	Parts per Million
PR	Preliminary Review
PRG	Preliminary Remediation Goal
RAGS	Remedial Action Guidance for Superfund
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RfD	Reference Dose
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RME	Reasonable Maximum Exposure
ROD	Record of Decision
RWQCB	California Regional Water Quality Control Board
SARA	Superfund Amendments and Reauthorization Act of 1986
SCS	Soil Conservation Service
SF	Slope Factor
SPLP	Synthetic Precipitation Leaching Procedure
SV	Sampling Visit
SVOC	Semivolatile Organic Compound
SWDIV	Southwest Division Naval Facilities Engineering Command
SWRCB	California State Water Resources Control Board

TAL	Target Analyte List
TCA	Trichloroethane
TCE	Trichloroethene
TCLP	Total Concentration Leaching Procedure
TPH	Total Petroleum Hydrocarbons
TSS	Total Suspended Solids
TVH	Total Volatile Hydrocarbons
UCL	Upper Confidence Limit
UST	Underground Storage Tank
VOC	Volatile Organic Compound
μg/kg	Micrograms per Kilogram
μg/l	Micrograms per Liter

1.0 Declaration

This Record of Decision (ROD) addresses 28 sites that constitute Operable Unit (OU) 3 at Marine Corps Base (MCB) Camp Pendleton, California.

1.1 Site Name and Location

MCB Camp Pendleton is located along the Pacific coast, about halfway between Los Angeles and San Diego (Figure 1-1). The vast majority of the base is within San Diego County, and a small portion of the northwest corner of the base is in Orange County.

Installation Restoration Program (IRP) sites at MCB Camp Pendleton were assigned to one of four groups (A, B, C, and D) during the investigation phase according to potential impact to human health and the environment. Group A sites were believed to have the highest potential for such impact; Group D sites have the lowest. OU3 includes the following sites from Groups B, C, and D:

- Group B: Site 7 soil and groundwater
- Group C: Sites 1D, 1E, 2A, 10, and 35 soil and groundwater; Sites 16 and 27 soil; and Site 17 sediment and surface water
- Group D: Sites 1A, 1B, 1C, 1F, 1I ,2C, 2D, 2F, 2G, 18, 32, 34, 36, 37, 38, 39, 40, 41, and 42 soil and groundwater.

The base is divided into 35 major area designations for location of base activities. The OU3 sites are located in various areas throughout the base, as shown in Figure 1-2. The OU3 site names are as follows:

- Site 1A - Refuse Burning Ground in 14 Area
- Site 1B - Refuse Burning Ground in 11 Area
- Site 1C - Refuse Burning Ground in 13 Area
- Site 1D - Refuse Burning Ground in 20 Area
- Site 1E - Refuse Burning Ground in 32 Area

- Site 1F - Refuse Burning Ground in 43 Area
- Site 1I - Refuse Burning Ground in 63 Area
- Site 2A - Grease Disposal Pit in 14 Area
- Site 2C - Grease Disposal Pit in 33 Area
- Site 2D - Grease Disposal Pit in 43 Area
- Site 2F - Grease Disposal Pit in 62 Area
- Site 2G - Grease Disposal Pit in 31 Area
- Site 7 - Box Canyon Landfill
- Site 10 - 26 Area Sewage Sludge Composting Yard
- Site 16 - 22 Area Buildings 22151 and 22187 Ditch Confluence and Ditch
- Site 18 - 22 Area Building 22187 Marsh and Ditch
- Site 19 - 13/16 Area Building 1687 Spill and Ditch
- Site 27 - 22 Area Ditches Behind Building 22210
- Site 32 - Drum Storage Area and Drainage Between Buildings 41303 and 41366
- Site 34 - Combat Engineers Maintenance Facility, Buildings 62580-62583
- Site 35 - Former Sewage Treatment Plant Facility in 25 Area
- Site 36 - Debris Pile Area Behind Ponds at Sewage Treatment Plant II
- Site 37 - Pesticide- and POL-Handling Areas at San Clemente Ranch
- Site 38 - 52 Area Sewer Line, Building 52188
- Site 39 - 41 Area Sewer Line, Buildings 41300 and 41346
- Site 40 - 13 Area Sewer Line, Building 13103
- Site 41 - 13 Area Sewer Line, Building 13128
- Site 42 - 13 Area Sewer Line, Building 13129.

Sites 1G, 2E, 29, 1H, and 30 were also originally included in OU3 in accordance with the Federal Facility Agreement (FFA) (U.S. Environmental Protection Agency [EPA], 1990a; as amended). Site 1G is part of Site 14 - San Onofre Landfill, an active disposal facility that was removed from the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process. Therefore, Site IG was also removed from the CERCLA process and will be addressed with Site 14 under the State's landfill program. Site 2E - Grease Disposal Pit in 53 Area, could not be located during surveying, historical aerial photograph surveys, or during field reconnaissance. If in the future Site 2E is located, it will be addressed as a new site. Site 29 - 25 Area Skeet Range, is an active facility and no plans have been made for its closure. Site 29 has been excluded from CERCLA in an amendment to the FFA (EPA, 1998) and will be addressed in accordance with the Department of Defense range rule, which is in draft form and is currently available for public comment. Site 1H - Refuse Burning Ground in 62 Area and Site 30 - Firing

Range Soil Fill in 31 Area have been moved to OU4 in order to further address site-specific technical issues.

1.2 Statement of Basis and Purpose

This decision document presents the selected remedial actions for Sites 1A, 1D, 1E, 1F, 2A, and 7. In addition, this document sets forth the basis for the no action decisions for Sites 1B, 1C, 1I, 2C, 2D, 2F, 2G, 10, 16, 17, 18, 27, 32, 34, 35, 36, 37, 38, 39, 40, 41, and 42. The actions selected for these sites were chosen in accordance with CERCLA 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

The decisions for these sites are based on the information contained in the administrative record file for MCB Camp Pendleton. The primary documents used for the basis of the decisions are the remedial investigation (RI) report for Group C sites (1 November 1996), the RI for Group D sites (16 July 1997), and the RI and feasibility study (FS) report for OU3 (12 December 1997).

The U.S. Marine Corps, the EPA, the Department of Toxic Substances Control (DTSC) and the San Diego Regional Water Quality Control Board (RWQCB) of the California Environmental Protection Agency (Cal/EPA) concur with the selected remedy for each OU3 site.

1.3 Assessment of Operable Unit 3 Sites

In accordance with the EPA's *Interim Final Guidance on Preparing Superfund Decision Documents* (EPA, 1989a), this assessment section applies only to Sites 1A, 1D, 1E, 1F, 2A, and 7 and not to the sites in this ROD requiring no further action.

If Sites 1A, 1D, 1E, 1F, 2A, and 7 are not addressed by implementing the response actions selected in this ROD, actual or threatened releases of hazardous substances from these sites could present current or potential future threats to the public health, welfare, or the environment.

1.4 Description of the Selected Remedy

RI sites at MCB Camp Pendleton were separated into four groups (Groups A, B, C, and D) for investigation based on potential impact to human health and the environment. As investigations were completed, sites were grouped into OUs for selection of cleanup alternatives. The ROD for OU1 was signed in December 1995 and addresses the selected remedies for soil and groundwater at Site 9, soil at Site 4/4A, and soil and groundwater at Site 24, all of which are Group A Sites. The ROD for OU2 was signed in September 1997 and includes 13 Group A, Group B, and Group C sites. These sites include Sites 2B and 31 soil; Sites 28 and 43 groundwater; Site 3 soil, sediment, and surface water; Site 5 soil and groundwater; Sites 19, 20, and 22 soil, sediment, groundwater, and surface water; Sites 8A and 44 sediment and surface water; and Sites 6 and 45 soil, sediment, and surface water.

This ROD addresses the remedies for OU3, which includes sites from Groups B, C, and D, as listed in Section 1.1. Descriptions of the selected remedies for OU3 sites are presented in the following sections.

1.4.1 Description of Selected Remedy for Sites 1A, ID, 1E, 1F, and 2A

The same remedy, excavation and on-base disposal, was selected for Sites 1A, 1D, 1E, 1F, and 2A. The major components of the selected remedy are as follows:

- Excavation of contaminated soils; for ecological concerns the maximum excavation depth is 5 feet and for human health concerns the maximum excavation depth is 10 feet.

- Confirmation sampling on bottom and side walls of excavation in accordance with EPA guidance Methods for Evaluating the Attainment of Cleanup Standards, Volume I: Soils and Media, PB89-234959.

- Transportation to and disposal of soil that meets the technical and legal requirements (i.e., specified in 40 CFR 264.552[c]) at an on-basc landfill, IR Site 7 - Box Canyon Landfill, a designated CAMU

- Backfilling, of the excavation with clean soil upon confirmation that cleanup goals have been met; if goals have not been met at the maximum excavation depths. i.e., 5 feet for ecological concerns and 10 feet for human health concerns, 5 or 10 feet of clean fill will be placed as relevant.

- Site regrading and revegetating.

The low-level threats posed by the contaminants at the sites specified are addressed by removing the contaminated soils and/or eliminating the exposure pathway.

1.4.2 Description of Selected Remedy for Site 7

An evapotranspiration (ET) cover was selected as the final remedy for the Site 7 landfill closure. The major components of the selected remedy are as follows:

- Installation of an ET cover consisting of a vegetated topsoil layer, a minimally compacted soil layer, and a compacted low-permeability bottom layer.

- Installation of lined ditches between the landfill benches on the north face of the landfill.

- Long-term monitoring.

- Land use restrictions.

The low-level threats posed by the contaminants at Site 7 are addressed through containment of the wastes, elimination of exposure pathways, and continued monitoring and maintenance.

1.4.3 Description of Selected Action for Sites 1B, 1C, 1I, 2C, 2D, 2F, 2G, 10 10, 16, 17, 18, 27, 32, 34, 35, 36, 37, 38, 39, 40, 41, and 42

No action was selected for soil and groundwater at Sites 1B, 1C, 1I, 2C, 2D, 2F, 2G, 10, 18, 32, 34, 35, 36, 37, 38, 39, 40, 41, and 42. No action was also selected for soil, sediment, and surface water at Site 16 and for sediment and surface water at Sites 17 and 27.

1.5 Statutory Determinations for Sites 1A, 1D, 1E, 1F, 2A, and 7

The remedies selected for Sites 1A, 1D, 1E, 1F, 2A, and 7 use permanent solutions to the maximum extent practicable. The remedy for Sites 1A, 1D, 1E, 1F, and 2A will not result in hazardous substance remaining on site because contaminated soil will be removed. Therefore, no 5-year reviews are required. At Site 7, landfilled wastes remain in place and 5-year reviews will be conducted to ensure protection of human health and the environment.

The selected remedies are protective of human health and the environment, comply with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial actions, and are cost-effective.

1.6 *Declaration Statement - No Action Necessary for Protection for Sites 1B, 1C, 1I, 2C, 2D, 2F, 2G, 10, 16, 17, 18, 27, 32, 34, 35, 36, 37, 38, 39, 40, 41, and 42*

No unacceptable human health or ecological risks are presented by soil and groundwater at Sites 1B, 1C, 1I, 2C, 2D, 2F, 2G, 10, 18, 32, 34, 35, 36, 37, 38, 39, 40, 41, and 42; soil, surface water, and sediment at Sites 16; or sediment and surface water at Sites 17 and 27. Therefore, no remedial action is necessary to ensure protection of human health and the environment. Consequently, 5-year reviews are not required for these sites.

FOR THE UNITED STATES MARINE CORPS, MARINE CORPS BASE CAMP PENDLETON:

E. Hanlon, Jr.
Major General, U.S. Marine Corps
Commanding

10 FEB 99
Date

FOR THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY:

Daniel D. Opalski
Chief, Federal Facilities Cleanup Office
U.S. Environmental Protection Agency, Region IX

23 March 1999
Date

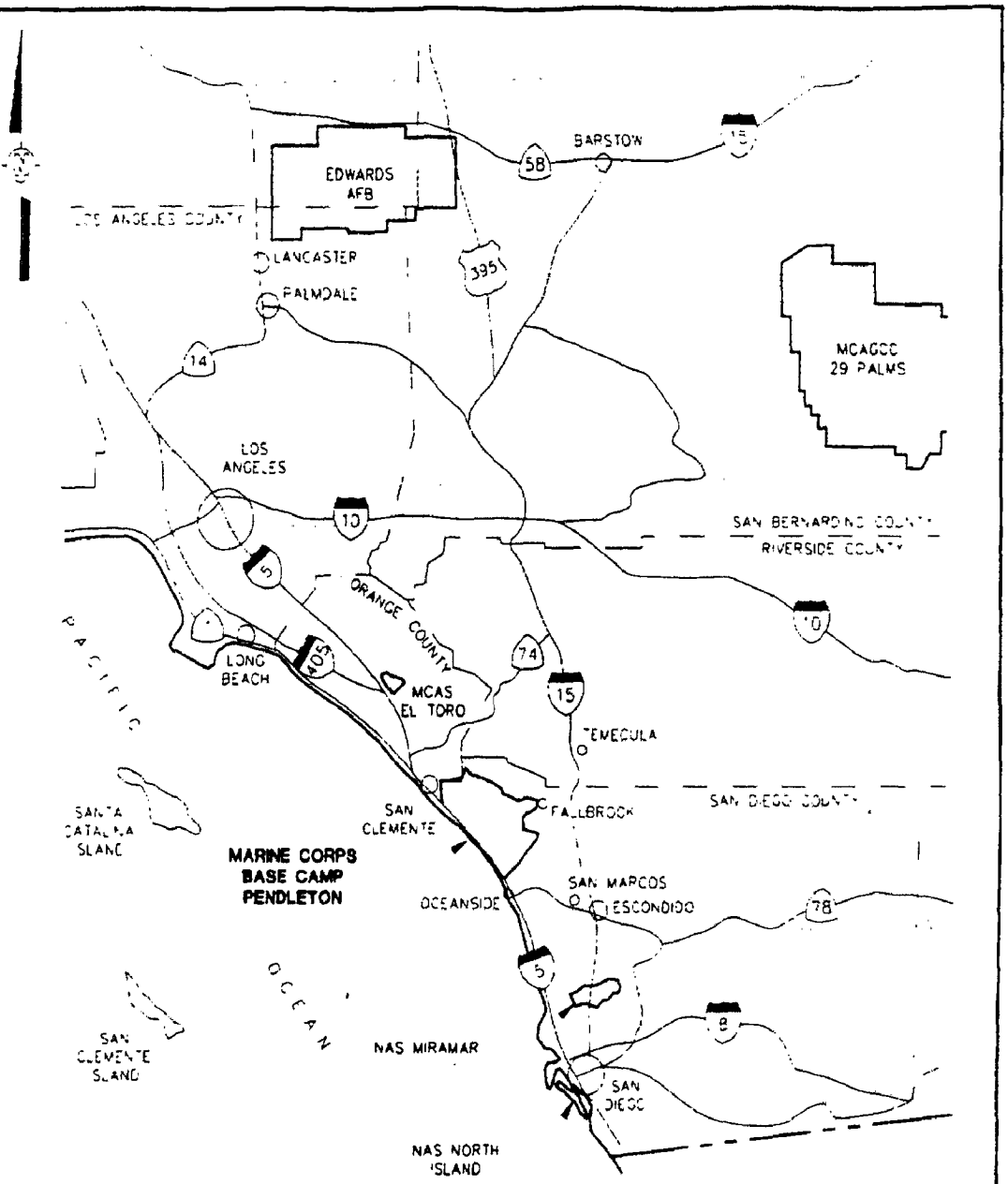
FOR THE STATE OF CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY:

John E. Scandura
Chief, Southern California Operations
Office of Military Facilities
Department of Toxic Substances Control

March 29, 1999
Date

John Robertus
Executive Officer
Regional Water Quality Control Board, San Diego Region

31 March 99
Date



REFERENCE

NAVAL ENERGY AND ENVIRONMENTAL SUPPORT ACTIVITY 1984, "INITIAL ASSESSMENT STUDY, MARINE CORPS BASE CAMP PENDLETON, CALIFORNIA" NEESA 13-057 PREPARED BY SCS ENGINEERS INC SEPT

FIGURE 1-1

LOCATION MAP
MCB CAMP PENDLETON, CALIFORNIA

PREPARED FOR

NAVAL FACILITIES ENGINEERING SERVICE CENTER
CONTRACT NO. N47408-92-D-3056

INTERNATIONAL TECHNOLOGY CORPORATION

DRAWN BY	CHECKED BY		DRAWING NUMBER
mbm 3-5-98	APPROVED BY	7/30/97	771529-A5

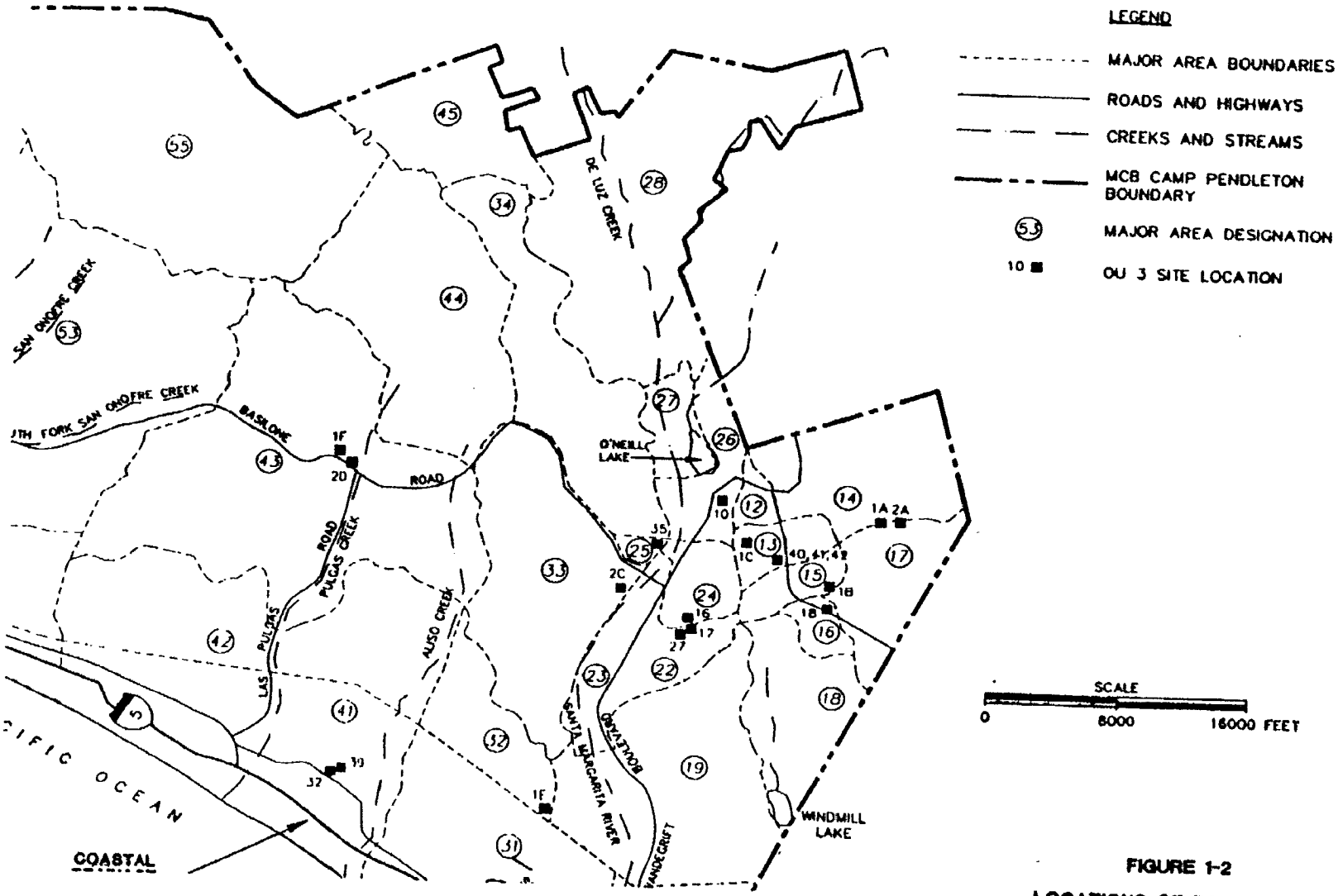


FIGURE 1-2

LOCATIONS OF MAJOR AREAS

2.0 Decision Summary

General information about MCB Camp Pendleton and information common to the individual sites are presented first in this section, followed by information specific to each site. The general discussion includes a general site description, site history and enforcement activities, the scope and role of OU3, and the history of community participation.

2.1 Site Name, Location, and Description

MCB Camp Pendleton is the primary Marine Corps amphibious training center on the west coast. Located between the cities of Los Angeles and San Diego, California, MCB Camp Pendleton covers approximately 125,000 acres, almost entirely in San Diego County (Figure 1-1). Camp Talega, in the 64 Area near the northwestern border of the base, extends into Orange County. Surrounding communities include San Clemente to the northwest, Fallbrook to the east, and Oceanside to the south. The base is bordered on the west by the Pacific Ocean and encompasses 17 miles of coastal area; rolling hills and valleys stretch inland from the coast an average of 10 to 12 miles.

Site History and Enforcement

Construction of MCB Camp Pendleton started in March 1942, and the base was dedicated as a permanent base in October 1944. The base currently supports more than 36,000 military personnel and employs approximately 4,600 civilians (Innis-Tennebaum Architects, Inc., 1990).

On 15 November 1989, MCB Camp Pendleton was added to the National Priorities List (NPL), primarily because a herbicide was detected in two base drinking water production wells.

2.2 Highlights of Community Participation

The proposed plan for OU3 was released to the public on 1 May 1998. This document and supporting documents were made available to the public in the information repositories at the Base Library and the Oceanside Public Library. The public was also made aware of the availability of these documents in the Administrative Record file, which is maintained at the Southwest Division Navy offices in San Diego. The notice of availability for the proposed plan and supporting documents was published in the *North County Times*, both *Inland* and *Coastal Editions*, the *Sun Post News*, and the *Scout* newspapers on 1 May 1998. In addition, a public meeting was held on

14 May 1998. Base, EPA, San Diego RWQCB, and Southwest Division Navy representatives attended the public meeting. No members of the public attended the meeting. A verbatim transcript of the pubic meeting was prepared in compliance with CERCLA Section 117(a)(2) and is presented in Appendix A. No comments were received during the public comment period or the public meeting.

2.3 Scope end Role of Operable Unit 3

For investigative purposes, the sites at MCB Camp Pendleton were assigned to groups based on their potential impact to human health and the environment. Those sites that pose the highest threat were addressed first and were designated Group A sifts. OU1 consists of Group A Sites 9 and 24 soil and groundwater and Site 4/4A soil. The final ROD for OU1 (Southwest Division Naval Facilities Engineering Command [SWDIV], 1995a) was signed on 12 December 1995.

Other sites with lesser degrees of potential threat were investigated as Group B, C, or D sites. The OU2 ROD includes sites from Groups A, B, and C as follows:

- Group A Sites: Site 3 soil, sediment, and groundwater, Site 5 soil and groundwater; Site 6 soil, sediment, and surface water
- Group B Sites: Site 8A sediment and surface water, Sites 19, 20, and 22 soil, sediment, groundwater, and surface water
- Group C sites: Sites 2B and 31 soil; Sites 28 and 43 groundwater; Site 44 sediment and surface water, Site 45 soil, sediment, and groundwater.

The final OU2 ROD was signed and issued on 30 September 1997 (SWDIV, 1997a).

OU3 includes 29 sites as listed in Section 1.1. OU4 includes groundwater at the 22/23 Area sites plus Sites 1H, 21, 30, 33, and 1111. The final ROD for OU4 is scheduled for December 1999.

2.4 Remedial Action Selected for Site 1A, 1D, 1E, 1F, and 2A

This section addresses five of the six OU3 sites requiring remedial action. Sites 1A, 1D, 1E, 1F, and 2A are discussed together due to the similar nature of the remedial actions proposed for each site. Site 7, the other OU3 site requiring remedial action, is presented separately in Section 2.5. A description of each site is provided, followed by a summary of site characteristics and potential site risks. In general, only those parameters that exceed screening criteria are shown in the site-

specific figures because the decision was made to pursue remedial action for these sites. A description of the alternatives evaluated for each site, a summary of the evaluation, and the rationale for selection of the remedies follow the site descriptions, characteristics, and risks. Four of the sites (Sites 1A, 1D, 1E, and 1F) are former refuse burning grounds and one site (Site 2A) is a former grease disposal pit.

2.4.1 Site 1-Refuse Burning Grounds

Four refuse burning grounds located throughout the base. Sites 1A, 1D, 1E, and 1F, require remedial action. These four burning grounds are discussed concurrently.

2.4.1.1 Site Name, Location, and Description - Site 1A, 1D, 1E, and 1F

Site 1 - Refuse Burning Grounds, consists of nine different areas that were used as burning grounds for base refuse. The nine burning grounds are labeled 1A through 1I (Figure 1-2) following the convention used in the initial assessment study (IAS) (Naval Energy and Environmental Support Activity [NEESA], 1984). One of the burning grounds, Site 1G, is part of the San Onofre landfill (Site 14), which has been removed from the CERCLA process and is addressed under the State's landfill program. Four of the burning grounds require remediation and are discussed in this section. No action has been selected for the other four burning grounds, as discussed in Section 2.5.

Site 1A is located in a densely vegetated, undeveloped training region in 14 Area, immediately northeast of base sewage treatment plant No. 1 (Figure 2-1). The 14 Area burning ground is no longer in operation and land surrounding the site is covered with natural vegetation. The nearest troop housing is approximately 0.25 mile west of the site and the nearest family housing, De Luz Housing, is approximately 2 miles north of the site.

Site 1D is located in 20 Area, immediately north of the intersection of Vandegrift Boulevard and Stuart Mesa Road (Figure 2-2). The burning ground covers an area of approximately 400 by 220 feet. Surrounding the site on the east and south are plateaus that rise 150 feet above the burning ground. The site is bordered on the north and west by relatively flat land containing moderate to dense vegetation; the Santa Margarita River flows through this area. To the northeast is the Box Canyon landfill; to the south, across Stuart Mesa Road, is the Twin Lake Sewage Disposal Plant. An unpaved road runs along the northern boundary of the site.

Site 1E is located in 32 Area, along MACS Road, approximately 0.75 mile northwest of Stuart Mesa Road, and approximately 3,000 feet from the Santa Margarita River (Figure 2-3). The burning ground covers an area of approximately 200 by 120 feet.

Site 1F is located in 43 Area, approximately 250 feet northeast of Basilone Road and immediately northwest of its intersection with Las Pulgas Road (Figure 2-4). The burning ground covers an area of approximately 275 by 280 feet. The site is bordered on the southeast by Sites 2D and 20, on the north and east by moderate to dense vegetation, and on the west and south by vegetation and Basilone Road. The site slopes gently to the southeast and eventually drains into Pulgas Creek. The surrounding area generally consists of low rolling hills.

2.4.1.2 Site History and Enforcement Activities - Sites 1A, 1D, 1E and 1F

The refuse burning grounds were used from 1942 through the early 1970s to bum refuse generated by base operations. The areas were not necessarily operated concurrently (NEESA, 1984). No information is available on the specific years of operation or the volume of refuse disposed of by burning at each burning ground. Until 1970, a refuse at the base was disposed of by burning. The entire base generated an estimated 20,000 to 28,000 tons of solid wastes annually, the entire volume of which is assumed to have been distributed to the nine burning grounds.

Although them are no confirmed reports of hazardous waste disposal at these sites, the burning grounds were the primary on-base disposal areas and, thus, could have been used for disposal of hazardous wastes.

The refuse burning grounds were closed sometime between the late 1960s and 1971. The burning grounds were covered with native soil and allowed to revert to natural vegetation. Visual inspection of the sites during 1994 revealed no evidence of environmental contamination (NEESA, 1984). However, the cover material has since eroded, thereby exposing refuse at some of the sites. Areas of stressed vegetation and stains have also been observed.

2.4.1.3 Summary of Site Characteristics

This section describes the investigations performed at Sites 1A, 1D, 1E, and 1F and summarizes the geology/hydrogeology and sampling results for each.

2.4.1.3.1 Site 1A - Refuse Burning Ground in 14 Area

A Phase 1 RI was conducted during June and July 1996 and a Phase 2 RI was conducted from May through June 1997 at Site 1A. Characterization of the site involved surface and subsurface soil and groundwater sampling to evaluate potential contamination from the burning ground and impact to human health and ecological receptors. Detailed results of the Phase 1 RI are presented in the draft final Group D RI report (SWDIV, 1997b) and results of the Phase 2 RI are presented in Appendix A of the draft final RI/FS for OU3 (SWDIV, 1998a). The results of these investigations are summarized in this section.

A total of 18 soil samples, including 2 duplicates, were collected from six soil boring locations during Phase 1. Sample locations am shown on Figure 2-1. Samples were analyzed for target analyte list (TAL) metals, molybdenum, chromium VI, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides and polychlorinated biphenyls (PCBs), and dioxins and furans. During Phase 2, a composite surface soil sample was collected from locations 1AB-01, 1AB-02, and 1AB-03 and a surface sample was collected from location 1AB-05. These samples were split for TAL metals plus molybdenum analyses and lettuce and earthworm bioassay studies.

One temporary well was drilled adjacent to boring location 1AB-01 as part of the Phase 1 investigation. A groundwater sample was collected at the water table (about 5.5 feet below ground surface) and analyzed for TAL metals, molybdenum, chromium VI, VOCs, SVOCs, and general chemistry.

Habitat receptor surveys and habitat mapping were conducted at Site 1A during June 1996 and May 1997. Dominant vegetation types and corresponding wildlife were identified and mapped. Wildlife surveys and small mammal trapping were also conducted in May 1997. Sherman live-traps were used. Trapped animals were identified, marked with a nontoxic marker, and released in the location where they were trapped.

Special-status species surveys for the arroyo toad, the California gnatcatcher, and the least Bell's vireo were conducted at Site 1A in late spring and early summer 1997. Also during May 1997, terrestrial invertebrate samples, plant samples, and small mammal samples were collected in the vicinity of sample locations 1AB-01, 1AB-02, 1AB-03, and 1AB-05. Nine plant tissue samples,

two invertebrate samples, and two mammal tissue samples were analyzed for TAL metals plus molybdenum. Sample locations are shown in Figure 2-1.

Geology and Hydrogeology

Geologic data were derived from the site boring logs. Shallow geology consists of unconsolidated to poorly consolidated alluvium overlying granitic rock. The alluvium consists of silty sand from ground surface to maximum depth of 18 feet. The remainder of the alluvium consists of fine- to medium-grained sand. Groundwater was encountered between 5.4 and 18.6 feet. No perennial surface water is present in the vicinity of the Site 1A burning ground.

Soil Results

The analytical results for soil samples collected during the Phase 1 and Phase 2 RI am summarized in Figure 2-1.

Organics

With the exception of benzo(a)pyrene, no organic compounds were detected at concentrations exceeding preliminary remediation goals (PRGs) in soil samples from Site 1A. Benzo(a)pyrene was detected at a concentration of 0.3 milligram per kilogram (mg/kg) in the duplicate sample from a depth of 10 feet in boring 1AB-02; this concentration is below the contract-required detection limit (CRDL) but exceeds the PRG of 0.061 mg/kg.

Acetone was detected at a depth of 5 feet in two borings; the maximum concentration was 0.005 mg/kg. Trichloroethene (TCE) was detected at a concentration of 0.01 mg/kg at 5 feet in boring 1AB-02. Benzoic acid was detected in the surface sample from boring 1AB-05 at a concentration of 0.094 mg/kg. Low concentrations of eight polycyclic aromatic hydrocarbons (PAHs) were detected in the duplicate sample at the 10-foot interval of boring 1AB-02; the highest PAH concentration detected was 0.5 mg/kg for benzo(k)fluoranthene. Chlorinated pesticides (4.4'-DDD, 4,4'-DDE, and 4,4'-DDT) were generally detected at low concentrations from ground surface to 10 feet; the maximum concentration was 0.2 mg/kg.

Concentrations of 4,4'-DDE in soil samples collected from 1AB-01, 1AB-02, and 1AB-05 and 4,4'-DDT in soil samples collected from 1AB-01 exceeded preliminary limits of exposure (PLEs). No other organic compounds exceeded PLEs.

Inorganics

Six metals were detected at concentrations exceeding PRGs: arsenic, beryllium, copper, lead, manganese, and thallium. In general, arsenic concentrations were near background levels and were higher in the northern portion of the site. Five arsenic detections exceeded the background concentration. Lead exceeded the PRG and background in 10 samples. Lead concentrations were generally higher in the northeastern portion of the site. The remaining four parameters exceeded PRGs only once each, at depths from ground surface to 5 feet. Of these four parameters, beryllium was below background.

The following 16 inorganic constituents were detected at concentrations exceeding PLEs: antimony, arsenic, barium, boron, cadmium chromium, copper, iron, lead, manganese, mercury, molybdenum, selenium, thallium, vanadium and zinc. Inorganic constituents were detected in all six soil sampling locations (1AB-01 through 1AB-06) at concentrations exceeding PLEs. The maximum concentrations of the 16 metals detected also exceeded background concentrations.

Groundwater Result

Groundwater results from the sample collected from temporary well 1AGWT-01 are summarized in the following paragraphs. Only detections above PRGs or MCLs are shown in Figure 2-1.

No organic compounds exceeded maximum contaminant levels (MCLs) or tap-water PRGs. Two organic compounds, acetone and benzoic acid, were detected at concentrations of 1 and 7 micrograms per liter (µg/l), respectively.

With the exception of manganese, no inorganics were detected at concentrations exceeding the evaluation criteria. Manganese was detected at a concentration of 2,200 µg/l, which exceeds the tap-water PRG of 1,700 µg/l.

Manganese has been detected in groundwater throughout MCB Camp Pendleton. In general, manganese concentrations have been higher in hydropunch samples than in samples from permanent monitoring wells, possibly because silts and total suspended solids (TSS) am not as efficiently filtered in undeveloped temporary wells and hydropunch samples compared with fully developed permanent wells. Because temporary well and hydropunch samples typically contain more suspended solids, more nondissolved particles pass through the filter. Some manganese

particles may be small enough to pass through the 0.45-micron filter used in the field (Hem, 1985).

2.4.1.3.2 Site 1D - Refuse Burning Ground in 20 Area

RI work was conducted at Site 1D between December 1993 and October 1995 and between May and July 1997. The RI involved surface and subsurface soil, groundwater, and biological sampling to evaluate potential contamination from the burning ground and impact to human health and the environment. Details of the investigations and results are presented in the Group C report (SWDIV, 1996a) and the draft final RI/FS for OU3 (SWDIV, 1998a). In October and November 1996, a supplemental field investigation was conducted by Kleinfelder to refine the vertical and lateral extent of soil contamination (Kleinfelder, 1997).

During the Phase 1 RI, 22 soil samples were collected from four soil boring locations and four separate surface soil locations to characterize soil contamination in the vicinity of the burning ground at Site 1D. The soil samples were analyzed for TAL metals, molybdenum, VOCs, SVOCs, pesticides and PCBs, gasoline, diesel, dioxins, furans, and chlorinated herbicides. During the supplemental Kleinfelder investigation, an additional 19 shallow soil samples were collected and analyzed for metals. Sample locations are shown in Figure 2-2.

Biological surveys were conducted at Site 1D during March through June 1995 and May through July 1997. Habitat receptor surveys included mapping of dominant vegetation types and corresponding wildlife. Wildlife surveys included bird, mammal, and herpetile (amphibian and reptile) surveys and photographic surveys to document site use by nocturnal mammals. During October 1995, biota sampling was conducted. Plant and invertebrate samples were collected, as well as soil samples for bioassay testing (Figure 2-2). Samples were analyzed for TAL metals plus molybdenum. Special-status species surveys for the California gnatcatcher, least Bell's vireo, and Pacific pocket mouse were conducted at Site 1D during May, June, and July 1997.

Three shallow groundwater wells were drilled at Site 1D to evaluate the potential for, and lateral extent of, groundwater contamination. Three rounds of groundwater sampling were conducted in March, July, and October 1994. Samples were analyzed for TAL metals and molybdenum, VOCs, SVOCs, gasoline, diesel, and general chemistry.

Geology and Hydrogeology

Site 1D is located on the south edge of the alluvial plain in the lower portion of the Santa Margarita Basin, approximately 2 miles upstream from the Pacific Ocean. The geology of the basin consists of stream-deposited younger and older Quaternary alluvium overlying bedrock of the San Mateo Formation. Site 1D is underlain by older alluvium consisting of interbedded, fine-to-coarse-grained, unconsolidated to poorly consolidated sand, silt, and gravel interspersed with clay lenses. The regional groundwater flow direction in the valley-fill aquifer is to the west. The current main channel of the Santa Margarita River is approximately 150 feet north of Site 1D.

Soil Results

Analytical results for soil samples collected during the RI and the supplemental investigation are presented in Figure 2-2. Only detections that exceeded PRGs or PLEs and background, as applicable, are shown.

Organics

No organic compounds were reported at concentrations exceeding PRGs or PLEs.

Toluene was detected at a concentration of 2 mg/kg in boring 1DB-01. The maximum concentration of bis(2-ethylhexyl)phthalate was 640 mg/kg in surface soil sample 1DSS003. Chlorinated pesticides were detected in the upper 5 feet of soil across the site, with the highest concentrations reported in surface soil samples. Total petroleum hydrocarbons (TPH) as diesel and as gasoline were detected in two surface soil samples, at maximum concentrations of 90 and 910 mg/kg, respectively.

Inorganics

Of the 19 metals detected in Site 1D soil, five (antimony, arsenic, beryllium, chromium, and lead) were reported at concentrations exceeding PRGs.

The antimony concentration in 1DB-03 exceeded the PRG and background. Beryllium was detected in 1DB-01 at a concentration exceeding the PRG but below background. Arsenic and chromium concentrations exceeding PRGs were reported for all soil boring and surface sample locations. Surface soil samples 1DSS001, 1DSS002, and 1DSS003 contained arsenic, chromium,and lead at concentrations exceeding PRGs and background.

Inorganic constituents detected at concentrations exceeding background levels were reported at all sampling locations, with the exception of 1DB-01, 1DB-03, and 1DSS004. Of the inorganic constituents exceeding background concentrations, antimony, arsenic, boron, chromium, copper, iron, lead, manganese, and zinc also exceeded the respective PLEs. The majority of the constituents exceeding background and PLEs were reported in surface samples 1DSS001, 1DSS002, and 1DSS003.

The soil investigation conducted by Kleinfelder (1997) confirmed that elevated concentrations of antimony, boron, cadmium, lead, mercury, and zinc are present in site soil. Abundant metal and glass debris was observed scattered on the ground surface at or between locations of most of the exploratory borings advanced by Kleinfelder. Most of the detected contamination is in surface or near-surface soil. Inorganic concentrations exceeding PRGs and/or PLEs and background were reported at locations K1DB-01, K1DB-03, K1DB-06. K1DB-09, K1DB-10, K1DB-12, K1DB-15, K1DB-16, K1DB-17, K1DB-18, and K1DB-19.

Groundwater Results

Groundwater results are summarized in Figure 2-2. Only constituents exceeding MCLs or PRGs are shown. During July 1994 (3rd quarter), 1,2-dichloroethane (DCA) was detected in well 1DW-01 at a concentration of 0.6 µg/l, which exceeds both the MCL and PRG. Benzoic acid, butylbenzylphthalate, di-n-butylphthalate, diethylphthalate, and bis(2-ethylhexyl)phthalate were detected in Site 1D wells during the July and October 1994 sampling events. Three PAH compounds were detected in well 1DW-01 during October 1994, each at a maximum concentration of 1 µg/l. Each of these detections were below respective MCLs or PRGs.

Three metals were detected at concentrations exceeding tap-water PRGs: arsenic, beryllium, and manganese. Arsenic exceeded background in well 1DW-03 during May (2nd quarter) and October 1994 (4th quarter). Beryllium exceeded the PRG but not the MCL in wells 1DW-02 and 1DW-03 during July 1994 (3rd quarter). The manganese concentration in well 1DW-03 during October 1994 exceeded the PRG and background.

2.4.1.3.3 Site 1E - Refuse Burning Ground in 32 Area

RI work at Site 1E involved surface/subsurface soil sampling and biological sampling to investigate potential contamination from the burning ground and impact to human health and ecological receptors. No groundwater investigation was performed because groundwater is

estimated to be more than 100 feet below ground surface in the vicinity of the site. At the completion of the RI, a supplemental investigation was conducted by Kleinfelder (1997) during October and November 1996 to refine the extent of soil contamination.

During the RI, 23 soil samples were collected from seven soil borings, five surface soil locations, and one background surface soil location to characterize potential soil contamination in the vicinity of the burning ground at Site 1E. Sample locations am shown in Figure 2-3. The samples were analyzed for TAL metals, VOCs, SVOCs, gasoline, diesel, pesticides, PCBs, dioxins, furans, and chlorinated herbicides. During the supplemental investigation in 1996, 11 additional soil samples were collected and analyzed for TAL metals. These sample locations am also shown in Figure 2-3.

Ecological investigations were also performed during the RI. A habitat and receptor survey was conducted in March 1995 and dominant vegetation habitats were mapped. Bird and general wildlife surveys were conducted to evaluate the potential presence of special-status species. Mammal trapping, using Sherman live-traps, was conducted to identify small mammal use of the site. All small mammals caught in the traps were identified and released.

During June 1995, one plant sample and one invertebrate composite sample were collected from the three soil locations having the highest detections of pesticides and metals (1EB-02, 1EB-03, and 1EB-06) (Figure 2-3). These samples were analyzed for TAL metals plus molybdenum, pesticides, and PCBs. Special-status species surveys for the California gnatcatcher, least Bell's vireo, and Pacific pocket mouse were conducted at Site 1E during May, June, and July 1997 .

Geology and Hydrogeology

Site 1E is within the Santa Margarita Basin. The geology of this basin consists of stream-deposited younger and older Quaternary alluvium overlying bedrock of the San Mateo Formation. Site 1E is underlain by older alluvium, which consists of interbedded, fine- to coarse-grained, unconsolidated to poorly consolidated sand, silt, and gravel interspersed with clay lenses.

Based on the site geology, groundwater is assumed to flow to the southwest, following the surface topography.

No perennial surface water is present in the vicinity of the burning ground area; however, surface-water flow is present in a lagoon downgradient from the site. During the winter, the tributary canyon derives some of its water from runoff originating from the burning ground. Ephemeral water from this canyon flows to an effluent lagoon and ultimately reaches the Santa Margarita River.

Soil Results

Soil analytical results are summarized in Figure 2-3. Only detections that exceed background, if available, and PRGs or PLEs are presented.

Organics

No organic compounds were reported at concentrations exceeding PRGs or PLEs.

Inorganics

Of the 19 metals detected in Site 1E soil, the following 6 exceeded PRGs: antimony, arsenic, beryllium, cadmium, chromium, and lead. The majority of the metals that exceeded PRGs were reported in shallow (0 to 5 feet) soil from borings 1EB-01, 1EB-02, 1EB-03, 1EB-04, and 1EB-06.

Antimony was detected at concentrations exceeding the PRG and background at locations 1ESS002 and 1EB-05. Lead concentrations exceeded the PRG and background in surface samples 1ES002 and 1ESS003. Concentrations of arsenic and chromium exceeded PRGs and background at locations 1ESS002, 1ESS003, and 1EB-03. Beryllium, cadmium. and chromium exceeded PRGs sporadically in several borings.

Inorganic constituents detected at concentrations exceeding PLEs (i.e., aluminum, antimony, barium, boron, cobalt, copper, iron, lead, molybdenum, silver, and zinc) were reported at sampling locations 1EB-01, 1EB-03, 1ESS02, and 1ES003. With the exception of boron, the maximum concentrations of these constituents also exceeded background concentrations. A background concentration is not available for boron.

The soil investigation conducted by Kleinfelder (1997) focused on the area near the bottom of an existing canyon to evaluate potential impact from surface runoff and contaminant transport. Overall, this investigation confirmed that antimony, arsenic, boron, cadmium, chromium, cobalt, lead, and zinc concentrations in Site 1E soil are elevated. Inorganic concentrations exceeding

PRGS and/or PLEs and background concentrations were reported at K1EB-01, K1EB-06, and K1EB-07.

2.4.1.3.4 Site 1F - Refuse Burning Ground in 43 Area

Phase 1 of the RI was conducted at Site 1F in June and July 1996 and Phase 2 was conducted in May, June, and July 1997. Details of the investigation and results are provided in the draft final Group D RI report (SWDIV, 1997b) and the draft final RI/FS for OU3 (SWDIV, 1998a) and are summarized here. The RI work involved surface/subsurface soil sampling, groundwater sampling, and biological surveys and sampling.

A total of 23 samples, including 2 duplicate samples were collected from four soil borings and one surface soil location during Phase 1 to characterize potential soil contamination in the vicinity of the burning ground at Site 1F. Sample locations are shown in Figure 2-4. Samples were analyzed for TAL metals, molybdenum, chromium VI, VOCs, SVOCs, pesticides, and PCBs. In addition, a temporary well (1FGWT-01) common to site boring 1FB-03 was installed and sampled during Phase 1 (Figure 2-4). The groundwater sample was analyzed for TAL metals, molybdenum, chromium VI, VOCs, SVOCs, and general chemistry. A habitat and receptor survey was also conducted, and dominant vegetation types and corresponding wildlife habitats were identified and mapped.

During the Phase 2 RI, special-status species surveys were conducted for the California gnatcatcher and least Bell's vireo.

Geology and Hydrogeology

Based on the soil borings advanced at the site, shallow geology consists of unconsolidated and semiconsolidated alluvium overlying the La Jolla Group. The alluvium is fine- to medium-grained sand, silty sand, and clayey sand with thin discontinuous lenses of clay. Groundwater is assumed to flow to the southeast following surface topography.

No perennial surface water is present in the vicinity of Site 1F. Surface water at the site is ephemeral and follows the gently sloping ground surface to the southeast.

Soil Results

Analytical results for soil samples collected from Site 1F are summarized in Figure 2-4. Only constituents that exceed both background and PRGs or PLEs are shown.

Organics

No organic compounds were detected in Site 1F soil samples at concentrations exceeding PRGs or PLEs. Chlorinated pesticides (4,4'-DDD, 4,4'-DDE, and 4,4'-DDT) were detected at low concentrations at the 5- and 10-foot intervals in borings 1FB-03 and 1FB-04; the maximum chlorinated pesticide concentration was 0.026 mg/kg for 4,4'-DDE.

Inorganics

Six metals were detected at concentrations exceeding PRGs: antimony, arsenic, beryllium, cadmium, lead, and copper. All but three of the arsenic concentrations and all of the beryllium concentrations that exceeded PRGs were below background levels. Antimony, cadmium, copper, and lead concentrations that exceeded PRGs also exceeded background levels. These detections occurred in the 5-foot interval samples from borings 1FB-03 and 1FB-04.

Concentrations of antimony, arsenic, boron, chromium, cobalt, copper, iron, lead, manganese, molybdenum, silver, and zinc at sample locations 1FB-03 and 1FB-04 exceeded PLEs. With the exception of boron, for which no background concentration is available, the maximum concentrations of these inorganic constituents also exceeded background concentrations. The iron concentration reported at a depth of 20 feet at location 1FB-02 exceeded the PLE and background. However, this iron detection is not of ecological concern because of its depth.

Groundwater Results

No organics were detected in the groundwater sample collected at Site 1F. Arsenic was detected at a concentration of 23.4 µg/l, which exceeds the tap-water PRG but is below the MCL. The detected concentration is consistent with concentrations observed in groundwater throughout the base and is most likely representative of background water quality.

2.4.1.4 Summary of Site Risks

The human health and ecological risk methodologies used for the OU3 sites are summarized in this section. The assessments are presented in detail in the draft final RI report for Group C sites and the draft final RI report for Group D sites (SWDIV, 1996a and 1997b).

Human Health Risk Assessment Methodology

The environmental sampling data were collected in accordance with knowledge-based, purposive sampling decision logic, with additional samples to provide data in areas of high, medium, and low contamination. All RI data were validated and evaluated in accordance with the EPA's *Risk Assessment Guidance for Superfund* (RAGS) (EPA, 1989b).

Exposure scenarios were developed based on available media at the site and current and future land use. The reasonable maximum exposure (RME) receptor was assumed to be present on site for all exposure scenarios.

Toxicity values for the chemicals of concern (COCs) were compiled from the *Integrated Risk Information System* (IRIS) (EPA, 1992a), *Health Effects Assessment Summary Tables* (HEAST) (EPA, 1992b), a Cal/EPA memorandum on criteria for carcinogens (Cal/EPA, 1992a), and tetrachloroethene (PCE) and TCE profiles from the Superfund Health Risk Technical Support Center (EPA, 1994). For the more recent risk assessments conducted after the EPA PRG tables (EPA, 1995 and 1996a) were developed, toxicity values were cited from the above sources, as well as from the National Center for Environmental Assessment.

Cancer slope factors (SFs) have been developed by the EPA for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. SF values, expressed in milligrams per kilogram per day $(mg/kg\text{-}day)^{-1}$, are multiplied by the estimated intake of a potential carcinogen (expressed in mg/kg-day) to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the SF. This approach makes underestimation of the actual cancer risk highly unlikely. Cancer SF values am derived from the results of human epidemiological studies or chronic animal bioassays using animal-to-human extrapolation and uncertainty factors.

Reference doses (RfDs) have been developed by the EPA to indicate the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs (expressed in mg/kg-day) are estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) can be compared with the RfD. RfDs are derived from human epidemiological studies or animal studies and incorporate uncertainty factors

(e.g., to account for the use of animal data to predict effects on humans). These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse effects.

Excess lifetime cancer risks are determined by multiplying the intake level with the cancer SF value. These risks are probabilities that are generally expressed in scientific notation (e.g., $1x10^{6}$). An excess lifetime cancer risk of $1x10^{-6}$ indicates that, as a plausible upper bound, an individual has a one in one million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at a site.

Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as the hazard quotient (HQ) (or the ratio of the estimated intake derived from the contaminant concentration in a given medium to the RfD for the contaminant). The hazard index (HI) can be derived by adding the HQs for all contaminants within a medium or across all media to which a given population could reasonably be exposed. The HI provides a useful reference point for gaging the potential significance of multiple contaminant exposures within a single medium or across media.

Lead was evaluated separately using both the Federal (EPA, 1991) and State (Cal/EPA, 1992b) lead models. Evaluation of soil and groundwater lead concentrations using Federal and State blood lead models indicated that blood lead concentrations would meet health protection target criteria. The target criteria are less than 10 micrograms per deciliter (mg/dl) for 95 percent of children (age range 0 to 6 years) using the Federal model and for 99 percent of children using the State model.

The EPA has developed a list of media-specific concentrations (PRGs) that represent a $1x10^{6}$ risk level (EPA, 1995 and 1996a). Soil and groundwater pathways were evaluated using the methodology described above to calculate excess lifetime cancer risk and noncarcinogenic effects. The target risk level of $1x10^{6}$ and upper-bound intake parameters were used to calculate concentrations. Site concentrations were then compared against these concentrations to calculate risks and hazard .

The quantitative results of the baseline risk assessments were compared against target risk criteria. An RME excess lifetime cancer risk of 10^{6} is considered the point of departure above which risk management should be considered, according to Title 40, Code of Federal Regulations (CFR),

Section 300.430(e)(2)(i)(A)(2). An excess lifetime cancer risk exceeding 10^{-4} generally requires remediation. Risk management should also be considered for an RME exposure with an HI greater than 1.0.

Risks/hazards associated with chemicals of potential concern (COPCs) were evaluated using maximum and representative (95 percent upper confidence limit [UCL]) concentrations for residential land use and commercial industrial exposure scenarios.

Ecological Risk Assessment Methodology

The baseline ecological risk assessment (EcoRA) methodology is presented in detail in the RI reports and work plans for the sites included in this ROD (SWDIV, 1991, 1993a, 1993b, 1995b, 1996a, and 1998). This section summarizes the approach and methodology for the baseline EcoRA.

To address the EcoRA objectives, a phased approach is used, as suggested by the EPA (1992c). This approach consists of three phases: site characterization and screening, initial determination of ecological impact, and bioassessment.

- **Phase I** - Site Characterization and Screening, involves identifying the presence and concentrations of chemicals of potential ecological concern (COPECs) at the sites and evaluating whether exposure pathways to ecological receptors exist.

- **Phase II** - Initial Determination of Ecological Impact, involves conducting ecological comparisons between potentially impacted and nonimpacted areas. The comparison can include parameters such as the presence or absence of species, health of plants and animals, community structure, and contaminant concentrations in the tissues of plants and animals in order to assess potential food-chain exposure. This phase includes habitat and wildlife surveys and collection of biota to measure bioaccumulation in plants, terrestrial invertebrates, and small mammals.

- **Phase III** - Bioassessment, involves further laboratory studies to determine what COPEC concentrations result in measurable effects. Information collected as part of this phase is used to help make decisions about potential remediation.

Quantification of potential risks to representative species was conducted using an HQ approach. An HQ was calculated for each preliminary COPEC (soil and biota) or sample location (sediment and surface water). The HQ was calculated by dividing the maximum detected concentration by

the PLE for each representative species. Because there is uncertainty in the PLE derivation process, the magnitude of the HQ is used as an indication of potential ecological effects and is discussed in broad terms, i.e., an HQ <1.0 represents no or low risk, 1.0 to 10 represents low to medium risk, 10 to 100 represents medium to high risk, and >100 represents high to very high risk). This results of the HQ approach are evaluated in conjunction with qualitative site-specific factors such as the extent of contamination or frequency of detection, habitat quality, and the home range of representative mammals and birds (which indicates the amount of time each representative species would potentially spend at each site).

A complete EcoRA requires several components. Although each is essential to the risk assessment, not all contribute equal weight to the development of conclusions. In addition, limitations and uncertainties are associated with each component. The conclusions of the EcoRA are based on an assessment of the following:

- Field surveys of receptor populations and habitats
- Home range of representative species
- Chemical concentrations in various media, including biota
- Potential toxicity to primary receptors, as determined through comparisons with reported and calculated effect levels (PLEs)
- Potential bioaccumulation of contaminants in primary receptors, as determined through accumulation measurements using site-collected plants, aquatic, and terrestrial invertebrates and comparison with concentrations measured in biota from reference locations
- Potential bioaccumulation of contaminants in aquatic invertebrates to secondary receptors, as determined through quantitative comparisons with PLEs for dietary intake.

Potential bioaccumulation of detected chemicals by primary and secondary receptors was also evaluated during the COPEC selection process. Bioaccumulation in primary receptors (terrestrial plants and aquatic and terrestrial invertebrates) was evaluated by comparing chemical concentrations detected in field-collected biota with concentrations detected in similar biota collected from several reference locations in the vicinity of the sites or at upstream locations. Bioaccumulation in secondary receptors (representative mammals and birds) was evaluated by

calculating bioaccumulation factors from field-collected plants, terrestrial invertebrates, and mice. These bioaccumulation factors were combined with toxicity information and dietary composition to derive soil PLEs for mammals and birds. Bioaccumulation in secondary receptors was also evaluated by calculating dietary PLEs for mammalian ingestion of aquatic invertebrates.

Potential chemical migration and exposure pathways were evaluated for each site. Current land use scenarios were used in the assessment. Results of the exposure assessment indicated that exposure to terrestrial plants and wildlife could occur through the following major pathways:

- Ingestion of soil
- Ingestion of surface water
- Root absorption of chemicals in soil (plants).

Exposures to aquatic plants and organisms could occur through the following pathways:

- Ingestion of sediment
- Ingestion of surface water
- Inhalation (across gill surfaces) of dissolved chemicals in surface water
- Dermal absorption of chemicals in surface water or sediment
- Root absorption of chemicals in sediment or surface water (plants).

Results of the field surveys, COPEC selection process, exposure assessment, and ecological effects assessment were evaluated in the risk characterization to identify final COPECs for each site. The recommendations for each site are based on both the quantitative and qualitative evaluations.

The PLEs for bird and mammal representative species were modified during the risk estimation based on a site-use factor calculated from the area of contamination for each COPEC and the foraging area for each representative bird or mammal species. The size of the area of concern was divided by the foraging range for each representative species to estimate the site-use factor. PLEs were modified only for COPECs that exceeded PLEs in the initial screening.

2.4.1.4.1 Site 1A - Refuse Burning Ground in 14 Area

This section summarizes the results of the human health risk assessment (HHRA) and EcoRA for Site 1A.

Human Health Risk Characterization

The probable sources of contamination at Site 1A am the refuse burning ground, surface soils, and subsurface soils. Potential transport and/or retention medium are surface-water runoff, air, and surface and subsurface soils. The potential receptors are residents or site workers, and the primary exposure points are air and surface/subsurface soils. A secondary exposure point for potential future residents is groundwater. Because only the residential land use scenario was used to determine whether a site was recommended for further action, this is the only land use scenario discussed in this section.

Analytical results from the Group D RI (SWDIV, 1997b) were used as a basis for the HHRA. The HHRA was conducted using only the results from the Phase 1 investigation because additional soil samples for Phase 2 were collected from Phase 1 locations and the results were similar.

The risk screening for soil exposure using maximum concentrations of COPCs results in a cumulative residential risk of 1.4×10^{-4} and is primarily attributable to arsenic. Excluding that portion of the risk attributable to naturally occurring metals, the EPA Region IX and Cal/EPA incremental lifetime cancer risk (ILCR) values are 9.7×10^{-5} and 9.9×10^{-5}, respectively. Both values are within the risk management range.

Replacing the maximum concentrations with the 95 percent UCL concentrations of the COPCs and excluding the portion of the risk attributable to naturally occurring metals results in EPA Region IX and Cal/EPA ILCRs of 9.1×10^{-5} and 9.2×10^{-5}, respectively. These values are also within the risk management range.

The cumulative residential HI for maximum detected COPCs is 19.0. Using the representative concentrations, the cumulative residential HI is 14.0. Background metals contribute an incremental hazard of 1.7. The primary contributors to the HI are arsenic, copper, and thallium, each of which has an individual HI exceeding 1.0. The maximum lead concentration is 8,800 mg/kg. This exceeds the background concentration for the San Luis Ray Basin (10.2 mg/kg) and is at least one order of magnitude greater than the EPA residential soil PRG of 400 mg/kg and the Cal/EPA residential soil PRG of 130 mg/kg.

As presented in the Group D RI report (SWDIV, 1997b), Site 1A soil represents an acceptable cancer risk under the residential exposure but may present an unacceptable noncarcinogenic

hazard; the HI exceeds the threshold value of 1.0. Final human health COCs for soils are arsenic, copper, thallium, and lead.

Excess cancer risk and noncarcinogenic health hazard for the future residential exposure scenario were evaluated for the groundwater pathway. No cancer risk was estimated because no carcinogenic contaminants were detected in groundwater. The HI is 1.6 and is primarily attributable to manganese (approximately 81 percent of the total hazard). For individual target organs, only the central nervous system exceeds the noncarcinogenic hazard criterion of 1.0 (HQ 1.3).

Uncertainty in the RfD used to calculate the PRG for manganese could result in an overestimation of hazard. In addition, uncertainty is associated with the results for the groundwater sample, which was collected from a temporary well. Temporary well groundwater samples usually have higher TSS (the sample is usually muddy) than samples from permanent wells because of the disturbance associated with the sampling method. Because samples from temporary wells contain more particles, more nondissolved particles could pass through the filter used in the field (Hem, 1985) and could result in a higher concentration of manganese in temporary well samples. Manganese is also naturally occurring, and some of the manganese in groundwater at Site 1A is assumed to be within the background concentration.

Groundwater at Site 1A is considered protective of human health for the following reasons:

- No carcinogenic chemicals were detected in groundwater.
- The HI only slightly exceeds 1.0 (HQ 1.3) for one target organ, the central nervous system, and the uncertainty associated with toxicity of manganese could result in an overestimation of hazard.
- A portion of the manganese concentration is likely background rather than site related.

Summed Groundwater and Soil Human Health Risk and Hazard

If it is conservatively assumed that under the future unrestricted residential use scenario a hypothetical resident could be exposed to soil contaminants and groundwater through domestic use, the incremental site risks and hazards for soil and groundwater can be summed for an overall residential exposure. Because no carcinogenic COPCs were detected in groundwater at Site 1A,

the incmmental site risk ($9x10^{-5}$) is completely attributable to soil, primarily due to arsenic. The incremental site hazard from soil (HI 12.3) combined with groundwater (HI 1.6) results in a total residential hazard of approximately 14.0. As discussed previously, the only target organ exceeding a hazard of 1.0 for groundwater was the central nervous system as a result of manganese. Consequently, the noncarcinogenic health hazard for Site 1A is primarily associated with site soil, specifically with metals. Individually, the potential exposure to either soil or groundwater represents the upper-bound RME; when combined, the potential exposure is likely much more conservative than the RME. The combined exposure should be considered a worst-case exposure scenario, especially given the low likelihood of residential use of this site combined with a low likelihood of placing a drinking water well at the point of the plume corresponding to maximum groundwater concentrations.

Ecological Risk Assessment

Site 1A consists primarily of area of California sagebrush series habitat with some disturbed areas. Some downstream portions of the site and its drainage pathway have riparian habitat. Representative species were selected for (this site) based on habitat types and expected occurrence of special-status species. The representative species include plants, terrestrial invertebrates, California gnatcatcher, California quail, least Bell's vireo, Belding's savannah sparrow, California mouse, and deer mouse. Although portions of the site are disturbed, several wildlife species were observed onsite, including the California gnatcatcher. The California gnatcatcher is a listed Federal threatened species and a State special-status species.

Soil concentrations for 17 preliminary inorganic COPECs exceeded background values. These inorganics and all detected organic COPECs were retained for the initial ecological risk screening. The results of the initial risk screening indicated that several inorganic constituents and a few organic compounds exceeded PLEs. COPECs exceeding PLEs were identified at all six soil sampling locations.

A final risk screening was conducted by modifying the PLEs for birds and mammals based on the foraging range and the size of the area of concern. These screening results indicated that modified PLEs were exceeded for plants, invertebrates, California quail, California gnatcatcher, least Bell's vireo, Belding's savannah sparrow, California mouse, and deer mouse. The following contaminants exceeded modified PLEs: antimony, arsenic, barium, boron, cadmium, chromium,

copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, thallium, vanadium, zinc, 4,4'-DDE, and 4,4'-DDT.

Subsequent to the risk screenings, biota tissue collected from site plants, invertebrates, and mice were compared against reference concentrations to evaluate adverse effects to ecological receptors due to bioaccumulation. Comparisons against reference concentrations for plants showed that site tissue concentrations of arsenic, chromium, copper, iron, lead, manganese, molybdenum, and zinc exceeded reference tissue concentrations. The tissue quotients are close to 1.0 for chromium (1.1), copper (1.2), and iron (1.6). However, tissue quotients for arsenic, lead, manganese, molybdenum, and zinc indicated that these COPECs are bioaccumulating and could result in adverse effects directly to plants or to receptors feeding on the plants. Comparison against reference concentrations for invertebrates were similar to those for plants and indicated that arsenic, copper, lead, manganese, and zinc are bioaccumulating in invertebrates and could result in either direct toxicity or food-chain transfer.

Comparison against reference concentrations for mice indicated that only manganese and nickel were present at concentrations greater than reference location concentrations. However, nickel did not exceed PLEs in the final screening and the tissue quotient is close to 1.0 (1.2), indicating the potential bioaccumulation risk from nickel is low. The tissue quotient for manganese is 2.9, indicating that manganese is bioaccumulating and could result in adverse effects directly to mice or to receptors feeding on them.

All COPECs that exceeded modified PLEs were retained as chemicals of ecological concern (COECs) with the exception of cadmium, molybdenum, selenium, 4,4'-DDE, and 4.4'-DDT. The HQs for cadmium, molybdenum, 4,4'-DDE, and 4,4'-DDT are very close to 1.0, indicating low potential risk. Selenium exceeded PLEs in only one sample (1AB-01) and had HQs close to 1.0, also indicating low potential risk.

The results of the EcoRA indicate that several inorganic chemicals are present in Site 1A soils at concentrations that could be directly toxic to ecological receptors or could bioaccumulate in the wildlife food chain. The final COECs for Site 1A are antimony, arsenic, barium, boron, chromium, copper, iron, lead, manganese, mercury, thallium, vanadium, and zinc.

2.4.1.4.2 Site 1D - Refuse Burning Ground in 20 Area

This section summarizes the results of the HHRA and EcoRA for Site 1D.

Human Health Risk Characterization

The conceptual site model for Site 1D indicates that current/future workers and future residents could be exposed to soil contaminants through incidental ingestion, dermal contact, and inhalation of VOCs and soil particulates. The model also shows that future workers and residents could be exposed to groundwater contaminants through inhalation of VOCs, ingestion of groundwater, and dermal contact with groundwater. The primary source of contaminan is burned and/or partially burned refuse, and the secondary source is underlying or adjacent soils. Analytical results collected during the Group C RI (SWDIV, 1996a) were used for the risk assessment.

The risk screening for soil exposure using maximum detected chemical concentrations for residential land use results in a cumulative residential risk of $2x10^{-4}$. Subtracting the portion of risk contributed by background concentrations, the ILCR is $3x10^{-5}$. The HI for the same scenario (i.e., removing the contribution from background) is 10.1. The primary contributors to risk and/or hazard are antimony, arsenic, and chromium. In addition, the maximum lead concentration (1,100 mg/kg) exceeds background, the EPA residential soil PRG of 400 mg/kg, and the Cal/EPA residential soil PRG of 130 mg/kg. The site-related risk and hazard indicate that further action is necessary.

To evaluate potential risks due to groundwater exposure, maximum concentrations were used for a residential scenario. The site-related carcinogenic risk, ILCR, is $2x10^{4}$ and the HI is 1.2. The potential risk was evaluated further using representative concentrations and resulted in an ILCR of $4x10^{5}$ and an HI of less than 1.0. Beryllium. detected in only 2 of 10 samples, contributes more than 99 percent of the $4x10^{5}$ ILCR. Although beryllium is a risk contributor in soil at Site 1D, no on-base activities are known or suspected of generating beryllium wastes. The average site concentration of beryllium is 1.27 µg/l, and the background concentration is 1 µg/l. As such, the beryllium concentration is likely representative of background. Based on the reasons presented, potential groundwater risks at Site 1D are considered acceptable.

Ecological Risk Assessment

The predominant habitat at Site 1D is California sagebrush series, interspersed with areas of open disturbed habitat. Various herpetiles, birds, and mammals were observed during general wildlife

surveys of the site. Coastal California gnatcatchers, a special-status species, were also observed. Representative species were selected for this site based on predominant habitat types and include plants, terrestrial invertebrates, California mouse, California quail, and California gnatcatcher.

Concentrations of inorganic chemicals at Site 1D were compared with background values for the Santa Margarita Basin. Concentrations of 13 preliminary inorganic COPECs exceeded available background values and were retained for the initial ecological risk screening, along with all preliminary organic COPECs plus boron. The results of the initial screening indicated that the maximum concentrations of 10 inorganic constituents exceeded PLEs. None of the detected organics exceeded PLEs.

Biota tissue collected from plants and invertebrates were compared against reference concentrations to evaluate adverse effects to ecological receptors due to bioaccumulation. Comparisons against reference concentrations for plants indicated that site tissue concentrations of arsenic, manganese, and zinc were close to the reference concentrations and indicate that exposure to these COPECs will not result in any increased risk to plants. No site invertebrate tissue concentrations exceeded reference concentrations.

A final risk screening was conducted by modifying PLEs. COPECs and HQs greater than 1.0 were grouped into areas of concern based on sample locations where PLEs were exceeded for any representative species. The size of the areas were estimated and the PLEs for birds and mammals were modified based on the foraging range for each representative species and the size of the area of concern. The final risk screening results indicated that modified PLEs were exceeded for plants, invertebrates, California quail, California gnatcatcher, and California mouse. The COPECs exceeding modified PLEs were antimony, arsenic, boron, chromium, copper, iron, lead, manganese, mercury, and zinc. Antimony, copper, iron, lead, and zinc were retained as COECs. Arsenic, boron, chromium, and manganese were not retained because HQs for each species, with the exception of birds, were less than 1.0. The HQs for birds were close to 1.0, indicating low potential risk. In addition, incremental risk above background concentrations resulted in HQs less than 1.0, indicating that the majority of risk is due to background levels. Mercury was not retained because it was detected only once, at location 1DSS003, and HQs were less than 1.0 for all species except the California mouse, which had an HQ of 1.2. which is close to 1.0.

The results of the EcoRA indicate that antimony, copper, iron, lead, and zinc are present in Site 1D soils at concentrations that could be directly toxic to ecological receptors or could bioaccumulate in the wildlife food chain.

2.4.1.4.3 Site 1E - Refuse Burning Ground in 32 Area

This section summarizes the results of the HHRA and EcoRA for Site 1E.

Human Health Risk Characterization

The conceptual site model for Site 1E indicates that current/future workers and potential future residents could be exposed to soil contaminants through incidental ingestion, dermal contact, and inhalation of VOCs and soil particulates. There are no complete groundwater exposure pathways at this site. The primary source of contaminants is burned and/or partially burned refuse; the secondary source is underlying or adjacent soils. Analytical results collected during the Group C RI (SWDIV, 1996a) were used for the risk assessment.

The risk screening for soil exposure using maximum detected concentrations for residential land use results in a cumulative residential risk of $6x10^{-4}$ and an HI of 20.1. Subtracting the portion of risk and hazard contributed by background concentrations, the ILCR is $4x10^{4}$ and the HI is 18.4. The site-related primary contributors to risk and/or hazard are antimony, arsenic, and chromium. In addition, the maximum lead concentration of 1,610 mg/kg exceeds background, the EPA residential PRG of 400 mg/kg, and the Cal/EPA residential soil PRG of 130 mg/kg.

The ILCR and the HI both exceed EPA acceptable levels, and evaluation of remedial actions was recommended.

Ecological Risk Assessment

Habitat at Site 1E consists primarily of California sagebrush series habitat. Various herpetiles, birds, and mammals were observed on site during general wildlife surveys. Pairs of coastal California gnatcatchers, a special-status species, were also observed at Site 1E. Representative species were selected for this site based on habitat types and include plants, terrestrial invertebrates, Pacific pocket mouse, California quail, and California gnatcatcher.

Concentrations of inorganic chemicals at Site 1E were compared with background values for the Santa Margarita Basin. Concentrations of 17 preliminary inorganic COPECs exceeded available

background values and were retained for the initial ecological risk screening along with all detected preliminary organic COPECs and boron. The results of this screening indicated that the maximum concentrations of 15 inorganic constituents exceeded PLEs.

Biota tissue collected from site plants and invertebrates were compared against reference concentrations to evaluate adverse effects to ecological receptors due to bioaccumulation. Comparisons against reference concentrations for plants indicated that site tissue concentrations of arsenic and mercury were greater than reference location concentrations. The tissue quotient for arsenic (1.6) indicated that concentrations are close to reference concentrations and are not expected to result on any increased risk to plants or receptors feeding on plants at the site. The tissue quotient for mercury is 2.3; however, this COPEC did not exceed PLEs for plants in either the initial or final screening, indicating only a small potential risk to receptors.

Comparisons against reference concentrations for invertebrates indicated that site tissue concentrations of cadmium, copper, and zinc were slightly greater than reference location concentrations. Tissue quotients were 1.6 for cadmium, 7.0 for copper, and 1.3 for zinc. Cadmium and zinc concentrations are close to the reference concentrations and indicate that exposure to these COPECs by invertebrates at the site would not result in increased risk. The tissue quotient for copper indicates that copper concentrations may pose an increased risk to invertebrates and receptors feeding on invertebrates at the site.

A final risk screening was conducted by modifying the PLEs for birds and mammals based on the foraging range for each representative species and the size of the area of concern. The final risk screening results indicated that modified PLEs were exceeded for plants, invertebrates, California quail, California gnatcatcher, and Pacific pocket mouse. COPECs exceeding modified PLEs are aluminum, antimony, barium, boron, cobalt, copper, iron, lead, molybdenum silver, and zinc. With the exception of barium, boron, molybdenum, and silver, these contaminants were retained as COECs.

Barium was not considered to pose a risk because HQs above 1.0 were due largely to background concentrations. Although the HQ for the representative Pacific pocket mouse still exceeds 1.0, excluding background, small mammals using this site are not expected to spend all of their time at Site 1E. In addition, no Pacific pocket mice were observed on site during surveys. Boron was not retained because the HQs were close to 1.0 (1.2 to 1.5). Molybdenum was not retained because

plants were the only representative species for which PLEs were exceeded, and the HQs are close to 1.0. Silver was detected at locations 1ESS002 and 1ESS003 only. At 1ESS002, the HQs for silver only slightly exceeded the plant PLE (HQ of 1.04). At 1ESS003, only one of the detected results exceeded the plant and invertebrate PLEs; the HQs for the other detected silver concentrations were less than 1.0.

The results of the EcoRA indicate that several inorganic chemicals are present in Site 1E soils at concentrations that could be directly toxic to ecological receptors or could bioaccumulate in the wildlife food chain.

2.4.1.4.4 Site 1F - Refuse Burning Ground in 43 Area

This section summarizes the results of the HHRA and EcoRA for Site 1F.

Human Health Risk Characterization

The conceptual site model for Site 1F indicates that current/future residents could be exposed to soil contaminant through incidental ingestion, dermal contact, and inhalation. The model also indicates that potential future residents could be exposed to groundwater contaminants through ingestion, inhalation of VOCs, and dermal contact. The primary source of contaminants is burned or partially burned refuse, and the secondary source is underlying or adjacent soils. Analytical results from samples collected during the Group D RI (SWDIV, 1997b) were used for the risk assessment.

The risk screening for soils using the maximum detected chemical concentrations results in a cumulative residential risk of $3x10^{-5}$. Subtracting the portion of total risk attributable to naturally occurring metals or background, the ILCR is $2.2x10^{-5}$. The cumulative residential HI for maximum detected contaminants is 8.7. Subtracting the portion attributable to background metals, the incremental HI is 7.5. The maximum lead concentration (1,260 mg/kg) exceeds the EPA residential soil screening value of 400 mg/kg and the Cal/EPA residential soil PRG of 130 mg/kg.

Because the HI exceeds the threshold criterion of 1.0. further risk evaluation for soil was conducted using a more reasonable value, the 95 percent UCL of the average concentration. Using the 95 percent UCL, the ILCRs for the residential scenario based on Region IX and Cal/EPA PRGs are $9.9x10^{6}$ and $1.2x\ 10^{-5}$. The incremental HI is 7.3. The HI results primarily from a single high detection of copper at 12,500 mg/kg. This detection is a duplicate of the original sample,

which had a reported concentration of 821 mg/kg. As such, a degree of uncertainty is associated with the copper results. Lead and antimony are the other main contributors to hazard.

Potential residential carcinogenic risks for soil are within the risk management range and are considered acceptable for this site. However, potential noncarcinogenic hazard exceeds the acceptable criterion of 1.0, thus requiring further action.

To evaluate potential risks due to groundwater exposure, maximum concentrations were used for a residential scenario. The ILCR is 5.2×10^{-4} and is completely attributable to arsenic. However, the maximum reported value of arsenic, 23.4 micrograms per liter (µg/l), is less than the MCL of 50 µg/l. The noncarcinogenic HI is 3.9 and is primarily attributable to arsenic and boron. As stated, the maximum arsenic concentration is less than the MCL and would not likely represent a threat to human health via ingestion. Boron is not likely a result of site-related activities. For the above stated reasons, groundwater at Site 1F is considered protective of human health.

Ecological Risk Assessment

Two brushfires have disturbed the habitat at Site 1F. One fire occurred in June 1996, just prior to the initial site habitat evaluation. The second brushfire occurred in early summer 1997 between site visits to evaluate special-status species. Prior to the second fire, the site was sparsely vegetated with California sagebrush series habitat. Various birds, the black-tailed hare, house mice, and deer mice were observed at the site. No coastal California gnatcatchers or least Bell's vireos, both special-status species, were observed at the site prior to the 1997 brushfire. However, least Bell's vireos were identified in riparian vegetation along Pulgas Crock adjacent to the site. The representative species selected for evaluation of this site include plants, terrestrial invertebrates, Belding's savannah sparrow, and deer mouse.

Potential ecological risks at Site 1F were evaluated using the RI data and sampling locations presented in the draft final Group D RI report (SWDIV, 1997b).

Concentrations of inorganic chemicals detected at the site were compared with background values for the Las Flores Basin background area Background values were available for all inorganic chemicals detected except boron. Concentrations of 14 preliminary inorganic COPECs exceeded available background values and were retained for the initial ecological risk screening, along with boron and all detected preliminary organics. The results of the initial screening indicated that the

maximum concentrations of 13 inorganic constituents exceeded PLEs. None of the detected organics exceeded PLEs.

In accordance with the work plan, biota samples (i.e., plants, terrestrial invertebrates, and small mammals) were not collected for tissue analysis at this site during the Phase 2 sampling conducted in May 1997. The site is similar to Site 1A in historical, use, habitat types, and potential ecological receptors. Because of their similarities, the biota sampling and bioassays conducted at Site 1A were extrapolated to Site 1F. Both sites are historical refuse burning grounds that consist of coastal sage scrub and disturbed habitat. The representative species for Site 1F included plants, terrestrial invertebrates, Beldings's savannah sparrow, and deer mouse. These species were also among those selected for Site 1A.

Biota tissue collected at Site 1A included plants, invertebrates, and mice. These tissue concentrations were also compared against reference concentrations for the chemicals detected at Site 1F. Comparisons for plants indicated that tissue concentrations of arsenic (tissue quotient of 3), chromium (1.1), copper (1.2), iron (1.6), lead (10), manganese (2.9), molybdenum (3.4), and zinc (9.2) were elevated compared with reference plants. Soil concentrations of arsenic, chromium, manganese, and molybdenum at Site 1F did not exceed plant PLEs, but only zinc slightly exceeded the PLE (1.2) at one sampling location (B-3). Copper, iron, and lead exceeded plant PLEs at two sampling locations (B-3 and B-4). Results of soil and biota evaluations indicate that copper and iron may bioaccumulate to a limited degree but are of more concern with regard to direct toxicity to plants. Zinc is bioaccumulating and could result in adverse effects directly to plants or to those receptors feeding on them.

Comparisons against reference concentrations for invertebrates were generally similar to those for plants. Resulting tissue quotients for arsenic (3.4), copper (10), lead (12), manganese (5.1), and zinc (4) indicated that these chemicals were accumulating in invertebrates collected from Site 1A. However, none of these chemicals exceeded soil PLEs for invertebrates in Site 1F, indicating that any potential risk at the site would be through food-chain transfer rather than direct toxicity.

Comparisons against reference concentrations for mice indicated that only manganese and nickel were present at concentrations exceeding reference values. Tissue quotients were 2.9 and 1.2, respectively. Manganese did not exceed small mammal PLEs in the final screening and nickel did not exceed small mammal PLEs in either the initial or final screening. These results indicate that

soil concentrations of manganese and nickel at Site 1F are of limited concern to mammals through either direct toxicity or food-chain transfer.

COPECs with HQs greater than 1.0 were grouped into areas of concern based on sample locations where PLEs were exceeded for any representative species. The size of the areas were estimated and the PLEs for birds and mammals were modified based on size of the area of concern relative to the foraging area for each representative species. The modified PLEs were then used for the final risk screening.

The final risk screening results indicated that modified PLEs were exceeded for plants, invertebrates, Belding's sparrow, and deer mouse. COPECs with HQs exceeding 1.0 are antimony, arsenic, boron, chromium, cobalt, copper, iron, lead, manganese, molybdenum, silver, and zinc. Arsenic, boron, chromium, cobalt, manganese, molybdenum, and silver were not retained as COECs because of their low potential risk indicated by low HQs, near background concentrations, and/or low frequency of detections.

The results of the EcoRA indicate that several inorganic chemicals are present in Site 1F soils at concentrations that could be directly toxic to ecological receptors or could bioaccumulate in the wildlife food chain.

2.4.2 Site 24 - Grease Disposal Pit in 14 Area

This section addresses Site 2A and summarizes site history and characteristics and associated risks.

2.4.2.1 Site Name, Location, and Description

Site 2A - Grease Disposal Pit in 14 Area, is located off Pilgrim Creek East Trails Road (Figure 2-5) and is one of seven mess hall grease pits scattered throughout the base. The grease disposal pit boundary is approximately 200 feet long and 300 feet wide. The site is bordered on the west and southwest by Site 1A and on the north, east, and south by areas of light to moderate vegetation. Site 2A slopes gently to the southwest and eventually drains into a stream-cut canyon adjacent to Site 1A. The surrounding area is characterized by low rolling hills.

2.4.2.2 Site History and Enforcement Activities

Grease disposal pits, typically less than 10 feet deep, were used throughout the base from 1942 to 1980 for disposal of mess hall grease. Petroleum, oil, and lubricants (POLs) may have also been placed in the pits. No information is available on the specific years of operation or the amount of grease disposed of in the pit at Site 2A. A burn area is adjacent to the disposal pit at 2A.

The pit at Site 2A was closed by allowing the disposed materials to decay to a semisolid state and then backfilling with native soil.

2.4.2.3 Summary of Site Characteristics

RI work at Site 2A involved surface/subsurface soil sampling and ecological surveys. No groundwater or surface-water sampling was performed. The investigation was conducted in two phases. Phase 1 was conducted in June 1996, and Phase 2 was conducted in May through July 1997. Detailed results of Phase 1 are presented in the draft final Group D RI report (SWDIV, 1997b) and results of the Phase 2 RI are presented in Appendix A of the draft final RI/FS for OU3 (SWDIV, 1998a). A summary is presented in this section.

A total of 19 samples. including 1 duplicate, were collected from five soil boring locations as part of Phase 1. Sample locations are shown in Figure 2-5. The borings were terminated when granitic material was encountered at depths between 15 and 20 feet below grade. The soil samples were analyzed for TAL metals, molybdenum. chromium VI, VOCs, SVOCs, dioxins, and furans.

A habitat and receptor survey was conducted in June 1996. Dominant vegetation types and corresponding wildlife habitats were identified. During the 1997 Phase 2 investigation, small mammal trapping was conducted using Sherman live-trap. Trapped animals were identified, marked with a nontoxic marker, and released in the location where they were trapped. Surveys for special-status species, the California, gnatcatcher and least Bell's vireo, were also conducted as part of the Phase 2 effort. Soil, plant tissue, and animal tissue were collected during Phase 2 for chemical analyses and bioassay studies to refine the conclusions of the EcoRA. Five plant samples, two invertebrate samples, and two mice samples were collected at Site 2A. One surface soil sample and one duplicate were collected from sample location 2AB-05. Soil and tissue samples were analyzed for TAL metals plus molybdenum and for organochlorine pesticides.

2.4.2.3.1 Geology and Hydrogeology

Geologic data were derived from the five soil borings advanced at the site. Shallow geology at the site is characterized by semiconsolidated to consolidated alluvium consisting of fine-to medium-grained, poorly graded sand, silt, and sand with silt. The alluvium overlies massive granitic basement rock. Basement granitic rock was encountered in all five soil borings at depths ranging from 3.5 to 18 feet. Based on site geology, groundwater is assumed to flow to the southwest, following surface topography. Using groundwater elevations from a nearby site and ground surface elevations, the depth to groundwater at site 2A is estimated to be nearly 100 feet below grade. No perennial surface water is present in the vicinity of Site 2A.

2.4.2.3.2 Soil Results

The analytical results for soil are summarized in Figure 2-5. Only results that exceed background and PRGs or PLEs are shown.

Organics

Two chlorinated pesticides were detected at concentrations at or exceeding PRGs at Site 2A: 4,4'-DDD in the 5-foot interval sample and 4,4'-DDE in the 5- and 10-foot interval samples from boring 2AB-05. In addition, 15 other organic contaminants were detected at concentrations below PRGs. Four VOCs were detected at low concentrations: acetone, 2-butanone, ethylbenzene, and total xylenes. The highest VOC concentration detected at Site 2A was 0.047 mg/kg for acetone. The SVOCs benzoic acid (3.8 mg/kg), bis(2-ethylhexyl)phthalate (0.13 mg/kg), and phenanthrene (0.18 mg/kg) were each detected once in borings 2AB-03, 2AB-05, and 2AB-01, respectively. Eight dioxin/furans were detected in the 5- and 10-foot samples from boring 2AB-05 at concentrations of 0.001 mg/kg or less.

1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-HpCDD), 4,4'-DDE, 4,4'-DDT, and total heptachlorodibenzo-p-doxins (total HpCDD) exceeded PLEs in soil samples collected from boring 2AB-05 during June 1996. The sampling conducted during May 1997 confirmed the presence of these pesticides.

Inorganics

A total of 9 metals were detected at concentrations exceeding PRGs: antimony, arsenic, beryllium, cadmium, copper, lead, manganese, thallium, and zinc. Although all arsenic detections exceeded the PRG, the concentrations were at or near background. All beryllium concentrations

were below the calculated background level. Antimony, cadmium, copper, lead, manganese, thallium, and zinc concentrations exceeded PRGs and background concentrations in samples from boring 2AB-05. In addition, the lead concentration for the 5-foot sample from boring 2AB-03 exceeded the PRG and background.

Concentrations of aluminum, antimony, barium, boron, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, silver, thallium, vanadium, and zinc exceeded PLEs in various boring locations. The maximum concentrations of these inorganic constituents also exceeded background concentrations. Boring location 2AB-05 had the greatest number of inorganic constituents with concentrations exceeding PLEs. The results for the surface samples collected near boring location 2AB-05 in 1997 are similar to the results for soil samples collected from the same location in June 1996.

2.4.2.4 Summary of Risks Associated with Site 2A

The HHRA was completed using data from the Phase 1 RI (SWDIV, 1997b). Because the samples for the Phase 2 RI (SWDIV, 1998a) were collected from the same locations as Phase 1 samples and the results were similar for both phases, the HHRA was not revised. The EcoRA was completed using both Phase 1 and Phase 2 results.

2.4.2.4.1 Human Health Risk Characterization

Based on the conceptual site model developed in the RI, current/future residents could be exposed to soil contaminants through incidental ingestion, dermal contact, and inhalation of VOCs and particulates. Groundwater was not considered a complete exposure pathway for current/future workers or residents. Data collected during the Group D RI were used for the risk assessment.

The cancer risk and noncarcinogenic hazard for the residential and industrial/commercial scenarios were evaluated using maximum detected contaminant concentrations in soils. Only the residential scenario is summarized here because decisions for the site were based on this scenario. The cumulative residential risk is $5x10^{-5}$ and is attributable primarily to arsenic. Subtracting the portion of total risk attributable to background metals, the ILCRs based on Region IX and Cal/EPA PRGs are $5.6x10^{6}$ and $1.2x10^{-5}$, respectively. The cumulative residential HI is 150. The primary hazard contributors are manganese, thallium, and zinc. Manganese and zinc concentrations exceed background concentrations by more than three orders of magnitude.

The highest detections of contaminants, driving both the cancer risk and the noncancer hazard, were found at boring location 2AB-05, which is located in the adjacent burn area. Therefore, the site was viewed as two separate area, the grease disposal pit area and the burn area, and the risks were reassessed.

The maximum concentrations for the grease disposal pit, excluding the samples from the burn area at boring 2AB-05, were compared against EPA Region IX soil PRGs. The results were a cumulative ILCR of 9.8×10^{-6} and an HI of 1.8. The only contributors are arsenic and beryllium, both of which are within the range of background concentrations. Subtracting the contribution from background, the ILCR for the residential scenario using EPA Region IX and Cal/EPA PRGs are less than 1×10^{8} and 1×10^{-6} respectively. The HI is 1.0. Based on this assessment, soil in the grease disposal pit area is considered protective of human health. However, the area surrounding boring 2AB-05 appears to present both an unacceptable carcinogenic risk and noncarcinogenic hazard. The human health COCs in this area are 4.4'-DDD, 4.4'-DDE, antimony, arsenic, cadmium, copper, lead, manganese, thallium, and zinc.

2.4.2.4.2 Ecological Risk Assessment

Vegetation at Site 2A burned during a brushfire in June 1997. Most of the existing California sagebrush series habitat and disturbed habitat were destroyed. Bird species observed prior to the fire included cliff swallow. California quail, California towhee, and song sparrow. Mammals observed included black-tail hare, cactus mouse, California mouse, deer mouse, desert woodrat, dusky-footed woodrat, and house mouse. Surveys for the California gnatcatcher and the arroyo toad, both special-status species, were conducted in May 1997, but none were observed. Surveys conducted in 1996 identified least Bell's vireos, also a special-status species, in riparian vegetation adjacent to the site. The representative species selected for evaluation at this site based on habitat types present are plants, terrestrial invertebrates, California gnatcatcher, Belding's savannah sparrow, California mouse, and deer mouse.

Concentrations of inorganic chemicals detected at Site 2A were compared against background concentrations for the San Luis Rey Basin. Inorganic contaminants that exceeded background, boron, and all organic contaminants detected were retained for the initial ecological risk screening. Results of the initial ecological risk screening indicated that 18 inorganics, 2 organochlorine pesticides, and 2 dioxin analytes had HQs exceeding 1.0.

Biota tissue collected from plants, invertebrates, and mice were compared against reference concentrations to evaluate adverse effects to ecological receptors due to bioaccumulation. Comparisons against reference concentrations for plants indicated that several metals are present at concentrations exceeding reference samples. The plant tissue quotients for aluminum (1.9), cobalt (1.2), iron (1.7), lead (1.7), molybdenum (1.3), and silver (1.3) are close to 1.0, indicating only a slightly increased accumulation. Tissue quotients for copper (2.3), manganese (2.8), and zinc (8.8) indicated that these chemicals are accumulating in plant tissue and could result in either direct toxicity or food-chain transfer.

Comparisons against reference concentrations for invertebrates were similar to those for plants and indicated that cadmium (1.04) and manganese (1.6) concentrations are similar to those for reference invertebrates. Copper (2.7), lead (3), and zinc (2.1) are accumulating in invertebrates at higher levels than in reference invertebrates and could result in either direct toxicity or food-chain transfer.

Comparisons against reference concentrations for mice indicated that manganese concentrations slightly exceed reference values. The tissue quotient is very close to 1.0 (1.4), indicating a relatively low potential increase in accumulation over reference levels.

For the final risk screening, COPECs with HQs greater than 1.0 were grouped into two areas of concern based on sample locations where PLEs were exceeded for any representative species. The PLEs for birds and mammals were then modified based on the size of the area of concern and the foraging range for each representative species. Based on the modified PLEs, COPECs with HQs exceeding 1.0 are aluminum, antimony, barium, boron, cadmium chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, silver, thallium, vanadium, zinc, 4.4'-DDE, and 4,4'-DDT.

Qualitative factors such as habitat quality, severity of potential adverse effects, frequency of PLE exceedances, frequency of detection, and uncertainty were used to evaluate COPECs further and to select COECs. The following compounds were retained as COECs: antimony, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, thallium, silver, and zinc. Aluminum, nickel, vanadium, 4.4'-DDF, and 4.4'-DDT were not retained based on qualitative factors.

2.4.3 Description of Alternatives - Sites 1A, 1D, 1E, 1F, and 2A

As recommended by EPA guidance and the NCP (EPA, 1989a and 1990b), acceptable engineering practices that relate to site-specific conditions were considered during development of the remedial action alternatives for Sites 1A, 1D, 1E, 1F, and 2A. The selected alternatives satisfy the requirements of 40 CFR 300.430(e), which specify that alternatives be developed to include no action; institutional actions; little or no treatment alternatives; and alternatives that reduce toxicity, mobility, or volume of contaminants.

Soils at OU3 Sites 1A, 1D, 1E, 1F, and 2A contain metals at concentrations that pose a potential threat to human health and the environment and could potentially impact groundwater. The soils that pose these potential risks are at depths of up to 10 feet below ground surface over areas approximated using historical information, geophysical survey data, sample results, and natural site boundaries. The remedial action objectives (RAOs) consist of media-specific goals for protecting human health and the environment, including groundwater. RAOs generally consider COCs, exposure pathways and receptors, and acceptable contaminant levels or range of levels for each exposure route. In addition to being protective of human health and the environment, the objective of the remedial action is to ensure that no further action is required in the future. The remedial action goals for Sites 1A, 1D, 1E, 1F, and 2A are listed in Table 2-1. The remedial action goals are based on the human health, ecological, or background levels.

The following alternatives were developed for remediation of soil at Sites 1A, 1D, 1E, 1F, and 2A:

- No action
- Excavation/removal and on-base disposal
- Excavation/removal and off-base disposal.

2.4.3.1 Alternative 1: No Action

The no action alternative provides no remediation, monitoring, or security activities at the sites to reduce risk to human health or the environment. The NCP (40 CFR 300.430[e][6]) requires that the no action response be carried through the detailed analysis of alternatives. This response action is further evaluated as a baseline for comparison with other remedial alternatives developed for contaminated soil.

2.4.3.2 Alternative 2: Excavation/Removal and On-Base Disposal

This alternative includes removal of contaminated soils via mechanical excavation. Upon removal, the impacted soils from Sites 1A, 1D, 1E, 1F, and 2A would be transported to Site 7 - Box Canyon Landfill, which is a designated corrective action management unit (CAMU). The process for CAMU designation is described in Appendix B, and was also included in the OU3 RI/FS (SWDIV, 1998a) and OU3 proposed plan for public review.

Heavy earthmoving equipment such as track-mounted excavators, bulldozers, graders, and front-end loaders will be used to remove impacted soils. For excavations greater than 2 feet deep, excavation sidewalls will be maintained at an approximate 2:1 (horizontal:vertical) engineered slope. Maintenance of the side slopes will provide stability and reduce the need for shoring. During inactive periods, excavation and stockpile areas will be secured with barrier tape and warning signs will be posted. Potential exposure and protection procedures for site workers will be addressed in the site-specific health and safety plan. Risks associated with exposure of site personnel to dust emissions and direct contact with impacted soil during excavation will be minimized by spraying water on stockpiled soil and the excavation areas, using appropriate personal protective equipment (PPE), and observing proper decontamination procedures. Detailed field procedures for management and maintenance of open excavation areas and temporary storage stockpiles will be provided in the remedial design documents.

The impacted soil will be loaded onto dump trucks for disposal at Site 7 - Box Canyon Landfill. All loads will be covered with a secured tarp to prevent fugitive dust emissions during transport. Because volatile compounds are not of primary concern, any potential risk to the public in case of a traffic accident would involve release of particulates and dust and/or physical injuries.

Following completion of excavation to the target depths, confirmation sampling will be performed for CLP metals analysis to meet remedial action standards for sod specified in Table 2- 1. For costing purposes in the FS, the confirmation sampling frequency was estimated at one sample per 10,000 square feet; this frequency will be finalized during remedial design in accordance with the EPA*Guidance Methods for Evaluating the Attainment of Cleanup Standards, Volume I: Soils and Media, PB89-234959.*Clean fill will then be obtained from a suitable nearby source and transported to the site for backfilling, compaction, and grading. The site will be graded to original contours to the extent possible, and the final grade will be confirmed via land surveying. The site will then be revegetated to restore habitat and limit erosion.

The time to complete this alternative varies for each of the six sites based on the volume of contaminated soil. This alternative would be completed in approximately 10 weeks for Site 1A, 9 weeks for Sites 1A and 1F, 6 weeks for Site 2A, and 3 weeks for Site 1E.

2.4.3.3 Alternative 3. Excavation/Removal and Off-Base Disposal

This alternative involves excavation of contaminated soil, transportation to an off-base disposal facility, and backfilling of the excavated area using clean imported soil. All of the components of this alternative are identical to Alternative 2 with the exception of the disposal location.

For costing purposes in the FS, excavated soil is expected to be managed as hazardous waste and would require Class I landfill disposal because total metals concentrations exceed 20 times the toxicity characteristic leaching potential (TCLP) criteria. Leachability testing is planned prior to disposal. Excavated soils will be transported off base to an approved hazardous waste facility. The Kettleman Hills landfill, a hazardous waste landfill operated by Waste Management, Inc., in King County, California, was selected as the probable disposal facility. The contaminated soil would be transported in covered trucks on interstate highway systems. The Kettleman Hills landfill is approximately 250 miles north of MCB Camp Pendleton and 55 miles south of Fresno, California. The route to the landfill is along Interstate 5, which passes through central Orange County, the Los Angeles metropolitan area, and the northwestern part of Los Angeles County. The route continues through western portions of Kern and Kings Counties.

Confirmation sampling and backfilling of clean imported soil will be performed in the same manner as for Alternative 2. Safeguards, measures, and management and maintenance procedures discussed for Alternative 2 will also be implemented for this remedial action alternative. The time frames to complete cleanup for each site varies based on soil volumes and would be greater than described for Alternative 2 due largely to the greater transportation distances involved. Time frames are approximately 20 weeks for Site 1D, 18 weeks for Site 1F, 16 weeks for Site 1A, 10 weeks for Site 2A, and 4 weeks for Site 1E.

2.4.4 Summary of Comparative Analysis of Alternatives - Sites 1A, 1D, 1E, 1F, and 2A

This section summarizes the comparison of alternatives based on the nine evaluation criteria provided in the NCP. The nine criteria are grouped into three categories: threshold criteria,

primary balancing criteria, and modifying criteria. The evaluation is the same for Sites 1A, 1D, 1E, 1F, and 2A and the summary, therefore, applies to each of the five sites.

2.4.4.1 Threshold Criteria

These two criteria relate directly to statutory findings that must ultimately be made in the ROD; selected alternatives must meet these criteria.

2.4.4.1.1 Overall Protection of Human Health and the Environment

The no action alternative includes no treatment and no control of exposure pathways. The contaminated soil would be left in place. Under this alternative, the potential long-term risks would be the same as those calculated in the baseline HHRA and EcoRA. This alternative is not protective of human health and the environment and does not prevent potential leaching of soil contamination to groundwater.

Alternatives 2 and 3 would provide protection of human health and the environment by removing and disposing of contaminated soils in on-base or off-base facilities. The excavated areas would be backfilled with clean soil under both alternatives. Both alternatives would eliminate the threat to groundwater because the contaminated soil would be removed and could not leach to groundwater at the sites.

2.4.4.1.2 Compliance with ARARs

No applicable or relevant and appropriate requirements (ARARs) were identified for Alternative 1, since no action is taken. Both Alternatives 2 and 3 comply with ARARs. On-site disposal under Alternative 2 is in compliance with RCRA CAMU requirements because the excavated soil would be placed at Site 7 - Box Canyon Landfill, a designated CAMU (Appendix B). Soil would be screened using the designated level methodology (DLM) to model leachability and DI WET leachability testing would be conducted as required to comply with groundwater ARARs for Site 7. The excavation for Alternatives 2 and 3 would meet Federal and State endangered species ARARs. Mitigation could be required for some of the sites after consultation with the U.S. Fish and Wildlife Service. Excavation and transportation of sod to Site 7 would comply with San Diego Air Pollution Control District (APCD) ARARs by limiting fugitive dust emissions using engineering controls.

2.4.2 Primary Balancing Criteria

These criteria represent the primary criteria upon which the analysis is based and take into account technical, cost, institutional, and risk concerns.

2.4.4.2.1 Long-Term Effectiveness and Permanence

The risks associated with the Alternative 1 - No Action were evaluated in the baseline HHRA and the EcoRA (SWDIV, 1997b and 1998). Alternative 1 would not provide additional actions or controls to reduce existing contaminant concentrations and the associated risks to human health and the environment. As a result, the reliability and adequacy of such actions or controls cannot be assessed. In addition, Alternative 1 would leave contaminated material undisturbed at the site. Therefore, Alternative 1 provides no long-term effectiveness and permanence.

Alternatives 2 and 3 would enhance long-term effectiveness through permanent removal of contaminated soil from the sites, resulting in adequate and reliable reduction of exposure pathways and potential human health and ecological risks. Alternatives 2 and 3 would satisfy all RAOs, including the objective for no future action at the site following implementation of the remedial action. Any remaining detections of COCs or COECs would be below acceptable levels for human health and ecological risks. Alternatives 2 and 3 would provide a high degree of long-term effectiveness and permanence.

2.4.4.2.2 Reduction of Toxicity, Mobility, and Volume Through Treatment

Alternatives 1, 2, and 3 do not entail on-site treatment of contaminated soil. Accordingly, no reduction in toxicity. mobility, or volt, would occur due to treatment.

2.4.4.2.3 Short-Term Effectiveness

No remedial actions would be implemented under Alternative 1 and, therefore, effectiveness during implementation cannot be evaluated.

Potential exposure and protection procedures for workers during implementation of Alternatives 2 and 3 would be addressed in the site-specific health and safety plan. Risks associated with exposure of site personnel and nearby receptors to dust emissions and direct contact with contaminated soil during excavation would be minimized using dust suppressants and appropriate PPE.

Heavy equipment operated at the OU3 sites would conform with California Occupational Safety and Health Administration (Cal/OSHA, 1979) specifications and would be operated only by authorized, trained personnel. Traffic accidents associated with routine driving on base roads could occur during transport of soil off base or to Site 7. If a traffic accident were to occur, the risk to the public would be from exposure to dust from contaminated soil, in addition to the risk of physical harm due to the accident.

Enviromnental impacts to direatened or endangered species or migmtory birds would be minimal. Only small portions of currently undisunbed habitat would be impacted during implementation of Alternatives 2 and 3, and the sites would be revegetated upon completion of remedial activities. The time required for completion of Alternative 2 varies from 3 to 10 weeks based on the volume of soil at each site; the time required for completion of Alternative 3 ranges from 4 to 20 weeks.

2.4.4.2.4 Implementability

No implementability concerns are posed by Alternative 1 because no action would be taken.

For Alternatives 2 and 3, excavation and disposal of contaminated soil at an existing on-base or off-base facility is readily implementable and several vendors are available. Alternative 2, on-base disposal, would be easier to implement because the transportation distance is less than for Alternative 3. Equipment, materials, and labor for both Alternatives 2 and 3 are available.

2.4.4.2.5 Cost

No cost is associated with Alternative 1 - No Action. The cost for Alternative 2 is lower than the cost for Alternative 3 for each of the five sites.

Site	Alternative 2 (millions)	Alternative 3 (millions)
1A	$1.3	$8.2
1D	$1.4	$10.4
1E	$0.1	$1.0
1F	$1.5	$9.4
2A	$0.7	$4.6

2.4.4.3 Modifying Criteria

Modifying criteria include State and community acceptance and were evaluated following the comment period for the FS and the proposed plan.

2.4.4.3.1 State Acceptance

The Cal/EPA San Diego RWQCB and DTSC have approved the OU3 RI/FS and proposed plan and agree with the selection of Alternative 2 as the preferred alternative for Sites 1A, 1D, 1E, 1F, and 2A.

2.4.4.3.2 Community Acceptance

A public meeting was held on 14 May 1998 to present the preferred alternative to the public. No comments were received during the public meeting or public comment period.

2.4.5 Selected Remedy for OU3 Sites 1A, 1D, 1E, 1F, and 2A

The selected remedy for OU3 Sites 1A, 1D, 1E, 1F, and 2A is Alternative 2: Excavation/ Removal and On-Base Disposal. Soil will be excavated and transported to Site 7 (Box Canyon landfill) for disposal.

The full description of Alternative 2 is presented in Section 2.4.3.2. The approximate areas of excavation are delineated in Figures 2-6 through 2-10. The excavation areas are based on sample results, physical attributes of the site, geophysical surveys conducted at the sites, and historical aerial surveys. The area designations are dashed where there are no sample data representing levels below remedial goals. Excavation depths range from 3 to 10 feet as shown in Figures 2-6 through 2-10. The estimated volumes of soil to be removed from each site are listed below:

Site	Estimated Excavated Soil Volume (cubic yards)
1 A	31,700
1D	40,000
1E	4,000
1F	36,300
2A	17,700

Additional data was collected in May 1998 as part of the preconstruction effort to refine the extent of contamination. While estimated boundaries and volumes of soils to be excavated changed for individual sites, based on the additional data, the combined site soil volume remained essentially the same. Results are provided in the Energy Dispersive X-ray Fluorescence Field Investigation Report, dated 5 August 1998. The additional data results will be incorporated into the remedial design report for these sites.

The excavation strategy for each site is to minimize the excavation depth while meeting the remedial objectives. In areas driven by ecological risk only, the maximum excavation depth will be 5 feet. During the site restoration phase, this area will be covered with a minimum of 5 feet of clean soil to eliminate future risk of ecological exposure to any residual contamination remaining below a 5-foot depth. The same strategy will apply to areas driven by human health risks. The maximum excavation depth will be limited to 10 feet. The area will be backfilled with a minimum of 10 feet of clean soil if contaminant concentrations at 10 feet still exceed remedial goals.

The excavated soil will be transported to Site 7 - Box Canyon Landfill, which has been designated as a CAMU for these remedial actions. The Site 7 landfill has been inactive since May 1984. A removal action has been implemented at Site 7 for a phased installation of a landfill cap. The second phase of the landfill cap was designed to use the excavated soil from the OU3 sites as part of the fill (SWDIV, 1997c). The CAMU designation of Site 7 was publicly reviewed as part of the OU3 proposed plan. The criteria, as specified in 40 CFR 264.552(c), and rationale for designation follow:

- The CAMU shall facilitate the implementation of reliable, effective, protective, and cost-effective corrective action measures.

  The use of Site 7 as a CAMU for the disposal of excavated soil from OU3 sites is a reliable, effective, and protective remedy. A landfill cap will be placed over the excavated soil to limit mobilization of contaminants and minimize potential exposure. The use of Site 7 as a CAMU is more cost-effective than other alternatives evaluated such as off-site disposal.

- Waste management activities associated with the CAMU shall not create unacceptable risks to humans or to the environment resulting from exposure to hazardous wastes, hazardous substances, or hazardous constituents.

The excavated soils from OU3 sites are not expected to result in any unacceptable risks at Site 7. The landfill cap will prevent direct future exposure to humans and the environment. In addition, site data has been evaluated to assess if soils from Sites 1A, 1D, 1E, 1F, and 2A would impact groundwater beneath Site 7. Results of the DLM using RI data and leachability testing of site soils show that placement of the wastes at Site 7 from these five sites would not have a detrimental impact on groundwater. Further evaluation of existing soil and groundwater data, soil pH, landfill gas generation, features of the planned cap at Site 7, and local rainfall data was performed to assess the leaching potential from the site soils. Each of the factors evaluated indicate that metals present in the soils to be placed at Site 7 will not adversely impact groundwater. Details of this evaluation are presented in the Technical Memorandum for Leaching Potential of Sites 1A, 1D, 1E, 1F, and 2A dated 2 October 1998 (SWDIV, 1998c). Review of this evaluation by the EPA's Office of Research and Development found the evaluation to be technically acceptable and found little risk of metals mobilization from the consolidated/capped contaminated soils (EPA, 1998b).

- The CAMU shall include uncontaminated areas of the facility, only if including such areas of the purpose of managing remediation waste is more protective than management of such wastes at contaminated areas of the facility.

  Excavated soil from OU3 sites will only be located within the existing footprint of the Site 7 landfill and will not include uncontaminated areas.

- Area within the CAMU, where wastes remain in place after closure of the CAMU, shall be managed and contained so as to minimize future releases, to the extent practicable.

  The Site 7 landfill will be capped to contain the excavated soil and minimize the potential for future releases from the soil to groundwater.

- The CAMU shall expedite the timing of corrective action activity implementation, when appropriate and practicable.

  Using Site 7 for disposal of excavated soil from OU3 sites will expedite the remedial action because it will take less time than off-site disposal.

- The CAMU shall enable the use, when appropriate, of technologies (including innovative technologies) to enhance the long-term effectiveness of corrective actions by reducing the toxicity, mobility, or volume of wastes that will remain in place after closure of the CAMU.

  The mobility of contaminants in the soil excavated from the OU3 sites will be reduced when placed at Site 7 because the depth to groundwater at Site 7 is greater than the OU3 remedial action sites and the landfill cap will be placed over the excavated soil.

- The CAMU shall, to the extent practicable, minimize the land area of the facility upon which wastes will remain in place after closure of the CAMU.

  The consolidation of soil wastes from OU3 sites at Site 7 will aid in minimizing the land area of MCB Camp Pendleton upon which wastes will remain in place.

Additional information regarding the CAMU designation of Site 7 is provided in Appendix B.

Costs for the selected alternatives for the OU3 sites are as follows:

Site	Cost for Removal/Excavation and On-Base Disposal (millions)
1A	$1.3
1D	$1.4
1E	$0.1
1F	$1.5
2A	$0.7

Groundwater at OU3 Sites 1A, 1D, 1E, 1F, and 2A was recommended for no further action in the Group C and Group D RI reports (SWDIV, 1996a and 1997b). Excavation of contaminated soil at these sites will eliminate the potential for soil contaminants to leach to groundwater. Based on the DLM, excavated soil from Sites 1A, 1D, 1E, and 1F will not have the potential to impact groundwater at Site 7 (SWDIV, 1998a). Soil from Site 2A exceeded the designated levels, although only slightly; therefore, the soil from Site 2A was tested for leachability using DI WET analysis. The DI WET results were compared against a soluble designated level predicted by the DLM. DI WET results were less than the soluble designated levels, indicating that Site 2A soils would not pose a threat to groundwater (SWDIV, 1998b). Additional detail regarding potential leachability of Sites 1A, 1D, 1F, 1F, and 2A soils is presented in the technical memorandum dated 2 October 1998 (SWDIV, 1998c).

2.4.6 Statutory Determinations

This section discusses how the selected remedy for Sites 1A, 1D, 1E, 1F, and 2A meets the statutory requirements of CERCLA Section 121. Under CERCLA Section 121, the selected remedy at a Superfund site must entail remedial actions that achieve adequate protection of human health and the environmental. In addition, CERCLA Section 121 establishes several other statutory

requirements and preferences specifying that, when complete, the selected remedial action must comply with ARARs established under Federal and State environmental laws unless a statutory waiver is justified. The selected remedy must also be cost-effective and must entail permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Finally, the statute includes a preference for remedies that employ, as their principal element, treatment technologies that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes.

2.4.6.1 Protection of Human Health and The Environment

Under current conditions, human health risks associated with Sites 1A, 1D, 1E, 1F, and 2A are within the EPA cancer risk management range of 10^{-6} to 10^{-4}, however, the noncancer HQ for humans is greater than 1.0 for each site and lead exceeds acceptable criteria set by the EPA and DTSC for most sites. The risk to ecological receptors also exceeds acceptable levels. The selected remedy was chosen because soil contamination will be reduced to acceptable levels for both human and ecological receptors. Removal of contaminated soil will also eliminate the potential for migration of soil contaminants to groundwater. The potential risk for workers implementing the remedial actions for these five sites will be addressed in a site-specific health and safety plan.

2.4.6.2 Compliance with Applicable or Relevant and Appropriate Requirements

The selected remedy will comply with all Federal and State ARARs. The ARARs for Alternative 2 at Sites 1A, 1D, 1E, 1F, and 2A are discussed in Appendix B.

2.4.6.3 Cost-Effectiveness

The selected remedy was evaluated for cost-effectiveness in comparison with the other two alternatives. The no action alternative is less expensive than the selected alternative but does not reduce risk at the sites to acceptable levels. The selected alternative is the least expensive alternative that will be protective of human health and the environment and comply with ARARs.

2.4.6.4 Use of Permanent Solutions and Alternative Treatment Technologies to the Extent Practicable

The selected remedy uses permanent solutions and treatment technologies to the maximum extent possible for Sites 1A, 1D, 1E, 1F, and 2A. Because of the nature and concentration of contaminants, treatment was not found to be a practical solution. However, capping will reduce the mobility of contaminants by reducing infiltration.

The selected alternative provides the best balance between effectiveness and cost of the three alternatives considered with respect to the five EPA balancing criteria (i.e., long-term effectiveness; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost).

Alternative 1 would leave contaminated soil in place. The selected alternative and Alternative 3 both provide a high degree of long-term effectiveness and permanence because contaminated soil would be removed. Under the selected alternative the contaminated soil will be excavated, placed into a CAMU, and covered with an engineered cap.

None of the alternatives would reduce mobility, toxicity, or volume of the waste because treatment was found to be neither practical nor feasible. Treatment technologies evaluated were not considered feasible because they did not meet RAOs, were energy-intensive and costly, or were not effective for the COCs. The selected alternative was the greatest short-term effectiveness. Although excavation and earthmoving activities we the same for Alternatives 2 and 3, potential exposure during implementation is greater for Alternative 3 because transportation distances and implementation schedules are longer.

Alternative 2 is slightly easier to implement than Alternative 3. Alternative 3 includes longer transportation distances and compliance with permitting requirements for off-base disposal.

For each of the five sites, Alternative 2 is less expensive than Alternative 3. Because Alternatives 2 and 3 are considered approximately equal with regard to three of the other four balancing criteria, the least costly alternative has been selected.

2.5 Remedial Action Selection for Site 7 - Box Canyon Landfill

2.5.1 Side Name, Location, and Description - Site 7

Site 7 - Box Canyon Landfill is located near the southwest corner of the base in 20 Area to the east of Vandegrift Boulevard less than a mile northeast of Stuart Men Road (Figure 2-11).

The inactive landfill covers an area of approximately 28 acres. The majority of Box Canyon in which landfilling activities were conducted has been filled with landfill material to the surface of the surrounding marine terrace, which is approximately 140 feet above the Santa Margarita

riverbed. Near the canyon entrance, the landfill slopes steeply down to the north and terrninates approximately 1,000 feet from the Santa Margarita River.

2.5.2 Site Historyand Enforcement Activities

The site was used for quarry operations from approximately 1946 to 1970. The site began Class III landfill operations in May 1974 which ended in 1984. The landfill has been inactive since 1984. Typical wastes accepted for landfilling reportedly included household and construction refuse consisting of tree and lawn clippings, scrap lumber and metal, appliances, furniture, paper, fill, dirt, asphalt, concrete, tile, cans, containers, magazines, and boxes. The site also reportedly received dry cleaning sludges containing stoddard solvent; contaminated soil and dumpster waste containing fuels, POLs, solvents, thinners, strippers, epoxies, sealants, paint wastes, and chemical cleaners.

Based on the nature of wastes disposed at Site 7, a removal action to cap the landfill following the EPA Presumptive Remedy guidance (EPA, 1993) was proposed in the Group B RI (SWDIV, 1995b). Because of the large volume and heterogeneity of the contents of municipal landfills, treatment usually is impracticable and the EPA considers containment to be the appropriate response action, or the presumptive remedy, for the source areas of municipal landfill sites.

An engineering evaluation/cost analysis (EE/CA) was prepared to evaluate closure of Site 7 (SWDIV, 1995d). An addendum to the EE/CA was prepared in 1997 to evaluate an additional cap option (SWDIV, 1997c). Capping alternatives were evaluated as discussed in Section 2.5.5. Since Site 7 is a landfill and the presumptive remedy approach was used in the EE/CA, the level of detail provided in the EE/CA is considered adequate to meet the requirements of an FS, and is used as such for this ROD. Phase 1 of the cap was completed in October 1997. Phase 2 is planned to coincide with disposal of soils from the OU3 remedial action sites.

2.5.3 Summary of Site Characteristics

The initial RI work at Site 7 was conducted during March 1993 through March of 1994. Four soil samples were collected from the surface of the landfill and one soil sample was collected from the surface just outside the northwest edge of the landfill (Figure 2-11). Soil samples were analyzed for VOCs, SVOCs, gasoline, diesel, pesticides, PCBs, and herbicides. Twenty new groundwater monitoring wells were installed and sampled at Site 7. Three groundwater monitoring wells installed during a previous investigation at the site were also sampled (Figure 2-11). Three rounds

of groundwater monitoring were conducted during the initial RI. Samples were analyzed for metals, VOCs, SVOCs, gasoline, diesel, pesticides. PCBs, herbicides, and general chemistry. Three additional rounds of groundwater sampling of the 23 wells were conducted between June 1994 and July 1995. An ecological survey was conducted to identify potential special-status species habitats and trappings were conducted to determine presence of the Pacific pocket mouse. No special-status species were identified at Site 7. Samples were analyzed for metals, VOCs, SVOCs, gasoline, diesel, pesticides, PCBs, herbicides, and general chemistry.

A 24-hour meteorological survey was conducted on 8 and 9 September 1993. Based on the results of the meteorological survey, four 24-hour ambient air samples were collected from 9 to 10 September 1993. Ambient air and air traps (e.g., stairwells, crawl spaces, confined spaces, vents and vaults) were sampled for methane and hydrogen sulfide.

The results of the initial RI at Site 7 are reported in the Group B RI report (SWDIV, 1995b). The results of additional sampling and surveys are presented in the technical addendum to the Group B RI report (SWDIV, 1996c). These results are summarized in the following sections.

2.5.3.1 Geology and Hydrogeology

This section summarizes the geology and hydrogeology for Site 7 from the Group B RI (SWDIV, 1996c). Five distinct geologic units were encountered during the RI at Site 7. These are, from youngest to oldest, the younger alluvium of the Santa Margarita River, Pleistocene marine terrace deposits, the Plio-Pleistocene San Mateo Formation, post-mid-Miocene/pre-Pleistocene sandy and gravelly alluvial deposits, and the mid-Miocene San Onofre Breccia.

The San Onofre Breccia is unconformably overlain by Pleistocene terrace deposits on the west side of the landfill and by the sandy and gravelly alluvial deposits on the north and cast sides of the landfill. Field measurements indicate that the San Onofre Breccia strikes to the northwest and dips 10 to 15 degrees to the southwest.

The San Onofre Breccia is not expected to contain or transmit substantial quantities of groundwater (Palmer, 1990). Although this formation is considered an aquitard because of its poor sorting and high percentage of fine-grained materials (Palmer, 1990), two aquifers were encountered in the lower member of the San Onofre Breccia. No significant groundwater was observed in the upper member of the San Onofre Breccia.

The sandy and gravelly alluvium unconformably overlies the San Onofre Breccia and has several characteristics that make it a potential preferential pathway for leachate migration from the Box Canyon landfill. Thus, leachate from the Box Canyon landfill could potentially migrate downgradient through the sandy and gravelly alluvium to the Santa Margarita Basin.

The Plio-Pleistocene San Mateo Formation is exposed in cliffs along Ash Road, approximately 1,500 feet southwest of the Box Canyon landfill, and unconformably overlies the San Onofre Breccia. The contact between the two units is concealed. This unit was not encountered during well installation or soil sampling activities; it is offset by a normal fault that may be related to other faults in the vicinity of Site 7.

The Pleistocene marine terrace deposits unconformably overlie the San Onofre Breccia on the south, west, and north sides of the Box Canyon landfill and the sandy and gravelly alluvium on the cast side of the landfill.

The younger alluvium was encountered only in the wells installed in the Santa Margarita Basin, adjacent to the Box Canyon landfill. The alluvium thickens northward and westward toward the Santa Margarita River (away from the landfill).

Evidence of at least two sets of faults was observed in the vicinity of Site 7. One set strikes northeast, and the other strikes northwest. The evidence of faulting includes offset bedding, drag folding, slickensides, fault gouge, and lineations in aerial photographs.

Monitoring wells at Site 7 were installed in three geologic units having distinct hydrogeologic characteristics: Pleistocene marine terrace deposits, San Onofre Breccia Formation, and sandy and gravelly alluvium

The Pleistocene marine terrace deposits are generally restricted to the uppermost 60 feet of strata and do not appear to act as a separate aquifer. These deposits locally may act as a perched aquifer; however, the presence of sandstone and cobble conglomerate (at the base of the deposits) probably allows percolation of surface waters to the underlying formations.

Nine groundwater monitoring wells were installed in the San Onofre Breccia Formation. Groundwater was encountered in two distinct zones: a shallow zone that extends from 110 to

150 feet below grade, and a deep zone that extends from approximately 150 to 190 feet below grade. The two saturated zones appear to be separated by an aquitard of variable thickness and moisture content (dry to moist).

Six groundwater monitoring wells were installed in the sandy and gravelly alluvium. Groundwater was first encountered within the alluvium at depths of approximately 144 and 160 feet below ground surface and was found to be continuous to at least 220 feet in wells 7W-03 and 7W-06C. In monitoring wells 7W-08B and 7W-08C, the sandy and gravelly alluvium extends from approximately 45 to 117 feet below ground surface and, again, appears to be a continuous aquifer.

No confining zones or changes in water content were observed during drilling, which further indicates that the alluvium acts as one continuous aquifer. The unit is expected to be highly permeable because of its relatively coarse overall grain size and low percentage of fine grains.

Groundwater recharged through the sandy and gravelly alluvium near well cluster 7W-03 would tend to flow toward the landfill. The northwesterly groundwater flow direction through the sandy and gravelly alluvium near well cluster 7W-06 suggests that a pathway may exist for leachate migration from the landfill toward the Santa Margarita River. The planned cover will minimize the potential for rainfall infiltration and the generation of leachate at concentrations above acceptable criteria.

Five groundwater monitoring wells were installed in the alluvium of the Santa Margarita Basin. Groundwater was encountered 12 to 21 feet below ground surface. Observations during drilling and aquifer testing indicate that the alluvium acts as a continuous aquifer from an elevation of 10 feet msl to its intersection with consolidated bedrock. This depth varies and generally increases with distance (to the north) from the marine terrace.

The groundwater flow direction at the site is southwest to northwest. The hydraulic gradient, as determined from water levels measured on 20 April 1994 and 21 August 1995, ranges from approximately 0.076 ft/ft northwest of the landfill to approximately 0.40 ft/ft southwest of the landfill.

The direction of the horizontal hydraulic gradient in the deeper water-bearing units generally is similar to that of the first-encountered groundwater, with the exception of the area in the vicinity

of well 7W- 11. Site 7 lies within a recharge area, as indicated by lower head readings in deep monitoring wells compared with shallow wells.

2.5.3.2 Soil Results

Soil sample locations are shown in Figure 2-11. Low concentrations (ranging from approximately 10 to 100 µg/kg) of several polycyclic aromatic hydrocarbon (PAH) compounds were detected in sample 07SD004. Two other organics, toluene and bis(2-ethylhexyl)phthalate were detected in four of the five surface soil samples. Toluene was detected at a concentration of 1J µg/kg in samples 07SD002-LABQC and 07SD005. Bis(2-ethylhexyl)phthalate concentrations ranged from 150J to 1,800B µg/kg.

2.5.3.3 Groundwater Results

Figure 2-11 presents groundwater analytical results for organic contaminants detected at concentrations exceeding MCLs or PRGs in at least one Site 7 well. The figure also presents the breakdown products associated with these organics even though they did not exceed MCLs or PRGs. Metals were all below background and/or MCLs during the last four quarters of monitoring. Therefore, no inorganics are shown in the figure.

Groundwater analytical results for the RI are briefly described below:

- 1,2-DCA was detected during the second quarter 1993 above the MCL in one well. 7W-11B, at 2.0J µg/l. The MCL for 1,2-DCA is at the detection limit, 0.5 µg/l. 1,2-DCA was detected in 7W-11C during the third quarter 1993 at 0.5 µg/l and in well 7W-11A during the first quarter 1994 at 0.6 µg/l. It was detected in wells 7W-11A, 7W-11B and 7W-11C during the fourth quarter 1994 at 0.7, 1.0, and 0.6 µg/l. respectively. 1,2-DCA was not detected in any of these three wells during the first and second quarters 1995.

- 1,2-DCA was detected in well 7W-06A in a duplicate sample during the fourth quarter 1994 at 0.5 µg/l but not in the two subsequent rounds of sampling. It was not detected in the other well of the 2-well cluster, 7W-06B.

- PCE was detected below its MCL (5 µg/l) in well 7W-06A during the second and third quarters 1993 and during the first and fourth quarters 1994 at 1.0, 2.0, 2.0, and 1.0 µg/l, respectively. It was not detected in subsequent quarters in well 7W-06A or in the other well of the 2-well cluster, 7W-06B.

- PCE was detected once below its MCL (5 μg/l) in well 7W-07 during first quarter 1994 at 2.0 μg/l, but was not detected in three subsequent quarters.

- PCE was not detected in well 7W-11C. It was detected in wells 7W-11A and 7W-11B but did not exceed MCLs. PCE was detected in well 7W-11B during the second and third quarters 1993 and the first quarter 1994 at 0.5, 0.9, and 0.7 μg/l. respectively. It was not detected in 7W-11B during the fourth quarter 1994, it was detected in the first quarter 1995 at 0.7 μg/l, but was not detected during the second quarter 1995. PCE was detected in 7W-11A during the second and third quarters 1990, the first and fourth quarters 1994, and the first and second quarters 1995 at 1.5, 1.2, 1.0, 1.0, 1.0, and 0.7 μg/l, respectively.

- 1,1-DCA was detected below its MCL (5.0 μg/1) in wells 7W-06A, 7W-11A, 7W-11B, and 7W-11C. It was detected in well 7W-06A during the first and fourth quarters 1994 (maximum 1.0 μg/l) but not during the two subsequent quarters. It was detected in 7W-11A, 7W-11B, and 7W-11C during the first and fourth quarters 1994 and the first and second quarters 1995 at a maximum concentration of 3 μg/l.

- TCE was detected once above its MCL (5.0 μg/l) at its maximum concentration in well 7MW-02 at 5.2 μg/l during the third quarter 1990 but was not detected during six subsequent quarters. TCE was detected below its MCL (5.0 μg/l) in wells 7W-06A, 7W-07, 7W-11A, 7W-11B, and 7W-11C. It was only detected once at 3.0 μg/l in 7W-07 during the first quarter of 1994 but it was not detected in this well during three subsequent quarters. TCE was detected twice in 7W-06A at 0.9 μg/l during the third quarter 1993 and the first quarter 1994 but not during three subsequent quarters. TCE was detected in well 7W-11A during the second and third quarters 1990, the first and fourth quarters 1994, and the first quarter 1995 at 2.0, 1.6. 2.0. 1.0, and 0.9 μg/l, respectively, but was not detected during the second quarter 1995. TCE was detected in well 7W-11B during the second and third quarter 1993, the first and fourth quarters 1994, and the first and second quarters 1995 at 0.8, 0.9, 1.0, 0.7, 0.9, and 0.9 μg/l, respectively. TCE was detected once in well 7W-11C during the second quarter 1993 at 0.4 μg/l, but was not detected during five subsequent quarters.

- Benzene was only detected once in Site 7 groundwater. It was detected below its MCL in well 7W-07 at 1 μg/l during the first quarter 1994, but was not detected during three subsequent quarters.

- Carbon tetrachloride was detected twice in Site 7 groundwater. It was detected above its MCL (0.5 μg/l) in wells 7W-07 at 7.0 μg/l during the first quarter 1994 and at its MCL in 7W-11C at 0.5 μg/l during the third quarter 1993. It has not been detected since in at least three quarters after each detection.

- 1,4-dichlorobenzene was detected below its MCL (5 μg/l) in 7W-11A during the fourth quarter 1994 and the first quarter 1995 at 0.5 and 2.0 μg/l, respectively, but was not

detected during the second quarter 1995. It was also detected in well 7W-11B during the first and second quarters 1995 at 2.0, and 0.6 µg/l.

- Dibromochloromethane, 1,3-dichlorobenzene, bromodichloromethane, phenol, benzoic acid, bromoform, and chloromethane were detected once or twice in the last four quarters of groundwater sampling but did not exceed MCLs or did not have MCLs. The maximum detected concentrations were 2.0, 0.6, 3.0, 19, 5.0, 3.0, and 5.0 µg/l, respectively.

- Antimony, barium, chromium, manganese, molybdenum, nickel, selenium, thallium, and vanadium were detected at maximum concentrations that exceeded upgradient background concentrations. However, the 95 percent upper confidence limit of the mean site concentrations of these metals did not exceed background except for barium. The maximum concentrations of other metals detected were less than background. There was no background for antimony or thallium available. Barium was detected in 48 of 85 groundwater samples at Site 7. The maximum barium concentration was 362 µg/l which is less than its MCL (1,000 µg/1). Antimony was detected in 2 of 85 groundwater samples. It was detected at 13.3 µg/l in wells 7W-4A and 7W-5A during the second quarter of 1993. The detected antimony concentrations exceed the MCL (6 µg/1). Antimony was not detected during the last four quarters of sampling in 1994 and 1995. Thallium was detected in 4 of 85 groundwater samples. The maximum thallium concentration was 26 µg/l which exceeds its MCL (2 µg/l). All other detections were less than the MCL. Thallium was not detected during the last four quarters of sampling in 1994 and 1995.

- Nitrate was detected at a concentration exceeding its MCL (10 µg/1) only once in an upgradient well 7W-01A during the first quarter 1994 at 14.3 µgl.

2.5.3.4 Ambient Air and Soil Gas Results

Ambient air monitoring consisted of a 24-hour meteorological survey of wind speed and direction, collection of 24-hour ambient air samples, and direct testing of hydrogen sulfide and methane concentrations. Four soil-gas samples were collected, in duplicate, at the Santa Margarita School and the Wire Mountain Housing Area. The presence of an impenetrable caliche-type soil layer limited sampling depths to 1.5 feet instead of the proposed 3 to 6 feet. The areal extent of the caliche layer is not well defined. Based on the four soil-vapor sample locations, it may extend about 800 feet in a north/south direction. This unit could act as a capping layer that would restrict the upward migration of soil vapors.

Air sampling results are summarized below:

- Four ambient air samplers were placed at the Box Canyon landfill in accordance with CARB requirements. Low levels (1.2 to 2.0 ppb) of 1,1,1-TCA were detected in all four samples. The presence of 1,1,1-TCA in the upwind samples indicates that the landfill is probably not the source for this compound. It is difficult to determine the source of these low levels of 1,1,1-TCA. However, sampling locations were relatively close to roads and developed areas.

- Hydrogen sulfide and methane were not detected in any of the tests at the specified instrument detection limits.

No halogenated volatile compounds were detected in the soil-gas samples. Complete analytical results for the soil-gas samples are, presented in Appendix G of the technical memorandum for Group B sites (SWDIV, 1993d).

2.5.4 Summary of Site Risks - Site 7

2.5.4.1 Human Health Risk Characterization

The HHRA for Site 7 soil was an interim screening assessment because of the planned capping of the landfill; capping of this landrill began in 1997, and Phase I was completed 17 November 1997. PAH compounds in one sample, 07SD004, were the primary contributors to risk and resulted in a maximum total site-related risk (residential scenario) of 1×10^{5} for soil at Site 7. No individual PAH exceeded the incremental lifetime cancer risk (ILCR) of 1×10^{6} for ingestion, and benzo(a)pyrene toxicity values were used for PAH compounds of probable lesser toxicity. The total maximum hazard index (HI for soil was less than the target criterion of 1.0. Because of the small number of soil samples collected and the placement of the landfill cap, no further risk assessment evaluation was conducted for Site 7 soil.

The landfill material is assumed to be contaminated and sampling of the fill material was not conducted consistent with the EPA presumptive remedy guidance. The site was investigated to determine the potential for off-site gas migration and the potential impact to groundwater during the remedial investigation. The potential for gas migration was determined not to be a concern based on results of air monitoring at the site and at the neighboring residential area and elementary school.

There were groundwater contaminants detected intermittently in some of the 23 monitoring wells at the site. The noncancer hazard index was 3.2 due to antimony (1.7 HQ) and thallium (1.4 HQ). Neither thallium nor antimony were detected during the latest 2 rounds of sampling. The main contributors to the groundwater cancer risk were 1,2-dichloroethane (1,2-DCA), tetrachloroethene, and trichloroethene. The cancer risk was calculated to be within the risk management range (1×10^{6}). The results of the latest 2 rounds of sampling (first and second quarter of 1995) were nondetect for 1,2-DCA and the other risk contributors were less than their MCLs. The risk/hazard for groundwater is within the NCP risk management range and is determined to be acceptable.

2.5.4.2 Ecological Risk Assessment

No ecological risk assessment was conducted for Site 7 because no special-status species or habitat were identified and a landfill cap was planned to be instaIlled.

2.5.5 Description of Alternatives - Site 7

The landfdl presumptive remedy approach was used to assess alternatives for Site 7. The components of the landfill presumptive remedy include: a landfill cap, source area groundwater control to contain the plume, leachate collection and treatment, landfill gas collection and treatment, and institutional controls.

An EE/CA was prepared to evaluate capping options for Site 7 (SWDIV, 1995d). Four cap alternatives were evaluated for Site 7. All four alternatives include drainage controls, gas monitoring, groundwater monitoring and land use restrictions. No landfill gas collection/control system is required because it has been determined that the landfill does not have the potential to generate significant amounts of gas. Three of the alternatives, Alternatives 1, 2, and 3, consisted of the four layers of a prescriptive cap, but the barrier layer material was varied. The prescriptive cap layers are as follows:

Foundation layer: minimum 2-foot-thick layer of soil over the waste, compacted to provide adequate structural support for successive layers

Barrier layer: infiltration barrier layer composed of low-permeability material

Drainage layer: soil or geocomposite layer with high permeability to permit drainage of infiltration through the topmost protective soil layer

Protective soil layer: minimum 12-inch soil layer to protect the barrier layer, control surface erosion, and provide a medium for vegetation

The different barrier layers for Alternatives 1, 2, and 3, respectively, are as follows:

1. Low permeability clay layer
2. Native soil mixed with bentonite to reduce permeability
3. A textured high-density polyethylene (HDPE) flexible membrane liner (FML).

One additional cap alternative, an evapotranspiration (ET) cover (Alternative 4), was evaluated in the Technical Addendum to the EE/CA (SWDIV, 1997d). This cap includes a vegetated topsoil layer (1 foot thick) over a minimally compacted 3- to 4-foot soil layer. The bottom layer consists of a 1-foot compacted low-permeability (1×10^{-5} centimeters per second [cm/s]) soil layer.

2.5.6 Summary of Comparative Analysis of Alternatives - Site 7

The four cap alternatives were evaluated on the basis of effectiveness, implementability, cost, and compliance with ARARS. A summary of the evaluation is provided in the following sections.

2.5.6.1 Overall Protection of Human Health and the Environment and Compliance With ARARs

Each of the four alternatives would provide adequate overall protection of human health and the environment. For each alternative, the major threat is addressed through containment and appropriate continued monitoring and maintenance. Each of the alternatives also comply with ARARs. Details are provided in Appendix B.

2.5.6.2 Long-Term Effectiveness and Permanence

Each of the alternatives provide a high degree of long-term effectiveness and permanence. The cap and monitoring activities provide adequate and reliable reduction of exposure pathways and potential human health and ecological risks. The ET cover, however, will require less maintenance than the other cap options since the cover is inherently self-renewing and not damaged by long-term wetting and drying. Also, the ET cover will not include synthetic materials and therefore will not be prone to potential deterioration over time.

2.5.6.3 Reduction of Toxicity, Mobility, and Volume Through Treatment

Alternatives 1, 2, 3, and 4 do not include treatment, therefore, no reduction in toxicity, mobility, or volume would occur due to treatment

2.5.6.4 Short-Term Effectiveness

Potential exposure and protection procedures for workers during implementation of the capping alternatives would be addressed in the site-specific health and safety plans. Potential exposure of site personnel and nearby receptors to windborne particulates would be minimized through the use of dust suppressants and appropriate personal protective equipment.

Each alternative would provide for protection of surface water and groundwater. Alternative 4 provides for restoration of the site to accommodate future habitat to support endangered species. Alternative 4 also preserves additional areas of habitat along the north slope, thus eliminating mitigation measures required by the other three alternatives.

Alternative 4 requires the least amount of construction time, approximately 7 months. The other alternatives range between 9 to 12 months for implementation.

2.5.6.5 Implementability

Equipment, materials, and labor for each alternative are available. The ET cover, Alternative 4, will be relatively easy to construct since only general earthwork is needed with no requirement for strict compaction control. Additionally, no seaming of synthetic materials is required.

2.5.6.6 Cost

The overall cost and cost per acre for Alternative 4 are less than the costs for Alternatives 1, 2, and 3. The estimated costs for each alternative are as follows:

	Cost (Millions $)	Cost per Acre (Millions $)
Alternative 1	$5.9	0.22
Alternative 2	$6.2	0.22
Alternative 3	$5.7	0.21
Alternative 4	$3.1	0.11

2.5.6.7 State Acceptance

The DTSC and San Diego RWQCB agree with the selection of the ET cap and associated actions for Site 7.

2.5.6.8 Community Acceptance

No comments were received from the public during the review for the Site 7 EE/CA.

2.5.7 Selected Remedy for Site 7

The selected remedy for Site 7 is Alternative 4 - Evapotranspiration Cover. This alternative includes construction of an ET cover system for the top dock of Box Canyon landfill. No additional cover material for the north slope of the landfill is planned. The north slope is approximately 4 acres in size with densely vegetated slopes of 2.0-2.5 horizontal on 1.0 vertical and includes approximately 5 feet of existing cover material. Since this slope is considerably steep, a majority of rainfall runs off the slope with very little actually infiltrating the slope. The TR-55 runoff model developed by the Soil Conservation Service (SCS) indicates that for a 24-hour, 100-year storm event (3.3 inches of rain) approximately 2.54 inches runs off and only 0.75 inch infiltrates into the slope. Due to the dense vegetation on the north slope, ET processes are effective at controlling the low percentage of infiltration on the steep slopes. However, lined drainage ditches will be installed at the benches to eliminate infiltration along the relatively flat terraces.

The ET cover utilizes the natural process of surface runoff, storage, evaporation, and transpiration to control infiltration of water through the landfill cover. The basic profile of an ET cover includes a vegetated top soil layer, a minimally compacted soil layer and an optional low-permeability layer. The purpose of the topsoil layer is to promote vigorous plant growth, and the purpose of the underlying minimally compacted soil layer is to provide substantial water storage for removal by the natural process of evapotranspiration. The basic purpose of the low permeability bottom layer is to act as a barrier between the cover and the waste. Soils most suitable for ET covers are those with a high available water retention capacity and an adequate supply of nutrients to support vigorous plant growth. Vegetation's most suitable for ET covers are generally a wide mixture of native grass species so that high transpiration is maintained even under adverse growing conditions and during long-term climatic changes.

ET covers, in general, require less maintenance than traditional covers since this type of cover system is inherently self renewing. Also, ET covers are generally more easily constructed since only general earthwork is required and strict compaction control is generally not required. Additionally, labor intensive details associated with synthetic materials are not required.

The ET cover selected for Site 7 includes a vegetated topsoil layer (1-foot-thick) underlain by a minimally compacted 3- to 4-foot soil layer with a 1- to 3-foot compacted, low-permeability bottom layer. A schematic diagram of this cross-section is shown in Figure 2-12. The cap will cover 28 acres. This alternative would include grading the existing surface, transporting on-base borrow soils as necessary, and importing topsoil. On-base borrow soil will be obtained from the Lemon Grove area of MCB Camp Pendleton. Lemon Grove is located approximately 1 mile southwest of Site 7. The borrow soil sites have been screened for biological and archaeological concerns. A vernal pool area was identified near the borrow sites. The vernal pool will be fenced prior to removal activities. No archaeological concerns were identified.

To ensure that human health and the environment are protected in the future, no breaching of the soil cap at Site 7, through trenching, excavation, or any other similar activity may occur unless prior approval of the FFA signatories is obtained. This restriction does not apply to maintenance activities for purposes of preservation or restoration of the physical integrity of the cap. Maintenance activities may include cleaning of drainage channels and pipes, replacement of erosion control materials, regrading of channels, and replacement of pipes, inlets, or catch basins. Also, if significant erosion results from heavy rain episodes, partial excavation of the cover soil and import and placement of additional cover soil, as well as reseeding of the cover, would be conducted. Access roads and the landfill perimeter road will be maintained and improved as necessary. Signs and fencing will also be repaired or replaced as part of the maintenance activities. If major land use changes are planned, including any change that is inconsistent with the exposure assumptions in the risk assessment, that is specifically prohibited to protect human health or the environment, that may disrupt the effectiveness of the remedy, or that might alter or negate the need for the land use restriction, the FFA signatories must be provided with written notification of such a proposed action at least 60 days prior to the beginning of the implementation of the proposed action. MCB Camp Pendleton shall prepare and include an evaluation of the risk to human health and the environment and an evaluation of any need for additional remedial action resulting from the proposed action and shall propose any necessary changes to the remedial action selected in the OU3 ROD in the written notification of a proposed

change. The EPA will advise whether a ROD amendment or an explanation of significant difference is required. The FFA signatories must provide written concurrence with MCB Camp Pendleton's evaluation of risk and proposal regarding any necessary changes in the remedial action, if required, within 30 days of receipt of the written notification from MCB Camp Pendleton.

MCB Camp Pendleton shall notify the FFA signatories of any plan to lease or transfer Site 7 real property to a non-Federal or Federal entity. Such notification shall be provided at least 30 days in advance of the lease or transfer conveyance. The land use restriction shall be incorporated as part of the lease or transfer agreement; including FOSL and FOST procedures. MCB Camp Pendleton shall comply with Section 120(h)(3) of CERCLA in any such transfers to a non-Federal entity.

The MCB Camp Pendleton Base Master Plan will be amended to incorporate the abovementioned use limitations and notice requirements for Site 7. The Master Plan amendments will also include language that describes the risk to human health and the environinent that exists at Site 7; will reference the MCB Camp Pendleton Group C and Group D RI reports, the Site 7 EE/CA, the OU3 FS report, and the OU3 ROD; and will provide a legal description (metes and bounds) of the boundaries of Site 7. The language in the Master Plan amendments will also include the title and dates of the above-listed documents and their storage location. These amendments to the Master Plan will be completed by MCB Camp Pendleton within 1 year of signing the MCB, Camp Pendleton OU3 ROD. The FFA signatories will be provided with a copy of the amendments to the Master Plan reflecting the land use limitations at Site 7. The land use restriction will be reviewed and verified during the CERCLA 5-year review process.

Long-term groundwater monitoring will also be conducted. Selected groundwater monitoring wells will be analyzed biannually for 5 years. The collected groundwater monitoring wells will be analyzed for volatile and semivolatile organics, metals, and general chemistry. These groundwater monitoring results will be assessed at the end of 5 years, or sooner if appropriate, to determine if any additional sampling is required. No remediation for groundwater at Site 7 is necessary. The carcinogenic human health risk is within the EPA's risk management range.

The estimated cost for this alternative is $3.1 million. The cost per acre is $109,300.

2.5.8 Statutory Determinations

This section discusses how the selected remedy for Site 7 meets the statutory requirements of CERCLA Section 121. Under CERCLA Section 121, the selected remedy at a Superfund site must entail remedial actions that achieve adequate protection of human health and the environment. In addition, CERCLA Section 121 establishes several other statutory requirements and preferences specifying that, when complete, the selected remedial action must comply with ARARs established under Federal and State environmental laws unless a statutory waiver is justified. The selected remedy must also be cost-effective and must entail permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Finally, the statute includes a preference for remedies that employ, as their principal element, treatment technologies that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes.

2.5.8.1 Protection of Human Health and the Environment

The remedy selected for Site 7 will provide protection of human health and the environment by eliminating direct contact of landfilled wastes or inhalation of particulates by humans and animals. The cap will also minimize infiltration of water and leaching of contaminants to the groundwater. Cleanup levels were not established because the type of cap selected and associated actions were determined by ARARs. Short-term potential risks to workers and nearby receptors will be addressed in the site-specific health and safety plan; dust suppression measures and protective clothing will be specified.

2.5.8.2 Compliance with Applicable or Relevant and Appropriate Requirements

The selected remedy will comply with all Federal and State ARARs. The ARARs for Alternative 4 at Site 7 are discussed in Appendix B.

2.5.8.3 Cost-Effectiveness

The selected remedy was evaluated for cost-effectiveness in comparison with the other three alternatives. The selected alternative is the least expensive alternative that will be protective of human health and the environment and comply with ARARs.

2.5.8.4 Use of Permanent Solutions and Alternative Treatment Technologies to the Extent Practicable

The selected remedy uses permanent solutions and treatment technologies to the maximum extent possible. Because the site is an inactive landfill, the presumptive remedy was considered appropriate for Site 7.

The selected alternative provides the best balance between effectiveness and cost of the four alternatives considered with respect to the five EPA balancing criteria (i.e., long-term effectiveness; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost).

The selected alternative and Alternatives 1, 2, and 3 provide a high degree of long-term effectiveness and permanence because wastes would be appropriately contained. Under the selected alternative the wastes would be covered with an engineered ET cap.

None of the alternatives would reduce mobility, toxicity, or volume of the waste because treatment was found to be neither practical nor feasible. Treatment technologies were not specifically evaluated because based on presumptive remedy guidance, they are routinely and appropriately screened out on the basis of effectiveness, feasibility, and cost. The selected alternative provided the greatest short-term effectiveness, due to the shorter timeframe required for implementation.

Alternative 4 is easier to implement than the other alternatives, because seaming and placement of synthetic materials are not components of the ET cap.

Alternative 4 is less expensive than Alternatives 1, 2, and 3. Because Alternative 4 provides greater long-term and short-term effectiveness, the most cost-effective alternative has been selected.

2.6 No Action Selected for Sites 1B, 1C, 1G, 1I, 2C, 2D, 2F, 2G, 10, 16, 17, 18, 27, 32, 34, 35, 36, 37, 38, 39, 40, 41, and 42

This section presents descriptions, histories, characteristics, and risks associated with the OU3 no action sites. For the no action sites, all inorganics exceeding screening criteria and any detected organics are typically shown in the site-specific figures.

2.6.1 Site 1 B - Refuse Burning Ground in 11 Area

Site 1B is a former refuse burning ground in the 11 Area.

2.6. 1. 1 Site Name, Location, and Description

Site 1B - Refuse Burning Ground in 11 Area, is located in the San Luis Rey Basin, on an unpaved road intersecting 14th Street, approximately 0.5 mile southeast of Vandegrift Boulevard (Figure 1-2). The former burning ground is approximately 340 feet long and 100 feet wide. The site is bordered on the east and south by a densely vegetated stream-cut canyon. To the north and west of Site 1B are low rolling hills with light to moderate vegetation.

No perennial surface water is present in the vicinity of the site. During significant rainfall events, surface water percolates into the subsurface, evaporates, or runs off the site and eventually discharges into Pilgrim Creek, approximately 0.5 mile to the east.

The burning ground is no longer in use and military and civilian personnel are not on site on a regular basis. The nearest residential housing is approximately 0.25 mile southwest of the site. No base production wells are located within a 1-mile radius of Site 1B. There are no water production wells in the San Luis Rey Basin.

2.6.1.2 Site History and Enforcement Activities

Site history and enforcement activities for refuse burning grounds are described in Section 2.4.1.2.

2.6.1.3 Summary of Site Characteristics

Site 1B was investigated in June and July 1996 during the RI for Group D sites. Five soil samples were collected from two borings and were analyzed for metals, VOCs, SVOCs, and pesticides and PCBs. No sediment or surface-water samples were collected because no surface water was present on site. No groundwater samples were collected because drilling refusal occurred at less than 50 feet below ground surface, before encountering sufficient groundwater for sampling.

2.6.1.3.1 Geology and Hydrogeology

Shallow geology at Site 13 consists of Quaternary alluvium overlying granitic rock (bedrock basement complex). Groundwater is assumed to flow to the east, following surface topography. The depth to groundwater is estimated to be more than 80 feet below grade.

2.6.1.3.2 Soil Results

This section discusses analytical results from soil sampling at Site 1B. Results are summarized in Figure 2-13, which presents detected organics and any inorganics that exceed risk/hazard criteria.

Organics

No organic compounds were detected at Site 1B at concentrations exceeding PRGs (Figure 2-13). Chlorinated pesticides (4,4'-DDD, 4,4'-DDE, and 4,4'-DDT) were detected at low concentrations in the surface sample from boring 1BB-02; the highest concentration was 0.011 mg/kg. In addition, 4,4'-DDT was detected at a concentration of 0.003 mg/kg in the 5-foot sample from the same boring. No organics were detected at concentrations exceeding ecological risk screening criteria.

Inorganics

Two metals, arsenic and beryllium, were detected at concentrations exceeding PRGs in two of five and four of five samples, respectively (Figure 2-13). All detections were below background levels. Only lead exceeded ecological risk screening criteria.

Summary

No organics were detected in soil at concentrations exceeding PRGs; arsenic and beryllium were the only inorganics detected, but concentrations were below background. Because only a few low-level detections of inorganics were reported and the depth to groundwater at the site is about 80 feet below ground surface, groundwater is not expected to be impacted. No significant site-related contamination exists at Site 1B.

2.6.1.4 Summary of Risks Associated with Site 1B

Human health and ecological risk assessments were conducted for Site 1B using data collected during the Group D RI. Risk assessment methodologies are summarized in Section 2.4.1.4. Risk assessment summaries for Site 1B are presented in this section.

2.6.1.4.1 Human Health Risk Characterization

COPCs in Site 1B soil include metals and pesticides. Based on the conceptual site model, current/future workers and future residents could be exposed to soil contaminants through incidental ingestion, dermal contact, and inhalation of particulates.

The total residential cancer risk for maximum reported COPCs is 1.1×10^{-5}. The primary contributors to risk are arsenic (approximately 76 percent of the total risk) and beryllium (approximately 24 percent of the total risk). However, arsenic and beryllium concentrations at Site 1B are below the respective background concentrations. Excluding arsenic and beryllium as naturally occurring, the incremental site risks calculated using EPA and Cal/EPA PRGs are both 1.4×10^{-8}, which is below the lower end of the risk management range. The cumulative residential hazard (noncarcinogenic) for maximum detected COPCs is 0.51.

The Site 1B residential cancer risk and noncarcinogenic hazard are less than the risk and hazard criteria. In addition, the maximum lead concentration in soil (26.8 mg/kg) at Site 1B is below the EPA and Cal/EPA residential PRGs of 400 and 130 mg/kg, respectively. Therefore, Site 1B soil is considered protective of human health.

Groundwater is not considered a complete exposure pathway for either current/future workers or future residents. Groundwater sampling was not performed at Site 1B because drilling refusal occurred before encountering sufficient groundwater for sampling. Site 1B is not located above a shallow aquifer associated with any of the four major groundwater basins at MCB Camp Pendleton (i.e., San Mateo, San Onofre, Las Flores, or Santa Margarita Basin). The site is topographically higher than, and isolated from, the aquifers associated with these major basins. Therefore, groundwater at Site 1B was not evaluated further in the HHRA.

2.6.1.4.2 Ecological Risk Assessment

Lead was the only preliminary COPEC with an HQ exceeding 1.0 (Figure 2-13). The HQ for lead (1.5) exceeds but is close to 1.0 for deer mouse, indicating that the potential for toxicity is relatively low. HQs are less than 1.0 for the other representative species evaluated.

Site 1B includes nonnative grasslands and coastal sage scrub habitat. Several wildlife species were observed, and special-status species could be present on site.

None of the preliminary COPECs were retained as final COPECs. The potential for exposure and effects is considered low. The HQs for all but one of the representative species are less than 1.0, indicating little or no potential for toxicity. In addition, because of its small size (approximately 1.3 acres) and proximity to developed areas, this site would provide only a limited proportion of the habitat available for the representative wildlife species. Therefore, ecological receptors would not likely be sufficiently exposed to potentially harmfull contaminant concentrations to cause adverse effects.

2.6.1.5 Description of the No Action Alternative

The no action alternative selected for Site 1B includes no institutional controls. Site 1B is considered protective of human health and the environment for the following reasons:

- Under the future residential exposure scenario, maximum soil concentrations resulted in an ILCR less than 1×10^{-6} and an HI less than 1.0.
- The maximum lead concentration is below the screening values.
- Groundwater is not considered a complete exposure pathway for either current/future workers or future residents.
- The refuse burning ground is no longer in operation, and military and civilian personnel are on site infrequently.
- Evaluation of potential ecological risks from exposure to soil indicated that the potential for exposure and effects is low and will not likely pose a risk to ecological receptors.

2.6.2 Site 1C - Refuse Burning Ground in 13 Area

Site 1C is a former refuse burning ground in the 13 Area.

2.6.2.1 Site Name, Location, and Description

Site 1C - Refuse Burning Ground in 13 Area, is located along "A" Street and Reservoir Road, approximately 0.5 mile southwest of Rattlesnake Canyon Road (Figure 1-2). The refuse burning ground is approximately 300 feet long and 200 feet wide. The site is bordered on the east by "A" Street, on the north by Reservoir Road, and on the west and south by light to moderate vegetation. Site 1C slopes gently to the south and eventually drains into a stream-cut canyon.

An unpaved dirt road runs directly through the middle of the site, and low rolling hills surround the site.

No perennial surface water is present in the vicinity of the Site 1C burning ground. During significant rainfall events, surface water percolates into the subsurface, evaporates, or runs off the site and discharges into the Santa Margarita River approximately 1 mile to the east.

No development is located in the immediate vicinity of the site. The refuse burning ground is no longer in operation, and military and civilian personnel are present on site infrequently. The undeveloped area surrounding the site is classified as a maneuver area with gently sloping topography covered by natural vegetation (Innis-Tennebaum Architects, Inc., 1990). The nearest troop housing is approximately 0.25 mile southeast of the site. The nearest family housing, the Ranch House, is located about 1 mile west of the site. No base production wells are located within a 1-mile radius of Site 1C.

The dominant habitat at Site 1C is nonnative grassland consisting primarily of wild oat and mustard. Coastal sage scrub habitat consists of coyote bush and castor bean, with a few sage interspersed. Special-status wildlife species potentially present at this site include California gnatcatcher. Bird species observed during the reconnaissance survey include western meadowlark and cliff swallow.

2.6.2.2 Site History and Enforcement Activities

Site history and enforcement activities for refuse burning grounds are described in Section 2.4.1.2.

2.6.2.3 Summary of Site Characteristics

Site 1C was investigated in June and July 1996 during the RI for Group D sites. Eight soil samples were collected from two borings and were analyzed for metals, VOCs, SVOCs, and pesticides and PCBs. No sediment or surface-water samples were collected because no surface water was present on site. No groundwater samples were collected because drilling refusal occurred before encountering sufficient groundwater for sampling.

2.6.2.3.1 Geology and Hydrogeology

Shallow geology at this site consists of Quaternary alluvium that was deposited by broad surface erosion. The alluvium is fine- to medium-grained, unconsolidated to poorly consolidated sand and interbedded silty sand. The alluvium is underlain by interbedded sandstone and siltstone bedrock of the La Jolla Group.

Based on site geology, groundwater is assumed to flow to the south, following surface topography. Soil borings were drilled to a maximum depth of 35 feet below ground surface at Site 1C. Groundwater was encountered at a depth of 34.5 feet in boring 1CB-02 but is interpreted to represent a localized, discontinuous perched layer of groundwater rather than a major water-bearing zone (aquifer) because Site 1C is located in a topographically elevated area and is isolated from the alluvial aquifer at the basin floor. Groundwater was consistently encountered at a depth of about 20 feet below grade in boreholes drilled for underground storage tank (UST) studies at the adjacent 12 and 13 Areas approximately 0.75 mile northeast of Site 1C (SWDIV, 1996b). Because topographically the 12 and 13 Areas are about 100 feet lower than Site 1C, the groundwater table at Site 1C is estimated to be nearly 120 feet below ground surface.

2.6.2.3.2 Soil Results

This section discusses analytical results from soil sampling at Site 1C. Results are summarized in Figure 2-14, which presents detected organics and any inorganics that exceed risk/hazard criteria.

Organics

No organic compounds were detected in soil at Site 1C at concentrations exceeding PRGs (Figure 2-14). Low concentrations of acetone were detected in samples from both borings at Site 1C; the highest concentration was 0.024 mg/kg. In addition, 2-butanone and Aroclor-1254 were detected at concentrations of 0.003 and 0.0 19 mg/kg, respectively, in the 10-foot sample from boring 1CB-01. None of the detected organics exceeded ecological screening levels.

Inorganics

Beryllium was the only inorganic compound detected in Site. 1C soil at concentrations exceeding PRGs. Although beryllium exceeded the PRG in all nine samples, concentrations were below the background concentration of 1.42 mg/kg and below the ecological screening value.

Summary

No organics were detected in soil at concentrations exceeding PRGs or PLEs; beryllium was the only inorganic compound detected, but concentrations were below background. Groundwater is estimated to be 120 feet below ground surface and is not expected to be impacted. No significant site-related contamination exists at Site 1C.

2.6.2.4 Summary of Risks Associated with Site 1C

Human health and ecological risk assessments were conducted for Site 1C using data collected during the Group D RI. Risk assessment methodologies are summarized in Section 2.4.1.4. Risk assessment summaries for Site 1C are presented in this section.

2.6.2.4.1 Human Health Risk Characterization

COPCs detected in Site 1C soil include metals, VOCs, and PCBs (Aroclor-1242). Current/future workers and future residents could be exposed to soil contaminants through incidental ingestion, dermal contact, and inhalation of VOCs or particulates.

The cumulative residential cancer risk for maximum detected COPCs in soil is 5.1×10^{6}. The primary contributor to risk is beryllium (approximately 94 percent of the total risk). The maximum concentration of beryllium detected at Site 1C is less than the background concentration for the San Luis Rey Basin. Excluding beryllium as naturally occurring, the incremental cancer risk is less than 1×10^{6}.

The cumulative residential HI for maximum detected COPCs is 0.78 and is attributable primarily to metals. Excluding the portion of total hazard attributable to background metals, the incremental site HI is 0.2, which is below the threshold criterion of 1.0.

The Site 1C residential cancer risk and noncarcinogenic hazard do not exceed risk and hazard criteria. In addition, the maximum lead concentration (6.2 mg/kg) is below the EPA and Cal/EPA residential soil PRGs of 400 and 130 mg/kg, respectively. Therefore, Site 1C soil is considered protective of human health.

Groundwater is not considered a complete exposure pathway for either current/future workers or future residents. Groundwater sampling was not performed at Site 1C during the RI because drilling refusal occurred in weathered bedrock less than 50 feet below ground surface, before

encountering sufficient groundwater for sampling. Site 1C is not located above a shallow aquifer associated with any of the four major groundwater basins at MCB Camp Pendleton (i.e., San Mateo, San Onofre, Las Flores, or Santa Margarita Basin). The site is topographically higher than, and isolated from, the aquifers associated with these major basins. Therefore, groundwater at Site 1C was not evaluated further in the HHRA.

2.6.2.4.2 Ecological Risk Assessment

None of the preliminary inorganic COPECs exceeded available background values. All preliminary organic COPECs were evaluated for potential toxicity. None of the preliminary COPECs had HQs exceeding 1.0; therefore, no final COPECs were identified for this site. Site 1C is considered protective of ecological receptors.

2.6.2.5 Description of the No Action Alternative

The no action alternative selected for Site 1C includes no institutional controls. Site 1C is considered protective of human health and the environment for the following reasons:

- Under the future residential exposure scenario, maximum soil concentrations resulted in an ILCR less than 1×10^{-6} and an HI less than 1.0.
- The maximum lead concentration is less than the screening values.
- Groundwater is not considered a complete exposure pathway for either current/future workers or future residents.
- The refuse burning ground is no longer in operation, and military and civilian personnel are on site only infrequently.
- Evaluation of potential ecological risks from exposure to soil indicated that the potential for exposure and effects is low and will not likely pose a risk to ecological receptors.

2.6.3 Site 1I - Refuse Burning Ground in 63 Area

Site 1I consists of a former refuse burning ground in the 63 Area.

2.6.3.1 Site Name, Location, and Description

Site 1I - Refuse Burning Ground in 63 Area, is located approximately 1,250 feet east of Cristianitos Road (Figure 1-2), northeast of its intersection with San Mateo Road. The refuse

burning ground is approximately 425 feet long and 125 feet wide. The site is bordered on the north and south by steep hills that rise 200 feet above the site and are covered with moderate to dense vegetation, on the south by a paved access road, and on the west and east by a vegetated stream-cut canyon. Site 1I is in the center of a stream-cut canyon that slopes to the west and eventually drains into Cristianitos Creek, approximately 1,500 feet west of the site. The surrounding area is characterized by low rolling hills.

No perennial surface water is present in the vicinity of Site 1I. Surface water at the site is ephemeral and follows the gently sloping ground surface to the west. During significant rainfall events, surface water percolates into the subsurface, evaporates, or runs off the site and discharges into Cristianitos Creek.

The Site 1I burning ground is no longer in operation, and military and civilian personnel are present on site only infrequently. The undeveloped area to the north, east, and south of the site is classified as a maneuver area and consists of steep slopes covered by moderate to dense vegetation. To the west of the site is the Cristianitos Area, which contains a fire station, two clubs, and a fleet hospital training complex. The nearest troop housing is approximately 1 mile southwest of the site in the 62 Area. No family housing is located within several miles of the site and none is planned. The nearest base production well is approximately 0.5 mile south of Site 1I.

The dominant habitats at Site 1I are coastal sage scrub and nonnative grassland. The site is densely vegetated with sage, coyote bush, fennel, laurel sumac, and mulefat. Special-status species potentially present on site include California gnatcatcher and least Bell's vireo. Bird species observed during the reconnaissance survey include California towhee, mourning dove, American kestrel, red-tailed hawk, scrub jay, and rufous-sided towhee. Evidence of coyote use (scat) was observed, along with active small mammal burrows and holes.

2.6.3.2 Site History and Enforcement Activities

Site history and enforcement activities for refuse burning grounds are described in Section 2.4.1.2.

2.6.3.3 Summary of Site Characteristics

Site 1I was investigated in June and July 1996 during the RI for Group D sites. Six soil samples were collected from two borings and were analyzed for metals, VOCs, SVOCs, and pesticides and PCBs. No sediment or surface-water samples were collected because no surface water was present on site. No groundwater samples were collected because groundwater was not encountered during sampling. Groundwater is estimated to occur in bedrock at a depth of more than 100 feet.

2.6.3.3.1 Geology and Hydrogeology

Shallow geology at this site is characterized by unconsolidated to poorly consolidated alluvium consisting of very fine grained to fine-grained sand with silt and clay. The alluvium overlies bedrock of the La Jolla Group.

Based on site geology, groundwater is assumed to flow to the southwest, following surface topography. Soil borings were drilled to a maximum depth of 10 feet below ground surface at Site 1I without encountering groundwater.

The nearest RI site at which groundwater was encountered is Site 34, which is approximately 1.5 miles south of Site 1I. Groundwater was encountered in a gravel unit at a depth of about 12 feet below grade at Site 34. Because Site 1I is topographically higher than Site 34 by about 100 feet, the groundwater table at Site 1I is expected to be deeper than 100 feet below ground surface.

No other site-specific groundwater level data were collected in the San Mateo Basin near Site 1I. However, the alluvial units at Site 1I and the bedrock underneath the alluvium are not expected to receive or retain a significant or beneficial amount of groundwater, Groundwater in the San Mateo Basin is concentrated primarily in the alluvium along the basin floor (where Site 34 is located) and not in the adjacent topographically higher areas (where Site 1I is located).

2.6.3.3.2 Soil Results

This section discusses analytical results from soil sampling at Site 1I. Results are summarized in Figure 2-15, which presents detected organics and any inorganics that exceed risk/hazard criteria.

Organics

No organic compounds were detected in soil samples from Site 1I (Figure 2-15).

Inorganics

Arsenic was detected in four of seven samples and beryllium was detected in all seven samples from both site borings at concentrations exceeding PRGs but below background concentrations (Figure 2-15). No inorganics were detected at concentrations exceeding PLEs. The maximum arsenic and beryllium concentrations were 2.9 and 1 mg/kg, respectively.

Summary

No organics were detected in soil; arsenic and beryllium were the only inorganic compounds detected, but concentrations were below background. Groundwater is estimated to be deeper than 100 feet below ground surface at Site 1I and is not expected to be impacted. No site-related contamination exists at Site 1I.

2.6.3.4 Summary of Risks Associated with Site 1I

Human health and ecological risk assessments were conducted for Site 1I using data collected during the Group D RI. Risk assessment methodologies are summarized in Section 2.4.1.4. Risk assessment summaries for Site 1I are presented in this section.

2.6.3.4.1 Human Health Risk Characterization

COPCs in Site 1I soil are limited to metals. Current/future workers and future residents could be exposed to soil contaminants through incidental ingestion, dermal contact, and inhalation of particulates.

The cumulative residential risk for maximum detected COPCs in soil is 1.2×10^{5}. The primary risks drivers are arsenic (approximately 63 percent of the total risk) and beryllium (approximately 37 percent of the total risk). However, arsenic and beryllium concentrations are below background. Excluding arsenic and beryllium as naturally occurring, no site-related carcinogenic COPCs are present at Site 1I.

The cumulative residential hazard for maximum detected COPCs is 0.57. Excluding the portion of total hazard attributable to background metals, the incremental residential site hazard is less than 0.01. Excluding arsenic and beryllium as naturally occurring background levels, the Site 1I

residential cancer risk and noncarcinogenic hazard are less than the risk and hazard criteria. In addition, the maximum lead concentration (9.6 mg/kg) is less than the EPA and Cal/EPA residential PRGs of 400 and 130 mg/kg, respectively. Therefore, Site 1I soil is considered protective of human health.

Groundwater is not considered a complete exposure pathway for either current/future workers or future residents. Groundwater sampling was not performed at Site 1I during the Group D RI because drilling refusal occurred in weathered bedrock less than 50 feet below ground surface, before encountering sufficient groundwater for sampling purposes. Site 1I is not located above a shallow aquifer associated with any of the four major groundwater basins at MCB Camp Pendleton (i.e., San Mateo, San Onofre, Las Flores, or Santa Margarita Basin). The site is topographically higher than, and isolated from, the aquifers associated with these major basins. Therefore, groundwater at Site 1I was not evaluated further in the HHRA and is considered protective of human health.

2.6.3.4.2 Ecological Risk Assessment

None of the preliminary inorganic COPECs exceeded background values, and no organic chemicals were detected. Therefore, no final COPECs were identified for Site 1I; the site is considered protective of ecological receptors.

2.6.3.5 Description of the No Action Alternative

The no action alternative selected for Site 1I includes no institutional controls. Site 1I is considered protective of human health and the environment for the following reasons:

- No carcinogenic chemicals were detected at concentrations exceeding background. Under the future residential exposure scenario, maximum soil concentrations resulted in an HI less than 1.0.
- The maximum lead concentration is below the screening values.
- Groundwater is not considered a complete exposure pathway for either current/future workers or future residents.
- The refuse burning ground is no longer in operation, and military and civilian personnel are on site only infrequently.

- Evaluation of potential ecological risks from exposure to soil indicated that no COPECs exceeded background concentrations and the site is protective of ecological receptors.

2.6.4 Site 2C - Grease Disposal Pit in 33 Area

Site 2C consists of a former grease disposal pit in the 33 Area.

2.6.4.1 Site Name, Location, and Description

Site 2C - Grease Disposal Pit in 33 Area, is located approximately 1,800 feet southwest of the intersection of Basilone and Stagecoach Roads (Figure 1-2). The grease pit is approximately 80 feet long and 70 feet wide. The site is bordered on the east by an unpaved road and is on a plateau surrounded by light to moderate vegetation. The site slopes gently to the northwest and drains into a flat land at an elevation approximately 65 feet lower than the site. The surrounding area consists of low rolling hills.

No perennial surface water is present in the vicinity of Site 2C. During the rainy season, surface-water runoff originating from the grease disposal pit percolates into the subsurface, evaporates, runs off the site, or drains northwesterly into the flatland and a tributary canyon that eventually discharges into the Santa Margarita River.

The grease pit is no longer in operation, and military and civilian personnel are present on site only infrequently. Land surrounding Site 2C is covered with natural vegetation. The area farther northwest is used primarily for training and contains a temporary biotreatment facility. The area north, east, and south of the site is undeveloped and is classified as a maneuver area; this area consists of gently rolling hills covered by natural vegetation (Innis-Tennebaum Architects, Inc., 1990). The nearest family housing, the Ranch House, is about 1 mile southeast of the site. The nearest designated troop housing is in the Vado Del Rio (25) Area, approximately 1 mile northeast of the site. No other family housing is located within several miles of the site and none is planned. The nearest base production well is approximately 1,700 feet northwest of Site 2C.

The dominant habitats at Site 2C are nonnative grassland and coastal sage scrub. Dominant plant species in the nonnative grassland include turkey mullein, annual grass (wild oat, brome), fivehook bassia, and yellow star-thistle. Black and white sage and coyote brush dominate the coastal sage scrub habitat. A wildlife survey of Site 2C was conducted in October 1995, after the main breeding period for many bird species. Nine species of birds were observed. No small

mammal trapping was conducted; however, active runways and holes associated with small mammals were observed. Botta's pocket gopher mounds were also present on site. No reptiles or amphibians were observed.

2.6.4.2 Site History and Enforcement Activities

Grease disposal pits were used between 1942 and 1980 for disposal of mess hall grease; the exact operation dates for most of the sites are unknown. No information is available on specific volumes of grease disposed of in the pits. Although there are no confirmed reports of hazardous waste disposal in these pits, the potential for such disposal practices cannot be altogether discounted. The pits were closed by allowing the greasy materials to decay to a semisolid state and then backfilling with native soil (NEESA, 1984). Visual inspection during the RI indicated that POLs may also have been disposed of in some pits. Field reconnaissance of the pits did not reveal any obvious stress to local vegetation.

2.6.4.3 Summary of Site Characteristics

Site 2C was initially investigated in 1993 and 1994 during the RI for Group C sites. Phase 2 RI was conducted at Site 2C in June and July 1996 during the RI for Group D sites. A total of 13 soil samples were collected from two borings and six surface sample locations. Sample locations, arc shown in Figure 2-16. Samples were analyzed for metals, VOCs, and SVOCs, pesticides and PCBs, TPH as diesel and gasoline, and leachability of lead and diesel. No sediment or surface-water samples were collected because no surface water was present on site. No groundwater samples were collected because groundwater was not encountered during sampling. Groundwater is estimated to occur in bedrock at a depth of more than 50 feet below ground surface.

2.6.4.3.1 Geology and Hydrogeology

Subsurface geology at Site 2C consists of artificial fill to about 9.5 feet below ground surface and older Quaternary alluvium from about 9.5 to 13.5 feet. The artificial fill was originally native soil used to backfill the grease disposal pit upon closure. The alluvium was deposited by both stream and broad surface erosion and consists of undifferentiated, fine- to coarse-grained, unconsolidated to poorly consolidated sand, silt, gravel, and minor clay. The alluvium overlies massive granitic basement rock. Weathered granitic rock was encountered at 11 feet below ground surface in boring 2CB-01 and extended to refusal at 16 feet below ground surface. Similar granitic material forced termination of boring 2CB-02 at 13 feet (Figure 2-16).

Based on site topography, local groundwater is assumed to flow to the northwest. Soil borings were drilled to a maximum depth of 16 feet below ground surface without encountering groundwater. Groundwater was encountered at about 10 feet below grade in wells installed in the nearby Santa Margarita Basin, which is about 100 feet lower in elevation than Site 2C. Based on this difference in topography, the groundwater table at Site 2C is estimated to be deeper than 100 feet below ground surface. The alluvium and bedrock at the site are not expected to receive or retain a significant or beneficial amount of groundwater. Groundwater in the Santa Margarita Basin is concentrated primarily in the alluvium along the basin floor and not in the adjacent topographically higher areas (where Site 2C is located).

2.6.4.3.2 Sod Results

This section discusses analytical results from soil sampling at Site 2C. Results are summarized in Figure 2-16, which presents detected organics and any inorganics that exceed risk/hazard criteria.

Organics

No organic compounds were detected at concentrations exceeding PRGs in Site 2C soil (Figure 2-16). Diesel was detected at concentrations of 120 and 2,500 mg/kg in the 9-foot sample from boring 2CB-1 and surface sample 2CSS001, respectively; these concentrations exceed the 100-mg/kg screening level for diesel recommended by the *LUFT Field Manual* guidance (California State Water Resources Control Board [SWRCB], 1989).

In addition, 15 other organics were detected at Site 2C at concentrations below evaluation criteria: ethylbenzene, TCE, total xylenes, 1,1,1-trichloroethane (TCA), benzoic acid, bis(2-ethylhexyl)phthalate, di-n-butylphthalate, butylbenzylphthalate, benzo(b)fluoranthene, chrysene, pyrene, 4,4'-DDE, dieldrin, Aroclor- 1254, and gasoline. The maximum concentration detected was 12 mg/kg for toluene. TCE was detected once at 0.11 mg/kg in the 9-foot sample from 2CSB-01 but was not detected in the two samples collected at deeper intervals in the same boring or in any other soil samples collected at the site.

The 2CSS001 location was resampled (Sample ID - 2CSS001A) for leachability testing during the Phase 2 RI. The sample was analyzed for TPH-diesel but no diesel was detected. The duplicate sample analysis from the same location (2CSS201A-01) yielded a diesel concentration of 1,800 mg/kg but was qualified, indicating that the detection did not match the diesel

calibration standard. The sample was further analyzed for volatiles using the synthetic precipitation leaching procedure (SPLP); the only detection was toluene at a concentration of 4.6 pg/l. Based on the SPLP results, volatiles are not expected to]each at unacceptable concentrations.

To evaluate the leachability of diesel, the 2CSS001 location was sampled for a third time (sample 2CSS001B) and subjected to TPH-diesel analysis and SPLP analysis for diesel. The total analysis indicated a diesel concentration of 260 mg/kg, and the SPLP analysis indicated a concentration of 2.6 milligrams per liter (mg/1). The same sample was reanalyzed once more (as sample 2CSS001C) by an independent laboratory to confirm the leachability. The total analysis showed a diesel concentration of 718 mg/kg, whereas the SPLP analysis for diesel indicated a concentration of 51.3 mg/l. These results indicated that diesel would not adversely impact groundwater.

Inorganics

Beryllium was detected in 4 of 12 samples and lead was detected in 1 sample at concentrations exceeding PRGs (Figure 2-16). Beryllium concentrations were below background (1.42 mg/kg). The lead concentration in surface sample 2CSS001 exceeded the PRG and background.

The 2CSS001 location was resampled (sample 2CSS001A) during the Phase 2 RI and was analyzed for total lead and leachable lead; the corresponding results were 4.7 mg/kg and nondetect (detection limit of 0.5 mg/1), respectively. To confirm the lead analytical results, location 2CSS001 was sampled for a third time (sample 2CSS001B). Lead was detected at a concentration of 65 mg/kg, but was not detected in the leachable lead analysis. Based on these results, lead is not expected to impact groundwater.

Summary

No organics were detected in soil at concentrations exceeding PRGs. Diesel was detected in two locations at concentrations exceeding the 100-mg/kg screening level. Beryllium and lead were detected at concentrations exceeding PRGs. All beryllium concentrations were below background. As discussed previously, the high lead detection was not confirmed during subsequent resampling efforts. TCE was detected in soil at a concentration below the PRG but was not detected in deeper samples at the same location or in any other samples collected at the site. Because no organic or inorganic compounds in Site 2C soil pose a concern, impacts to

groundwater from site-specific contamination are unlikely. In addition, leachability testing indicated that diesel concentrations in soil would not adversely impact groundwater.

2.6.4.4 Summary of Risks Associated with Site 2C

Human health and ecological risk assessments were conducted for Site 2C using data collected during the Group C and Group D RIs. Risk assessment methodologies are summarized in Section 2.4.1.4. Risk assessment summaries for Site 2C are presented in this section.

2.6.4.4.1 Human Health Risk Characterization

COPCs in Site 2C soil include metals, VOCs, SVOCs, pesticides, and PCBs. Current/future workers and future residents could be exposed to soil contaminants through incidental ingestion, dermal contact, and inhalation of VOCs or particulates.

The cumulative residential risk from the maximum detected COPCs is 8.0×10^{-6} and is primarily attributable to beryllium (approximately 88 percent of the total risk). The maximum reported concentration of beryllium (0.98 mg/kg) is below the associated background concentration (1.42 mg/kg) and was excluded from the risk evaluation as naturally occurring. Excluding the portion of total risk attributable to background metals, the incremental residential risk from maximum detected COPCs is 9.5×10^{-7}.

The cumulative residential HI from maximum detected COPCs is 0.32 and is primarily attributable to metals (approximately 81 percent of the total hazard). Excluding the portion of total hazard attributable to background metals, the incremental residential site hazard is 0.06, which is below the threshold criterion of 1.0.

The results of the HHRA indicate that the incremental residential site risk (9.5×10^{-7}) for Site 2C is below the lower end of the risk management range and the incremental residential site hazard (0.06) is below the threshold criterion of 1.0. The maximum reported lead concentration (421 mg/kg) exceeds the EPA and Cal/EPA residential PRGs of 400 and 130 mg/kg, respectively, but is below the EPA and Cal/EPA industrial soil PRGs of 1,000 and 3,289 mg/kg, respectively. The duplicate sample for the maximum lead concentration was substantially lower (114 mg/kg), and the remaining nine detections of lead were below the background concentration of 21.7 mg/kg. Therefore, no adverse health impacts are expected. Based on the results of the HHRA, Site 2C soil is considered protective of human health.

Groundwater is not considered a complete exposure pathway for either current/future workers or future residents. Groundwater sampling was not performed at Site 2C during the RI because drilling refusal occurred in weathered bedrock less than 50 feet below ground surface, before encountering sufficient groundwater for sampling. Site 2C is not located above a shallow aquifer associated with any of the four major groundwater basins at MCB Camp Pendleton (i.e., San Mateo, San Onofre, Las Flores, or Santa Margarita Basin). The site is topographically higher than, and isolated from, the aquifers associated with these major basins. Therefore, groundwater at Site 2C was not evaluated further in the HHRA and is considered protective of human health.

2.6.4.4.2 Ecological Risk Assessment

The HQs for two preliminary COPECs (lead and diesel) exceed 1.0 (Figure 2-16). HQs were calculated for representative species for each of six soil samples, which were analyzed for 119 inorganic and organic chemicals. With one exception, the HQs that exceed 1.0 are less than 10, indicating that the potential for toxicity is relatively low; one HQ for lead exceeds 10 (23 for deer mouse), indicating medium potential for toxicity. Lead HQs for all other representative species are less than 1.0. The frequencies of detection for lead and diesel were 100 and 67 percent, respectively.

Site 2C consists of nonnative grassland and disturbed habitat. Birds were observed at the site, but special-status species are not expected to be present because of the lack of suitable habitat. Representative species for this site with HQs exceeding 1.0 include terrestrial invertebrates, deer mouse, and Savannah sparrow.

None of the preliminary COPECs were retained as final COPECs because the potential for exposure and effects is considered low. The toxicity estimates for lead are based on a single detection at a high concentration; all other lead concentrations are within background. The toxicity estimates for diesel are also based on a single high value, the remaining diesel concentrations are less than the PLEs for representative species. The site is less than 0.1 acre in size, which is considerably smaller than the home range size for representative bird and mammal species. The habitat quality at the site is somewhat less suitable than the surrounding areas. For these reasons, wildlife receptors are not likely to spend a significant proportion of time at the site. Therefore, the level of exposure to preliminary COPECs at the site is not expected to result in adverse effects to wildlife receptors.

2.6.4.5 Description of the No Action Alternative

The no action alternative selected for Site 2C includes no institutional controls. Site 2C is considered protective of human health and the environment for the following reasons:

- Under the future residential exposure scenario, maximum site-related soil concentrations resulted in an ILCR less than $1x10^{-6}$ and an HI less than 1.0.
- Lead concentrations in soil are not expected to pose a threat to human health.
- Groundwater is not considered a complete exposure pathway for either current/future workers or future residents.
- The grease pit is no longer in operation, and military and civilian personnel are on site infrequently.
- Evaluation of potential ecological risks from exposure to soil indicated that the site is protective of ecological receptors.

2.6.5 Site 2D - Grease Disposal Pit in 43 Area

Site 2D consists of a former grease disposal pit in the 43 Area.

2.6.5.1 Site Name, Location, and Description

Site 2D - Grease Disposal Pit in 43 Area, is located approximately 300 feet northeast of Basilone Road, immediately northwest of its intersection with Las Pulgas Road (Figure 1-2). The grease disposal pit is approximately 110 feet long and 90 feet wide. The site is bordered on the southeast by Site 20, on the northeast by Site 1F, and on the west and south by light to moderate vegetation and Basilone Road. Site 2D slopes gently to the southeast and eventually drains into Pulgas Creek, approximately 500 feet southeast of Site 20. The surrounding area is characterized by low rolling hills.

No perennial surface water is present in the vicinity of Site 2D. Surface water at the site is ephemeral and follows the gently sloping ground surface to the southeast. During significant rainfall events, surface water percolates into the subsurface, evaporates, or runs off the site and discharges into Pulgas Creek.

The grease pit is no longer in operation, and military and civilian personnel are present on site only infrequently. West of Site 2D, 43 Area contains several hundred buildings that are used for

a variety of purposes, including personnel training, troop housing, mess, recreation, administration, vehicle fueling and storage, maintenance and repair, and artillery storage and repair. The undeveloped area southeast of the site, beyond Basilone Road, is classified as a maneuver area (Innis-Tennebaum Architects, Inc., 1990). No family housing is located within several miles of the site and none is planned. Base production wells in the Las Flores Basin are located approximately 5 miles south-southwest of Site 2D.

2.8.5.2 Site History and Enforcement Activities

Site history and enforcement activities for grease disposal pits are described in Section 2.6.4.2.

2.6.5.3 Summary of Site Characteristics

Site 2D was investigated in June and July 1996 during the RI for Group D sites, A total of 12 soil samples were collected from three borings and were analyzed for metals, VOCs, SVOCs. No sediment or surface-water samples were collected because no surface water was present on site. Groundwater sampled at Site 1F is considered representative of Site 2D because the sites are directly adjacent to one another. No additional groundwater samples were collected at Site 2D.

Site 2D was included in additional ecological surveys, as part of Site 1F, conducted during May and June 1997. The surveys included habitat receptor surveys, wildlife surveys, small mammal trapping, and special-status species surveys. Sites 1F and 2D were combined for the surveys because of their proximity. The surveys for special-status species included the California gnatcatcher and least Bell's vireo.

2.6.5.3.1 Geology and Hydrogeology

Shallow geology at this site is characterized by unconsolidated to semiconsolidated alluvium consisting of interbedded, fine- to medium-grained sand, sand with silt, and sand with clay overlying the La Jolla Group.

Based on site geology, groundwater is assumed to flow to the southeast following surface topography. Soil borings were drilled to a maximum depth of 30 feet below ground surface at Site 2D without encountering groundwater. Groundwater was encountered at a depth of about 17 feet below grade at adjacent Site 1F and about 19 feet below grade at nearby Site 20. The surface elevation at Site 2D is approximately 260 feet above mean sea level (msl), which is approximately the same elevation as the groundwater sample location at Site 1F. The surface

elevation at the Site 20 groundwater sample location was approximately 245 feet msl. Site 2D is located within 450 feet of both groundwater sampling locations. Although groundwater was not encountered to a depth of 30 feet at Site 2D, the depth to groundwater at the site is estimated to be fairly close to 30 feet based on the depth to groundwater at Sites 1F and 20. The same aquifer encountered at Sites 1F and 20 is expected to underlie Site 2D.

2.6.5.3.2 *Soil Results*

This section discusses analytical results from soil sampling at Site 2D. Results are summarized in Figure 2-17, which presents detected organics and any inorganics exceeding risk/hazard criteria.

Organics

No organic compounds were detected in soil samples from Site 2D (Figure 2-17).

Inorganics

Arsenic was detected in 11 of 12 samples and beryllium was detected in 2 of 12 samples at concentrations exceeding PRGs but generally below or near background. Arsenic and beryllium each exceeded background once.

2.6.5.3.3 *Groundwater Results*

One groundwater sample was collected from temporary groundwater well 1FGWT-01 at Site 1F to represent conditions at both Sites 1F and 2D. Analytical results are discussed in Section 2.4.1.3.4 and are summarized in Figures 2-4 and 2-17.

2.6.5.3.4 *Ecological Results*

Vegetation on Site 2D burned in a brushfire in June 1997, prior to the fifth survey visit. Most of the original habitat (coastal sage scrub) was burned. Prior to the fire, disturbed habitat was found on the site and was sparsely vegetated with fennel, coyote brush, thistle, mustard, and wild oat.

No coastal California gnatcatchers were observed on Site 2D during surveys prior to the fire. Habitat destroyed by the fire was considercd marginal. Although no least Bell's vireos were observed on site, surveys conducted in 1996 identified least Bell's vireos in riparian vegetation along Pulgas Creek, approximately 1,000 feet downstream from the site.

2.6.5.3.5 *Summary*

No organics were detected in soil; arsenic and beryllium were the only inorganic compounds detected, but concentrations were near background. Groundwater data for Site 1F are also representative of Site 2D groundwater. No site-specific contamination was detected in groundwater. Accordingly, no evidence of site-related contamination was observed at Site 2D.

2.6.5.4 *Summary of Risks Associated with Site 2D*

Human health and ecological risk assessments were conducted for Site 2D using data collected during the Group D RI. Risk assessment methodologies are summarized in Section 2.4.1.4. Risk assessment summaries for Site 2D are presented in this section.

2.6.5.4.1 *Human Health Risk Characterization*

COPCs in Site 2D soil are limited to metals. Current/future workers and future residents could be exposed to soil contaminants through incidental ingestion, dermal contact, and inhalation of particulates.

The cumulative residential risk for maximum detected COPCs is 3.1×10^{-5}. The primary risk drivers are arsenic (approximately 66 percent of the total risk) and beryllium (approximately 44 percent of the total risk), both of which exceeded background concentrations for the Las Flores Basin once but are not considered COPCs for the expected waste streams at this site. Excluding the portion of total risk attributable to background metals, the ILCR is 1.1×10^{-5}. The 95 percent UCL soil concentration for arsenic is 4.3 mg/kg. The 95 percent UCL concentration for arsenic and the maximum concentration for beryllium are close to the 95th percentile background concentrations (4.25 and 1.2 mg/kg, respectively). From ground surface to 10 feet, the depth of interest for the HHRA, beryllium was detected in only one of nine samples, at a concentration of 1.5 mg/kg. Although arsenic was detected in nine of nine samples within the same depth interval (10 feet), it exceeded background in only one sample. Excluding the portion of total risk attributable to background, the incremental residential risk is 2×10^{-6} and is solely attributable to beryllium; this risk value is at the lower end of the risk management range.

The cumulative residential hazard for maximum detected COPCs in soil is 1.1. This estimated hazard is primarily attributable to aluminum (approximately 43 percent of the total hazard), arsenic (approximately 23 percent of the total hazard), manganese (approximately 10 percent of the total hazard), and vanadium (approximately 17 percent of the total hazard). Excluding the portion of total hazard attributable to background metals, the incremental residential site hazard

is 0.5, which is below the threshold criterion of 1.0. The maximum lead concentration (103 mg/kg) is less than the EPA and Cal/EPA residential PRGs of 400 and 130 mg/kg, respectively.

The cumulative industrial risk and hazard for maximum detected COPCs are 4.7×10^{-6} and 0.55, respectively. Arsenic and beryllium are the main contributors. Excluding background concentrations, the risk is 1.8×10^{-6}. Using the 95 percent UCL soil concentrations and excluding background, the industrial risk is 3×10^{-7}. The industrial risk is below the lower end of the risk management range, and the hazard is less than the threshold criterion of 1.0.

Soil at Site 2D is considered protective of human health for the following reasons:

- The HI is less than 1.0 and the maximum lead concentration is less than the EPA screening value.
- The incremental cancer risk for the residential scenario (2×10^{-6}) is at the lower end of the risk management range.
- The only significant contributors to cancer risk are arsenic and beryllium, which were detected at concentrations that are very close to background concentrations.
- Arsenic was detected in nine of nine samples to a depth of 10 feet but only once at a concentration exceeding background and beryllium was detected only once at 10 feet.

Site 2D is adjacent to Site 1F and the groundwater contaminants characterized for Site 1F are used as the groundwater COPCs for Site 2D. The COPCs detected in groundwater at Site 1F are limited to metals. Future residents could be exposed to groundwater contaminants through ingestion.

The residential ILCR from ingestion of groundwater is 5.2×10^{-4} and is completely attributable to arsenic. However, the maximum reported groundwater concentration of arsenic (23.4 µg/l) is below the MCL (50 µg/l, which corresponds to an incremental cancer risk of 1×10^{-3}).

The total noncarcinogenic health hazard is 3.8 and is primarily attributable to arsenic (55 percent of the total hazard) and boron (26 percent of the total hazard). Although the HI exceeds 1.0, the maximum groundwater concentration of arsenic is below the MCL and would not likely represent a threat to human health via ingestion. Furthermore, boron is not expected to be

present in groundwater as a result of site-related activities. Therefore, groundwater at Site 2D is considered protective of human health.

2.6.5.4.2 *Ecological Risk Assessment*

The EcoRA for Site 2D was revised based on additional data collected in May and June 1997 (SWDIV, 1998a). Most of the HQs that exceed 1.0 are in the 1 to 10 range, indicating a low potential for toxicity. All preliminary COPECs detected are metals and most had relatively high frequencies of detection (greater than 80 percent).

Site 2D is presumed to have been primarily coastal sage scrub, but had been disturbed by burning prior to the habitat evaluations. Birds were observed, but special-status species are not expected to be present on site because of the site disturbance. The final risk screening results indicated that modified PLEs were exceeded for plants, invertebrates, Belding's savannah sparrow, and deer mouse. Preliminary COPECs with HQs exceeding 1.0 are shown in Figure 2-17.

HQs for aluminum exceeded 1.0 for plants (5.9), invertebrates (3.9), and mammals (7.4); however, only one detection of aluminum exceeded background and, thus, the overall risk from aluminum was determined to be low. The HQ for cobalt exceeded 1.0 for mammals (1.7) at one location and was partially due to background. The overall risk from cobalt was determined to be low. HQs for iron exceeded 1.0 for plants (3.8), invertebrates (1.03), birds (3.6), and mammals (16). Most of the risk was due to background concentrations; the overall risk due to iron was determined to be low. HQs for lead exceeded 1.0 for mammals (1.5 to 8.7). The average concentration of site-related lead resulted in an HQ less than 1.0. The overall site risk due to lead was determined to be low. The HQ for vanadium exceeded 1.0 for mammals (3.1) but was mostly due to background. The average site concentration of vanadium results in an HQ less than 1.0, and the overall risk due to vanadium was determined to be low.

No final COECs were identified at Site 2D. The risk to ecological receptors was determined to be low.

2.6.5.5 Description of the No Action Alternative

The no action alternative selected for Site 2D includes no institutional controls. Site 2D is considered protective of human health and the environment for the following reasons:

- The HI for soil is less than 1.0, and the maximum lead concentration in soil is below the screening criteria.

- The incremental cancer risk (2×10^{-6}) for soil under the residential scenario is at the lower end of the risk management range. The only significant contributors to soil cancer risk are arsenic and beryllium at concentrations that are close to background concentrations. Arsenic was detected in nine of nine soil samples to a depth of 10 feet but only once at a concentration exceeding background, and beryllium was detected only once at a depth of 10 feet.

- Groundwater was determined to be protective of human health based on background contribution of the risk contributors and assuming that there is no current or planned future use of groundwater at the site.

- Evaluation of potential ecological risks from exposure to soil identified no COECS.

2.6.6 Site 2F - *Grease Disposal Pit in 62 Area*

Site 2F consists of a former grease disposal pit in the 62 Area.

2.6.6.1 *Site Name, Location, and Description*

Site 2F - Grease Disposal Pit in 62 Area, is located approximately 1,200 feet north of San Mateo Road (Figure 1-2). The grease disposal pit is approximately 100 feet long and 75 feet wide. The site is bordered on the east by a paved road and Site 1H, on the north and west by moderate to dense vegetation. and to the south by vegetation and San Mateo Road. The surrounding area is characterized by low rolling hills.

No perennial surface water is present in the vicinity of Site 2F. The area receives only low annual rainfall, primarily during the winter months. Surface water at the site is generally ephemeral and follows the gently sloping ground surface to the south. During significant rainfall events, surface water percolates into the subsurface, evaporates, or runs off the site and eventually discharges into San Mateo Creek.

The 62 Area grease pit is no longer in operation, and military and civilian personnel are present on site only occasionally. The undeveloped area surrounding the site is classified as a maneuver area and is covered by natural vegetation (Innis-Tennebaum Architects, Inc., 1990). Site 1H is east of Site 2F. The area south of Site 2F contains several hundred buildings that are used for a variety of purposes, including personnel training, troop housing, mess, recreation, and

administration. No family housing is located within several miles of the site and none is planned. The nearest base production well is approximately 1 mile south-southwest of Site 2F. Site 2F contains predominantly nonnative grassland habitat. Dominant grass species include wild oat and brome. Herbaceous species include pearly everlasting and mustard. A few tree tobacco, coyote bush, and sage plants are also present. No special-status species are expected to be present at this site. Wildlife species observed during the reconnaissance survey include cliff swallow, American crow, sparrow (species not identified), black-tailed hare, and western fence lizard.

2.6.6.2 *Site History and Enforcement Activities*

Site history and enforcemcnt activities for grease disposal pits are described in Section 2.6.4.2.

2.6.6.3 *Summary of Site Characteristics*

Site 2F was initially investigated in June and July 1996 during the RI for Group D sites. A total of 10 soil samples and 1 duplicate were collected from four borings at Site 2F. The samples were analyzed for metals, VOCs, and SVOCs. No surface-water or sediment samples were collected because no surface was present on site. Groundwater is estimated to be greater than 200 feet below grade. Because drilling reftisal occurred at a maximum depth of 13.5 feet no groundwater samples were collected. Further sampling was conducted in October 1997 to evaluate site-specific background concentrations of arsenic. At that time, 12 soil samples were collected from four boring locations with similar lithology and settings as the samples collected during the 1996 RI. The samples were analyzed for metals to establish a site-specific background for arsenic because concentrations of arsenic detected at Site 2F during the 1996 RI were consistently higher than surrogate background concentrations from the Santa Margarita Basin.

2.6.6.3.1 *Geology and Hydrogeology*

Shallow geology at Site 2F is characterized by unconsolidated and semiconsolidated alluvium consisting of interbedded, fine- to medium-grained sand, sand with silt, gravel, and clay. The alluvium at Site 2F overlies massive granitic basement rock. Weathered granitic rock was encountered at 9.5 feet and drilling refusal occurred at 13.5 feet below ground surface in boring 2FB-04.

Based on site geology, groundwater is assumed to flow to the south or southwest, following surface topography. Soil borings were drilled to a maximum depth of 13.5 feet below ground surface at Site 2F without encountering groundwater.

The nearest RI site at which groundwater was encountered is Site 34 (groundwater level of 12 feet below ground surface), which is approximately 1.25 miles south of Site 2F. Because Site 2F is topographically higher than Site 34 by about 230 feet, the groundwater table at Site 2F is expected to be deeper than 200 feet below ground surface.

No other site-specific groundwater level data were collected in the San Mateo Basin near Site 2F. However, the alluvial units and underlying bedrock at Site 2F are not expected to receive or retain a significant or beneficial amount of groundwater. Groundwater in the San Mateo Basin is concentrated primarily in the alluvium along the basin floor (where Site 34 is located) and not in adjacent topographically elevated areas (where Site 2F is located).

2.6.6.3.2 *Soil Results*

This section discusses analytical results from soil sampling at Site 2F. Results are summarized in Figure 2-18, which presents detected organics and any inorganics that exceed risk/hazard criteria. The initial 10 soil samples and 1 duplicate were used for site characterization. The additional 12 soil samples were used to characterize background.

Organics

No organic compounds were detected in soil at concentrations exceeding PRGs (Figure 2-18), but 11 organics were detected at concentrations below the evaluation criteria: acetone, 2-butanone, 4-methyl-2-pentanone, ethylbenzene, toluene, total xylenes, chrysene, 2-methylnaphthalene, phenanthrene, diethylphthalate, and dimethylphthalate. Of these 11 compounds, phenanthrene was reported at the highest concentration (12 mg/kg).

Inorganics

Concentrations of arsenic in 9 of 11 samples and beryllium in all 11 samples exceeded PRGs in soil (Figure 2-18). Beryllium concentrations were below the background concentration of 1.42 mg/kg. Three arsenic detections exceeded the Santa Margarita Basin background concentration of 4.25 mg/kg. The highest arsenic concentration was 15 mg/kg.

Arsenic was detected in all 12 site-specific background samples. The site-specific background concentrations ranged from 1.4 to 10.9 mg/kg. The 95th percentile of the site-specific background concentration was calculated to be 10.9 mg/kg using equation 13.24 from Gilbert (1987) and assuming a lognormal distribution. This result was compared against arsenic concentrations detected during the 1996 RI. The site-specific background concentration was

exceeded by three detected concentrations at Site 2F (15, 11.8, and 11 mg/kg). However, the duplicate sample of the maximum detected concentration was less than background. The 95 percent UCL of the mean arsenic concentration detected at Site 2F was calculated to be 10.9 mg/kg using the EPA's supplemental guidance for calculating the concentration term (EPA, 1992d). The UCL of the mean arsenic concentration at Site 2F is equal to the site-specific background concentration.

Summary

No organics were detected in soil at concentrations exceeding PRGs. Arsenic and beryllium were the only inorganics that exceeded PRGs; however, concentrations were within background. As a result, groundwater, which is estimated to be more than 100 feet below ground surface, is not expected to be impacted.

2.6.6.4 *Summary of Risks Associated with Site 2F*

Human health and ecological risk assessments were conducted for Site 2F using data collected during the Group D RI. Risk assessment methodologies are summarized in Section 2.4.1.4. Risk assessment summaries for Site 2F are presented in this section.

2.6.6.4.1 *Human Health Risk Characterization*

COPCs in Site 2F soil include metals, VOCs, and SVOCs (PAHs). Current/future workers and future residents could be exposed to soil contaminants through incidental ingestion, dermal contact, and inhalation of VOCs or particulates.

The cumulative residential risk for maximum detected COPCs is 4.6×10^{-5} and is primarily attributable to arsenic (approximately 85 percent of the total risk) and beryllium (approximately 14 percent of the total risk). However, arsenic and beryllium are within background concentrations and are not considered COPCs for the expected waste streams at this site. Excluding the portion of total risk attributable to background metals, the incremental site risk for maximum detected COPCs is less than 1×10^{-6}.

The cumulative residential hazard is 1.2. The primary hazard is due to arsenic, which is within background. Excluding the portion of total hazard attributable to background metals, the incremental residential site hazard is 0.5, which is below the threshold criterion of 1.0.

The cumulative industrial risk for maximum detected COPCs is 7.2 x 10^{-6} and is primarily attributable to arsenic (approximately 89 percent of the total risk) and beryllium (approximately 11 percent of the total risk). Excluding the portion of total risk attributable to background metals, the incremental industrial site risk is less than 1 x 10^{-6}. The incremental industrial hazard for maximum detected COPCs is 0.04.

Based on the results of the HHRA, the incremental site risks arc within the risk management range and the incremental site hazards are below the threshold criterion of 1.0 under both the residential and industrial exposure scenarios. In addition, the maximum lead concentration (25.8 mg/kg) is below the screening criteria. Therefore, Site 2F soil is considered protective of human health under both the residential and industrial land use scenarios.

Groundwater is not considered a complete exposure pathway for either current/future workers or future residents. Groundwater sampling was not performed at Site 2F during the RI because drilling refusal occurred in weathered bedrock at less than 50 feet below ground surface, before encountering sufficient groundwater for sampling purposes. Site 2F is not located above a shallow aquifer associated with any of the four major groundwater basins at MCB Camp Pendleton (i.e., San Mateo, San Onofre, Las Flores, or Santa Margarita Basin). The site is topographically higher than and isolated from the aquifers associated with these major basins. Therefore, groundwater at Site 2F was not evaluated further in the HHRA and is considered protective of human health.

2.6.6.4.2 *Ecological Risk Assessment*

Three preliminary COPECs (arsenic, 2-methyinaphthalene, and phenanthrene) had HQs exceeding 1.0 (Figure 2-18). HQs were calculated for representative species for each of nine soil samples. The HQs that exceed 1.0 are all close to 1.0, indicating that the potential for toxicity is relatively low. Arsenic had a relatively high frequency of detection (90 percent) but is considered to be within background. Although HQs for phenanthrene and 2-methylnaphthalene exceed 1.0, these compounds were detected in only one of nine samples collected at depths of ecological concern.

Site 2F is predominantly nonnative grasslands. Representative species for this site with HQs exceeding 1.0 include plants, terrestrial invertebrates, deer mouse, and Savannah sparrow.

None of the preliminary COPECs were retained as final COECs because the potential for exposure and effects is considered low for the chemicals and exposure pathways present. HQs for most of the chemicals detected are less than 1.0, indicating little or no potential toxicity, and those that exceed 1.0 are relatively low. The size of this site is approximately 0.14 acre, which is smaller than the home ranges for the representative mammal and bird receptor species (deer mouse and Savannah sparrow). Given the habitat quality of the site and surrounding areas, these receptors would likely be present on the site for only limited periods of time. Therefore, ecological receptors are not expected to suffer adverse effects because they would not be exposed to site contaminants on a consistent basis.

2.6.6.5 *Description of the No Action Alternative*

The no action alternative selected for Site 2F includes no institutional controls. Site 2F is considered protective of human health and the environment for the following reasons:

- Under the residential scenario, the incremental cancer risk for soil is less than 1×10^{6}.
- Excluding background, the HI for soil is less than 1.0 and the maximum lead concentration in soil is less than the screening criteria.
- Groundwater was determined to be protective of human health based on the depth to groundwater and the lack of significant soil contamination. There is no current or planned future use of groundwater at the site.
- Evaluation of potential ecological risks from exposure to soil identified no COECS and indicated that the site is protective of ecological receptors.

2.6.7 *Site 2G -Grease Disposal Pit in 31 Area*

Site 2G consists of a former grease disposal pit in the 31 Area.

2.6.7.1 *Site Name, Location, and Description*

Site 2G - Grease Disposal Pit in 31 Area, is located southwest of the Marine Corps Tactical System Support Activity (MCTSSA), along an unpaved dirt road approximately 0.75 mile southwest of Stuart Mesa Road (Figure 1-2). The grease disposal pit is approximately 190 feet long and 115 feet wide. Site 2G is located in a stream-cut canyon surrounded by a gently sloping marine terrace. The site is bordered on the northeast by the MCTSSA, on the east and southeast by agricultural fields, on the north by light to moderate vegetation, and on the west and south by the Pacific Ocean, which is about 300 feet from the site.

The grease pit is no longer in operation, and military and civilian personnel are present on site only occasionally. The undeveloped area surrounding the site on the north, northeast, and east is classified as a clear zone for operation of various types of radar associated with MCTSSA. The agricultural outlease area east and southeast of the site consists of a marine terrace covered by natural vegetation (Innis-Tennebaum Architects, Inc., 1990). The nearest family housing, Stuart Mesa Housing, is approximately 1.5 miles northeast of the site. Troop housing is located approximately 0.5 mile north of the site.

No perennial surface water is present in the vicinity of Site 2G. Surface water at the site is ephemeral. Runoff originating from the agricultural fields or from significant rainfall events flows into the intermittent stream-cut canyon and discharges into the Pacific Ocean, percolates into the subsurface, or evaporates. No base production wells are located within the Cockleburr Basin or within a 1-mile radius of Site 2G.

Disturbed habitat is the dominant habitat at Site 2G. The site is vegetated by a variety of ice plants, including buckwheat, wild oat, brome, common reed, tree tobacco, ice plant, and curly dock. Except for the nonnative grasses, most of the vegetation is confined to the arroyo that traverses the site. No special-status species are expected to be present at this site.

2.6.7.2 Site History and Enforcement Activities

Site history and enforcement activities for grease disposal pits are described in Section 2.6.4.2.

2.6.7.3 *Summary of Site Characteristics*

Site 2G was investigated in June and July 1996 during the RI for Group D sites. A total of 10 soil samples were collected from three boring locations and one surface location (Figure 2-19). Soil samples were analyzed for metals, VOCs, and SVOCs. A groundwater sample was collected from a temporary well placed in an estimated downgradient location (Figure 2-19). The water sample was analyzed for the same parameters as soil, plus general chemistry. A habitat and receptor survey was conducted to identify wildlife present on site.

2.6.7.3.1 *Geology and Hydrogeology*

Shallow geology at this site is characterized by serniconsolidated alluvium consisting of very fine grained to fine-grained sand, sand with silt, gravel, and clay. Based on site geology, groundwater is assumed to flow to the southwest, following surface topography. Groundwater was encountered at a depth of 14 feet below ground surface in the three borings completed at the site

and at approximately 2 feet below ground surface in temporary well 2GGWT-01, which was placed in a shallow location on the beach near the center of the canyon.

2.6.7.3.2 *Soil Results*

This section discusses analytical results from soil sampling at Site 2G. Results are summarized in Figure 2-19, which presents detected organics and any inorganics that exceed risk/hazard screening criteria.

Organics

No organic compounds were detected in soil at Site 2G.

Inorganics

Arsenic was detected in two of eight samples and beryllium was detected in four of eight samples at concentration exceeding PRGs but below background levels (Figure 2-19). The detections were primarily in surface samples.

2.6.7.3.3 *Groundwater Results*

No organic compounds were detected in the groundwater sample from Site 2G (Figure 2-19). With the exception of arsenic, no inorganics were detected at concentrations exceeding MCLs or tap-water PRGs (Figure 2-19). Arsenic was detected at a concentration of 16.9 μg/l, which exceeds the tap-water PRG of 0.045 μg/l but is below the MCL of 50 μg/l.

2.6.7.3.4 *Summary*

No organics were detected in soil; arsenic and beryllium were the only inorganic compounds detected, but concentrations were below background. With the exception of arsenic at a concentration observed basewide and below the MCL, no other contaminants were detected in groundwater.

2.6.7.4 *Summary of Risks Associated with Site 2G*

Human health and ecological risk assessments were conducted for Site 2G using data collected during the Group D RI. Risk assessment methodologies are summarized in Section 2.4.1.4. Risk assessment summaries for Site 2G are presented in this section.

2.6.7.4.1 *Human Health Risk Characterization*

COPCs in Site 2G soil are limited to metals. Current/future workers and future residents could be exposed to soil contaminants through incidental ingestion, dermal contact, and inhalation of particulates.

The cumulative residential risk for the maximum detected COPCs is 1.1×10^{-5} and is primarily attributable to arsenic (approximately 64 percent of the total risk) and beryllium (approximately 36 percent of the total risk). The maximum detected concentrations of these metals are less than Site 2G background concentrations; there are no site-related carcinogenic COPCs after exclusion of naturally occurring background.

The cumulative residential HI from the maximum detected metals is 1.0. Excluding the portion of total risk attributable to background metals, the incremental residential site hazard for maximum detected metals is 0.14, which is below the threshold criterion of 1.0.

The Site 2G residential cancer risk and noncarcinogenic hazard are less than the risk and hazard criteria. In addition, the maximum lead concentration in soil (16.2 mg/kg) is below residential screening criteria. Therefore, Site 2G soil is considered protective of human health.

The COPCs detected in groundwater at Site 2G are limited to metals. Future residents could be exposed to groundwater contaminants through ingestion.

The cumulative residential cancer risk from ingestion of groundwater is 3.8×10^{-4} and is completely attributable to arsenic. However, the maximum reported groundwater concentration of arsenic (16.9 μg/1) is below the MCL (50 μg/l, which corresponds to an incremental cancer risk of 1×10^{-3}). Furthermore, because the maximum detected concentration of arsenic in soil is within naturally occurring background, the groundwater concentration of arsenic is also likely naturally occurring. The total noncarcinogenic hazard associated with ingestion of groundwater is 1.9 and is primarily attributable to arsenic (1.5 HI). Because arsenic in groundwater is likely naturally occurring, groundwater at Site 2G is considered protective of human health.

2.6.7.4.2 *Ecological Risk Assessment*

Site 2G is within the background area for marine terrace deposits; background values were available for 16 of the 17 inorganic chemicals detected in site soils. Background values were not

available for boron. Two preliminary inorganic COPECs (iron and zinc) exceed available background values. Boron, iron, zinc, and all preliminary organic COPECs were evaluated for potential toxicity.

Three preliminary COPECs (boron, iron, and zinc) had HQs exceeding 1.0 (Figure 2-19). HQs were calculated for representative species for each of six soil samples, which were analyzed for 146 inorganic and organic chemicals, including VOCs, SVOCs, pesticides, and PCBs. The HQs that exceed 1.0 are all less than 10, with the exception of boron (32 for plants) and zinc (19 for deer mouse). Iron and zinc had relatively high frequencies of detection (100 percent), but boron was detected in only one of six samples.

Site 2G is predominantly disturbed habitat. Most of the vegetation was confined to a small arroyo that traverses the site. Representative species for this site with HQs exceeding 1.0 include plants, terrestrial invertebrates, deer mouse, and Savannah sparrow.

None of the preliminary COPECs were retained as final COECs even though some had HQs greater than 1.0. The potential for exposure and effects is considered low for these chemicals. The HQs for most of the chemicals detected are less than 1.0, indicating little or no potential toxicity. Only two HQs exceed 10 and the highest, for boron, was detected only once. Zinc was detected in all six samples; HQs for mammals are less than 1.0 at three locations, in the low toxicity range (1 to 10) at two locations, and in the medium toxicity range (10 to 100) at one location. The HQs for zinc exceed 1.0 only for a single species, the deer mouse. The size of the contaminated area is approximately 0.4 acre. The suitable habitat is primarily limited to an arroyo that traverses the site; as a result, the actual area where exposure would occur is considerably smaller than the home range size of any of the representative bird or mammal species for this site. None of the ecological receptors are expected to be sufficiently exposed to the preliminary COPECs at this site for adverse effects to occur.

2.6.7.5 *Description of the No Action Alternative*

The no action alternative selected for Site 2G includes no institutional controls. Site 2G is considered protective of human health and the environment for the following reasons:

- No site-related carcinogens were detected.

- The incremental residential site-related hazard for maximum metals concentrations is below the threshold criterion of 1.0.
- The maximum lead concentration in soil is below residential screening criteria.
- Arsenic was the only contributor to the risk and hazard for groundwater but was determined to be naturally occurring.
- There is no potential use for groundwater at the site. Site 2G is close to the ocean and is not in a beneficial use zone, primarily because of the potential for saltwater intrusion.
- Evaluation of potential ecological risks from exposure to soil identified no COECS and indicated that the site is protective of ecological receptors.

2.6.8 Site 10 - 26 *Area Sewage Sludge Composting Yard*

Site 10 was used for composting sewage sludge.

2.6.81 *Site Name, Location, and Description*

Site 10 - 26 Area Sewage Sludge Composting Yard, is located in 26 Area, approximately 600 feet southwest of the intersection of Vandegrift Boulevard and Santa Margarita Road (Figure 1-2). The site consists of a level, open field. A pile of sewage sludge approximately 100 feet long, 90 feet wide, and 15 feet high was removed in 1997 from the site area and placed at Box Canyon landfill on base. The site is bordered on the north and west by graded piles of concrete mixing facility materials, light vegetation, and an unpaved road; on the east by moderate vegetation; and farther east by a ridge that rises up to 250 feet above the composting yard. South of the site is the 26 Area maintenance yard, which is surrounded by a chain-link fence. The site slopes gently to the southwest, parallel to the Santa Margarita River, and eventually drains into the river farther downstream. The Santa Margarita River is approximately 2,500 feet west, Sites 3 and 28 are southwest, and Site 24 is northeast of the composting yard.

The only perennial surface water in the vicinity of Site 10 is the Santa Margarita River. Ephemeral water is often visible in pools during the rainy season. During significant rainfall events, surface water percolates into the subsurface, evaporates, or runs off the site and eventually discharges into the Santa Margarita River.

Land use in the vicinity of Site 10 consists of activities associated with MCB facilities and maintenance operations. Structures in the area include maintenance buildings, administrative buildings, heavy equipment facilities, base joint safety centers, communications/electronics outside plant, and MCB laundry facilities. Military and civilian personnel are present in the immediate vicinity of the site on a daily basis. Approximately 2,000 feet north of the site is Lake O'Neill, a recreation area. The Santa Margarita River is west of the site. East of the site is an undeveloped hill classified as a maneuver area; the hill has a steep slope and is covered by natural vegetation (Innis-Tennebaum Architects, Inc., 1990). The nearest designated troop housing areas are the Vado Del Rio (25) and 24 Areas, approximately 1.5 miles northwest of the site. The nearest family housing, the Ranch House, is about 1.75 miles southwest of the site. The nearest base production well is approximately 1/2 mile northeast of Site 10.

Dominant habitats at Site 10 are nonnative grassland and disturbed habitat. Ripgut brome, red brome, and wild oat are the dominant grass species in the nonnative grassland habitat. Pineapple weed, mustard, and filaree are found in the disturbed habitat, which also contains a small grove of eucalyptus trees. During surveys, 21 species of birds were observed on the site; song sparrow and California towhee were the most prevalent. Least Bell's vireo, a special-status species, was observed on the site during the bird surveys. Small mammals captured during live-trapping include western harvest mouse, deer mouse, California mouse, and California ground squirrel. Audubon cottontail and bats (unidentified species) were also observed during the surveys. A western toad was caught in a live-trap; however, no reptiles were observed.

2.6.8.2 *Site History and Enforcement Activities*

Composting operations consisted of placing sewage sludge from base sewage treatment facilities into small piles (less than 10 cubic yards) and allowing it to air dry in an area where groundwater is approximately 11 to 13 feet below ground surface. After the sludge dried, it was composted and stockpiled and was reportedly either used as soil supplement at various base locations or hauled off base. No information is available on the dates of composting operations in the 26 Area.

2.6.8.3 *Summary of Site Characteristics*

Site 10 was initially investigated in 1993 and 1994 during the RI for Group C sites. Phase 2 RI was conducted at Site 10 in June and July 1996 during the RI for Group D sites. A total of 29 soil samples were collected from 10 borings. Boring locations are shown in Figure 2-20. Samples were analyzed for metals, VOCs, SVOCs, pesticides and PCBs, and TPH as diesel and

gasoline. SPLP and deionized waste extraction test (DI WET) leachability analyses were conducted on samples from resampled locations where diesel, SVOCs, and lead were detected during the Phase 1 RI. No sediment or surface-water samples were collected because no surface water was present on site. Two groundwater monitoring wells were installed and three rounds of groundwater samples were collected during 1994 (Figure 2-20). The groundwater samples were analyzed for metals, VOCs, SVOCs, TPH as diesel and gasoline, and general chemistry. Two sets of plants and invertebrates were collected at random locations from the sludge pile. The biota samples (plants and invertebrates) were analyzed for metals, PCBs, and pesticides.

2.6.8.3.1 *Geology and Hydrogeology*

Geology at Site 10 consists primarily of stream-deposited alluvium of Holocene age. The predominant lithology is poorly graded to well-graded sand, with discontinuous lenses of lower permeability silty sand, silt, and clay. Poorly graded sand and less abundant lenses of lowpermeability sand (e.g., silty sand and clayey sand), silt, and clay underlie the sludge composting yard. The shallow geology indicates that Site 10 is underlain by up to 10 feet of strata consisting predominantly of silt and clay. The fine-grained strata are unsaturated. The top 10 to 20 feet of the saturated portion of the aquifer occurs within strata consisting primarily of sand.

No borings were advanced to bedrock at Site 10; however, borings at Group A Site 24 in the Santa Margarita River floodplain and within 1 mile of Site 10 encountered the La Jolla Group, suggesting that the alluvium is up to 50 feet thick.

The La Jolla Group crops out on hillsides surrounding the 26 Area. This unit consists of fine- to medium-grained sandstone interbedded with silty sandstone, clayey sandstone, siltstone, and claystone.

Site 10 is located on the alluvial plain of the Santa Margarita Basin, on the east edge of the Upper subbasin. The groundwater flow direction beneath the site is primarily southwest, parallel to the long axis of the basin. Local groundwater flow is southwest, parallel to the long axis of the basin, and is consistent with regional flow, which is parallel to the long axis of the Upper subbasin.

2.6.8.3.2 *Soil Results*

This section discusses analytical results from soil sampling at Site 10. Results are summarized in Figures 2-20 and 2-21, which present detected organics and any inorganics that exceed risk/hazard criteria.

Organics

With the exception of 2,4-dinitrotoluene, N-nitroso-di-n-propylamine, pentachlorophenol (PCP), benzo(a)pyrenc, and diesel, none of the organic compounds detected in Site 10 soil exceeded human evaluation criteria (Figure 2-20). Diesel and PCP concentrations in boring 10B-03 exceeded ecological evaluation criteria (Figure 2-21). Six detections of diesel in samples from five soil borings exceeded the 100-mg/kg screening level. The highest diesel concentration was 4,300 mg/kg in the 7-foot sample from boring 10B-03. The other four detected organics exceeded PRGs only once in the surface sample from boring 10B-03.

In addition, the following 25 organics were detected in Site 10 soil but at concentrations below PRGs: acetone, 2-butanone, toluene, benzoic acid, bis(2-ethylhexyl)phthalate, 4-chloroanitine, 4-chloro-3-methylphenol, 2-chlorophenol, chrysene, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 4-methylphenol, 4-nitrophenol, phenol, pyrene, 1,2,4-trichlorobenzene, acenaphthene, benzo(b)fluoranthene, diethylphthalate, dimethylphthalate, di-n-butylphthatate, dieldrin, 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT. Most of the detections were from 10B-03, which also had the highest concentrations of PCP (32 mg/kg), 4-chloroaniline (13 mg/kg), and diesel (4,300 mg/kg) and the only detections of N-nitroso-di-n-propylamine (1.8 mg/kg), benzo(a)pyrene (6.4 mg/kg), and 2,4-dinitrotoluene (2.5 mg/kg).

Sample location 10B - 03 was resampled during the Phase 2 RI (sample 10SS003) for SVOC analysis. Only bis(2-ethylhexyl)phthalate (2.3 mg/kg) and 4-chloroaniline (1.7 mg/kg) were detected. Benzo(a)pyrene, 2,4-dinitrotoluene, N-nitroso-di-n-propylamine, and PCP, which were reported at concentrations exceeding the PRGs during the Phase 1 RI, were not detected during this round of sampling. In an effort to confirm these results, the same location was sampled for a third time (sample 10SS003A) and analyzed for TPH-diesel, SPLP-diesel, total SVOCs, and SPLP SVOCs. Total and leachable diesel concentrations were 100 mg/kg and 2.8 mg/l, respectively. The only SVOC detected was 4-chloroaniline at 3.4 mg/kg; no leachable SVOCs were detected. To confirm the leachability of diesel, the sample was reanalyzed (as sample 10SS003B). Total and leachable diesel concentrations were reported at 2,160 mg/kg and 55.4 mg/l, respectively.

Although diesel was detected in soil at leachable concentrations, no leachable semivolatile organic compounds were detected, indicating that no toxic constituents of diesel were leachable. No volatile organics or sernivolatile organic constituents of diesel were detected in groundwater. Therefore, the diesel concentrations detected in soil are not considered a threat to groundwater or human health. Diesel was evaluated in the ecological risk assessment and was determined not to be a significant threat to the environment.

Inorganics

Out of the 23 samples analyzed for metals, concentrations of arsenic in 6 samples, beryllium in 14 samples, lead in 1 sample, and manganese in 1 sample exceeded PRGs (Figure 2-20).

Arsenic was detected in surface samples from six boring locations and at depth in one boring location at concentrations exceeding the PRG but below background. Although beryllium concentrations exceeded the PRG in several samples at Site 10, the concentrations were only slightly higher than the regional background concentration (1.42 mg/kg); the maximum concentration for beryllium was 2.2 mg/kg.

Antimony, barium, chromium, copper, lead, mercury, molybdenum, silver, and zinc exceeded ecological screening criteria (Figure 2-21).

2.6.8.3.3 *GroundwaterResults*

No organics detected in groundwater exceeded MCLs or tap-water PRGs (Figure 2-20). Benzoic acid was detected once in well 10W-02 (approximate groundwater level of 8 feet below ground surface) and bis(2-ethylhexyl)phthalate, butylbenzylphthalate, and diethylphthalate were detected once in well 10W-01 (approximate groundwater level of 7 feet below ground surface). No other organics were detected in Site 10 groundwater.

No inorganics exceeded MCLs; however, arsenic and beryllium were detected at concentrations exceeding tap-water PRGs (Figure 2-20).

Beryllium was detected twice (2 and 2.2 μg/l) in well 10W-01 at concentrations exceeding the tap-water PRG. Arsenic was detected twice (3.3 and 2.8 μg/1) in well 10W-01 and twice (3.7 and 4.4 μg/l) in well 10W-02 at concentrations exceeding the tap-water PRG.

2.6.8.3.4 *Biota Results*

Terrestrial plant and invertebrate samples were collected from the main portion of the site and the sludge piles. The maximum detected tissue concentrations in biota collected from the main portion of the site were compared with similar biota collected from reference areas. For plants, most chemical concentrations were 1 to 10 times higher than reference levels, indicating uptake of these chemicals at levels exceeding background. None of the tissue concentrations in terrestrial invertebrates exceed the reference value. The maximum detected tissue concentrations in biota collected from the sludge pile were compared with similar biota collected from reference areas, but no tissue concentrations exceeded those from the reference areas.

2.6.8.3.5 *Summary*

Four semivolatile organics were detected in one surface sample at concentrations exceeding PRGs but were not detected in subsequent boring intervals or elsewhere in Site 10 soil. Diesel was detected at various locations at concentrations exceeding the evaluation criterion, but is not a threat to groundwater or human health. Manganese, lead, and mercury exceeded PRGs but only once each in 23 soil samples, indicating that inorganics in soil do not pose a concern. Four organics and two inorganics were detected in Site 10 groundwater but at concentrations below MCLs.

2.6.8.4 *Summary of Risks Associated with Site 10*

Human health and ecological risk assessments were conducted for Site 10 using data collected during the Group C and Group D RIs. Risk assessment methodologies are summarized in Section 2.4.1.4. Risk assessment summaries for Site 10 are presented in this section.

2.6.8.4.1 *Human Health Risk Characterization*

COPCs in Site 10 soil include metals, VOCs, SVOCs, and pesticides. Soil results from the sludge pile were not included in the human health assessment because of the planned removal of the pile. Current/future workers and future residents could be exposed to soil contaminants through incidental ingestion, dermal contact, and inhalation of VOCs or particulates.

The cumulative residential risk from the maximum detected COPCs in soil is 7.2×10^{5} and is primarily attributable to arsenic (approximately 11 percent of the total risk), beryllium (22 percent of the total risk), N-nitraso-di-n-propylamine (approximately 42 percent of the total risk), PCP (approximately 18 percent of the total risk), and 2,4-dinitrotoluene (approximately 5 percent

of the total risk). Arsenic is below the associated background concentration and was excluded from the risk evaluation as naturally occurring. N-nitroso-di-n-propylamine has been shown to be a laboratory contaminant in the past, was detected only once during the Group C Phase 1 RI, and has never been associated with site-related activities. Both PCP and 2,4-dinitrotoluene were detected only once at concentrations exceeding PRGs. The sample location (10SB003 surface sample) at which these compounds were detected was resampled twice during the Group D RI but no detections of these compounds were reported. Therefore, N-nitroso-di-n-propylamine, PCP, and 2,4-dinitrotoluene were excluded from the risk evaluation. Excluding the portion of total risk attributable to background metals and to N-nitroso-di-n-propylamine, PCP, and 2,4-dinitrotoluene, the incremental residential site risk is $6x10^{-6}$. The only contributor exceeding $1x10^{-6}$ is beryllium. The maximum detected beryllium concentration is 2.2 mg/kg and exceeds the background concentration of 1.42 mg/kg by only 0.78 mg/kg.

The cumulative residential noncarcinogenic hazard from maximum detected COPCs is 2.4 and is primarily attributable to metals (approximately 92 percent of the total hazard). Excluding the portion of total hazard attributable to background metals, the incremental residential site hazard is 1.3, just above the threshold criterion of 1.0. However, the incremental residential hazard (site total hazard minus the hazard attributable to background metals) is below the threshold criterion of 1.0 for each target organ, indicating that soil COPCs will not result in adverse health effects for future residential land use.

The cumulative industrial cancer risk from maximum detected COPCs is $1.6x10^{-5}$. Excluding the portion of total risk attributable to background metals and N-nitroso-di-n-propylamine, PCP, and 2,4-dinitrotoluene, the incremental industrial site risk is $1x10^{-6}$. The cumulative noncarcinogenic hazard from maximum detected COPCs is 0.41 and is primarily attributable to metals. Excluding the portion of total hazard attributable to background metals, the incremental industrial site hazard is 0.15.

The results of the HHRA indicate that the incremental residential ($6x\ 10^{-6}$) risk at Site 10 is within the risk management range and the incremental residential site hazard by target organ is below the threshold criterion of 1.0. In addition, the maximum reported lead concentration (95 mg/kg) is below screening criteria. Based on the results of the HHRA, Site 10 soil is considered protective of human health.

Detected COPCs in groundwater include metals and SVOCs. Future residents could be exposed to groundwater contaminants through ingestion.

The cumulative residential cancer risk from ingestion of groundwater is 2.4×10^{-4} and is primarily attributable to arsenic (approximately 41 percent of the total risk) and beryllium (approximately 58 percent of the total risk).

The total noncarcinogenic health hazard is 1.4 and is primarily attributable to metals in groundwater, specifically manganese (HQ 0.71) and arsenic (HQ 0.4). The incremental residential hazard is below the threshold criterion of 1.0 for each target organ evaluated, indicating that groundwater COPCs will not result in adverse health effects for future domestic use of groundwater.

2.6.8.4.2 Ecological Risk Assessment

The site was divided into the main portion and the sludge pile for purposes of the EcoRA. The sludge pile has limited ecological habitat but was included in the EcoRA because it could provide prey items (e.g., soil invertebrates) for secondary receptors. Samples collected from each area include soil (0 to 6 feet below ground surface) and biota (plants and terrestrial invertebrates).

COPECs that exceed background and that have HQs exceeding 1.0 are shown in Figure 2-2 1. The COPECs are mostly metals but include maximum detected concentrations of diesel and PCP at one location. Most chemicals were not considered COECs because they had a low frequency of detection and/or of exceeding an HQ of 1.0, average concentrations that resulted in HQs less than or close to 1.0, or were not found in tissue samples representing species of concern. The main contributors to ecological risk are lead, copper and zinc. Representative species for this site with HQs exceeding 1.0 include plants, terrestrial invertebrates, California mouse, deer mouse, American robin, and Swainson's hawk.

The HQs for lead and mercury in soil in areas of concern at the Site 10 main site and sludge pile range from approximately 1.0 to 5 and 1.0 to 4, respectively. These HQs indicate low potential risk. Average detected concentrations of lead and mercury were 46 and 2.2 mg/kg, respectively. Background concentrations of lead and mercury are 29 and 0.08 mg/kg, respectively. The site-

related portion of the average concentration of lead results in an HQ less than 1.0. The site-related portion of the average concentration of mercury results in an HQ of 2.2.

The HQs for copper range from 1.0 to 73. The average detected concentration of copper (440 mg/kg) results in an HQ of 21. The receptors of concern for copper are mammals. The laboratory test species used to derive the PLEs for mammals is the rat. The toxicity for copper is based on a subchronic no observed adverse effect level (NOAEL); the adverse effects measured or observed are impairment of learning ability, hyperactivity, and behavioral aberrations. These subtle adverse effects have not been measured in the field and are not fatal. Samples of representative mammal species at Sites 1A and 2A, where similar or higher concentrations of lead, copper, and mercury were detected in soil, were analyzed for these metals. The detected concentrations in the representative species did not exceed reference concentrations. This indicates that these metals are not significantly bioaccumulating in mammals or their diets at the concentrations detected in Site 10 soil and that these metals may not be in a bioavailable chemical state for mammals.

Sewage sludge composting has not made Site 10 a favorable area for mammals. Cover vegetation is limited relative to surrounding areas, and the site appears to be a less favorable habitat than surrounding areas. The site is near base maintenance facilities and land use is not likely to change from industrial use.

Although a few chemicals present a potential low to medium risk at Site 10, the overall potential risk is low.

2.6.8.5 Description of the No Action Alternative

The no action alternative selected for Site 10 includes no institutional controls. Site 10 is considered protective of human health and the environment for the following reasons:

- The HI for soil does not exceed the 1.0 criterion for individual target organs.
- The ILCR is at the lower end of the NCP range of 10^{-6} to 10^{-4} for risk management evaluation.
- At least some portions of the main groundwater risk contributors (arsenic and beryllium) are likely, and are assumed to be, within background.

- Beryllium detections were limited to the first two rounds of sampling in well 10W-01; beryllium was not detected in 10W-01 during the third round of sampling and was not detected in the other Site 10 well (10W-02).

- The arsenic and beryllium detections were qualified with a "B," indicating that these compounds were detected below the CRDL but at or above the IDL.

- The likelihood of installing a drinking water well at the point of maximum arsenic and beryllium concentrations is considered low.

- The maximum arsenic and beryllium groundwater concentrations are less than one-half the respective MCLs (50 and 4 µg/l).

- Although a few chemicals pose a potential low to medium ecological risk at Site 10, the overall potential risk is low.

2.6.9 Site 16 - 22 Area Buildings 22151 and 22187 Ditch Confluence and Ditch

Site 16 is the ditch and ditch confluence between Buildings 22151 and 22187.

2.6.9.1 Site Name, Location, and Description

Site 16 - 22 Area Buildings 22151 and 22187 Ditch Confluence and Ditch, is located about 0.25 mile southeast of the Marine Corps Air Station (MCAS) and approximately 1 mile from the Santa Margarita River (Figure 1-2). Seasonal surface water flows in a highly vegetated, unlined ditch at this site. The ditch is approximately 10 feet wide and 2 to 8 feet deep. Site 16 is adjacent to the south corner of the base motorpool and is immediately northwest of Site 17. The nearest base production well is approximately 2 miles west-southwest of Site 16.

The site includes the Buildings 22151 and 22187 ditch confluence and ditch and an oil/water separator. The site is bordered on the northeast side by a fenced, asphalt-paved area (motor transportation/ maintenance facility) north of the ditches and by an asphalt parking lot south of the ditches, on the southwest and northwest by light to moderate vegetation; and on the southeast by grass. An elevated concrete walkway crosses perpendicular to the ditch. The Santa Margarita River is approximately 1 mile north, Site 17 is south, and Site 27 is southwest of the ditch confluence.

No perennial surface water is present in the vicinity of Site 16. The area receives only low annual rainfall, primarily during winter months. Surface water at the site is generally ephemeral,

follows the gently sloping ground surface, and drains southwesterly in well-defined ditches. In addition, the Site 16 ditch drains into the Site 27 ditches, which flow southwesterly and eventually discharge into the Santa Margarita River. The remaining surface water either percolates into the subsurface or evaporates. The ditch confluence between Buildings 22151 and 22187 is within the Santa Margarita River floodplain.

Land use in the vicinity of Site 16 consists of activities associated with major warehousing and food storage functions for the base. Structures in the area include maintenance shops, motor pools, fueling facilities, administrative buildings, scrap yards, recreation areas, troop housing, and industrial and warehouse buildings. Military and civilian personnel are present on roads and buildings in the vicinity of the site on a daily basis. The nearest designated troop housing areas are located in the Chappo (22) Area, approximately 200 feet from the site. The nearest family housing is the Ranch House, about 1.5 miles northeast of Site 16. The nearest base production well is approximately 3,400 feet northwest of Site 16.

Site 16 contains a 30-foot-wide strip of riparian habitat that runs parallel to Avenue "D." Cottonwood and willow are the dominant tree species; mulefat, tree tobacco, and cattail are found in the understory. Nonnative grassland habitat surrounds the riparian strip and is mowed along Avenue "D." Southeast of the riparian strip is a small patch of coastal sage scrub. Sagebrush, coyote brush, and deerweed are the dominant species in this habitat. During the surveys, 17 bird species were identified. Common species include European starling, common yellowthroat, and California towhee. A least Bell's vireo (a special-status species) was observed in the riparian strip parallel to Avenue "D." Deer mice, western harvest mice, and house mice were observed on site. Audubon cottontails were observed throughout the site. No amphibians were observed. A western diamondback rattlesnake was found in a rock pile near the riparian strip.

2.6.9.2 Site History and Enforcement Activities

Site 16 consists of a naturally occurring drainage ditch that could have received hazardous materials from an oil/water separator and from previous operations at the base motorpool north of the site. Adjacent to the ditch is an oil/water separator that was installed in the mid-1980s and used until the late 1980s, when operational problems were observed. Petroleum and oil could have spilled into the ditch during that time; however, no information is available on the constituents or the quantity of effluent from the separator. Facilities in the area include a lube

bay, maintenance shop, auto shop, welding facility, steam-cleaning pad, frame-straightening rack, and auto grease rack. These facilities have been operating for more than 20 years and use or store materials such as POLs and solvents.

2.6.9.3 Summary of Site Characteristics

Site 16 was initially investigated in 1993 and 1994 during the RI for Group C sites. Phase 2 RI was conducted in June and July 1996 during the RI for Group D sites. A total of 18 soil samples were collected from 10 borings and 3 surface locations (Figure 2-22). Samples were analyzed for metals, VOCs, SVOCs, and TPH as diesel and gasoline. SPLP and DI WET methods were used for leachability tests on samples from resampled locations where diesel and lead were detected during the Phase 1R1.

A total of 14 surface-water samples were collected from eight locations during three sampling events in 1994 and 1995 (Figure 2-23). The surface-water samples were analyzed for the same analytes as soil, plus general chemistry. Three sediment samples were collected during the June and July 1996 investigation. The sediment samples were analyzed for metals, PCBs and pesticides. In addition, leachability tests were run on the sediment samples for toluene, ethylbenzene, xylenes, TCE, and total lead. Groundwater at Site 16 is included in OU4.

A habitat and receptor survey was conducted and dominant vegetative habitats were noted during March 1995. Bird and general wildlife surveys were conducted, along with mammal trappings conducted to identify small mammal use of the site.

During June 1995, one composite plant sample and one composite invertebrate sample were collected. Additional crayfish samples were collected at location 7 during Phase 2 to evaluate organochlorine pesticide (e.g., 4,4'-DDT) bioavailability at the site and potential sources of pesticides previously detected in downstream sediment (Site 27). The samples were analyzed for metals, PCBs, and pesticides.

2.6.9.3.1 Geology and Hydrogeology

The geology of Site 16 consists primarily of stream-deposited alluvium of Holocene age overlying the La Jolla Group bedrock of Eocene age. Soil at this site consists of alluvial sand, silt, and clay deposited as discontinuous lenses. Poorly graded to well-graded sand is the predominant lithology in the area, with discontinuous lenses of lower permeability silty sand,

silt, and clay. Poorly graded sand and less abundant lenses of low-permeability silty sand, clayey sand, silt, and clay underlie the ditch confluence area. The La Jolla Group crops out on hillsides surrounding 22 Area and consists of fine- to medium-grained sandstone interbedded with silty sandstone, clayey sandstone, siltstone, and claystone.

Site 16 is located on the alluvial plain of the Santa Margarita Basin, on the south edge of the Chappo subbasin. The groundwater flow direction beneath the site is primarily southwest, parallel to the long axis of the basin. Local groundwater flow is west-southwest, parallel to the long axis of the Chappo subbasin and consistent with regional groundwater flow. Depth to the groundwater table at Site 16 ranges from 5 to 10 feet below ground surface.

Complicated localized variations in the water table were observed throughout the south side of the Chappo subbasin, particularly along the basin edge. The water-level variations could be caused by a combination of factors, including the lower hydraulic conductivities of the abundant fine-grained strata on the edge of the basin, numerous anthropogenic influences (such as pavement and buildings) that decrease evapotranspiration in some areas, and extensive storm-water control measures that channel and redirect surface-water flow and infiltration.

2.6.9.3.2 Soil Results

This section discusses analytical results from soil sampling at Site 16. Results are summarized in Figure 2-22, which presents detected organics and any inorganics that exceed risk/hazard criteria.

Organics

With the exception of diesel, none of the organic compounds detected in Site 16 soil exceeded evaluation criteria (Figure 2-22).

Diesel concentrations in samples from four soil borings exceeded the 100-mg/kg screening level. The highest diesel concentration was 1,000 mg/kg, at sample location 16B-04, which exceeds the LUFT *Manual* guidance and the ecological screening criterion.

The following nine organics were detected in Site 16 soil at concentrations below the evaluation criteria: acetone, toluene, 1,1,1-TCA, methylene chloride, benzoic acid, bis(2-ethylhexyl)-phthalate, butylbenzylphthalate, diethylphthalate, and 4,4'-DDT. Of these nine analytes, the highest concentration was 0.2 mg/kg for benzoic acid.

Surface soil was resampled at locations 16B-04 and 16B-05 during the Phase 2 investigation (samples 16B-04-01RE and 16B-05-01RE, respectively) for TPH-diesel analysis; the corresponding analytical results were 31 and 160 mg/kg, respectively. The samples were further analyzed for leachability via SPLP analysis for toluene, ethylbenzene, xylenes, and TCE. No VOCs were detected in the SPLP analysis, indicating that these constituents are not likely to leach to groundwater.

Surface soil at location 16B-05 was sampled for a third time (sample 16B-05-01RE2) to evaluate the leachability of diesel. However, diesel was not detected in the soil sample or the SPLP test.

Inorganics

Arsenic was detected in 3 samples, beryllium in 15 samples, and lead in 1 sample out of 20 at concentrations exceeding PRGs (Figure 2-22). No other inorganics exceeded the evaluation criterion.

Arsenic was detected in surface samples from three boring locations at concentrations exceeding the PRG but below background. Although beryllium concentrations exceeded the PRG in several samples at Site 16, concentrations were below the regional background concentration (1.42 mg/kg) at all locations except 16B-07, where beryllium was detected in the surface and 6-foot samples at concentrations of 2.2 and 2.4 mg/kg, respectively.

The maximum lead concentration (465 mg/kg) was detected in surface soil at sample location 16B-05 and exceeded the PRG and background. Location 16B-05 was resampled (sample 16B-05-01 RE) and tested for total lead and leachable lead by DI WET analysis. The total lead concentration for the repeat sample was 35 mg/kg, but the corresponding leachable lead concentration was 610 µg/l, which is unusually high considering the low total lead concentration. Consequently, the same location was sampled for a third time (sample 16B-05-01 RE2). The total lead concentration of 17 mg/kg confirmed the low soil concentration from the previous resampling effort. Leachability testing using DI WET analysis detected no leachable lead. The results are summarized below:

Sampling Round	Total Lead (mg/kg)	DI WET Lead (µg/l)
Phase 1	465	Not performed
Phase 2	35	610
3 January 1997	17	ND

Based on this testing, the original elevated lead detection is considered anomalous, as confirmed by the low concentrations detected during the two subsequent resampling efforts. Given the low total lead concentration of 35 mg/kg, a leachable lead value of 610 µg/l seems to be erroneously high, The final DI WET analysis data support this contention and indicate that leaching of lead to groundwater is unlikely for lead concentrations in this range.

2.6.9.3.3 Groundwater Results

Groundwater at Site 16 is included in OU4 and results are not presented here.

2.6.9.3.4 Surface-Water and Sediment Results

Results of surface-water and sediment sampling arc summarized in Figure 2-23. Because no pathways for human exposure exist for sediment or surface water, contaminants detected in these media are of concern only for ecological receptors. Accordingly, the results are not compared against human health evaluation criteria. Instead, the analytical results for these media are screened against ecological risk criteria.

Diesel and 4,4'-DDT are the only organic compounds that exceeded ecological screening criteria. Diesel exceeded ecological screening criteria at three surface-water sample locations, with a maximum concentration of 1,580 µg/l. The 4,4'-DDT concentration in sediment sample 16SD003 was 3.6 µg/kg, which exceeds the screening criteria.

Barium exceeded screening criteria at three sediment sample locations, with a maximum concentration of 124 mg/kg. Barium, copper, iron, and zinc exceeded screening criteria in surface-water samples, with maximum concentrations of 169, 28.5, 2,280, and 220 µg/l, respectively.

2.9.3.5 Biota Results

Terrestrial plant and aquatic invertebrate samples were collected at Site 16. Biota collected from the site included terrestrial plants and aquatic invertebrates. The maximum detected tissue concentrations were compared with similar biota collected from reference areas. For terrestrial plants, all reference HQs are less than 1.0, indicating that bioaccumulation from site-related chemicals is less than that for reference areas.

Aquatic invertebrates (crayfish) were compared with reference values from two different reference areas, as well as with PLEs for ingestion by raccoons. One reference area (R8) was located upstream of sample station 7, in an arm of the drainage into Sites 16 and 27; this location had not been sampled previously and was not expected to be affected by site-related activities. The second reference area (R4) was located above the inlet to the upper end of Lake O'Neill and was used to represent background conditions for the base. Aluminum, barium, copper, and iron at sample station 1 and nickel at station 7 exceeded both R4 and R8 reference values. Manganese and nickel at sample station 1 and cobalt and copper at sample station 7 exceeded only R8 reference values. Arsenic at sample station 1 and aluminum and silver at sample station 7 exceeded only R4 reference values. With the exception of nickel at sample station 7, reference HQs were less than 10, indicating that tissue levels were relatively close to those at unaffected reference areas. Tissue concentrations could be representative of local ambient concentrations because no significant differences were observed in upstream locations compared with downstream sample locations. In addition, the organochlorine pesticide 4,4'-DDT, which exceeded sediment PLEs at Site 27, was not detected in crayfish tissues, indicating that biota are not bioaccumulating this chemical. A comparison of crayfish tissue concentrations against PLEs for ingestion by raccoons indicated that concentrations could reflect general ambient conditions because PLEs were exceeded by the same chemicals in tissues collected from both the site and the Lake O'Neill reference area.

2.6.9.4 Summary of Risks Associated with Site 16

Human health and ecological risk assessments were conducted for Site 16 using data collected during the RI. Risk assessment methodologies are summarized in Section 2.4.1.4. Risk assessment summaries for Site 16 are presented in this section.

2.6.9.4.1 Human Health Risk Characterization

The HHRA evaluated soil only. Groundwater at Site 16 is included in OU4. The pathways for human exposure to surface water and sediment are not complete and, thus, were not evaluated.

Detected COPCs in soil include metals, SVOCs, and VOCs. Current/future workers and future residents could be exposed to soil contaminants through incidental ingestion, dermal contact, and inhalation of VOCs or particulates.

The cumulative residential risk from maximum detected COPCs is $1.9x10^{-5}$ and is primarily attributable to arsenic (approximately 10 percent of the total risk) and beryllium (approximately 90 percent of the total risk). The maximum concentration of arsenic (0.7 mg/kg) is below the background value (4.25 mg/kg), whereas the maximum concentration of beryllium (2.4 mg/kg) exceeds background (1.42 mg/kg). Excluding the portion of total risk attributable to background metals, the incremental residential site risk is $7x10^{-6}$. Assuming that beryllium is lognormally distributed throughout the soil at Site 16, the estimated 95 percent UCL soil concentration for beryllium is 1.2 mg/kg. Excluding the portion of total risk attributable to background, the incremental residential site risk for the 95 percent UCL soil concentration is $2.0x10^{-7}$.

The cumulative residential noncarcinogenic hazard for the maximum detected COPCs is 0.64 and is primarily attributable to metals (approximately 99 percent of the total hazard). Excluding the portion of total hazard attributable to background metals, the incremental residential site hazard is 0.1.

The incremental residential cancer risk is less than $1x10^{6}$ and the incremental noncarcinogenic hazard is less than 1.0. The maximum lead concentration (465 mg/kg) exceeds the residential soil PRG. During two resampling events at the location where the maximum lead concentration was detected, lead concentrations were 35 and 17 mg/kg. The other 18 detections of lead were below residential PRGs. The single high concentration of lead is not uniformly distributed throughout site soil, as indicated by the lower detections of lead in subsequent sampling at the maximum concentration location and at other locations. Based on the conservative assumptions used, no adverse health impacts are expected from lead at Site 16. Therefore, Site 16 soil is considered protective of human health.

2.6.9.4.2 Ecological Risk Assessment

Seven preliminary COPECs (six inorganics and one organic) in soil had HQs exceeding 1.0 (Figure 2-23). HQs were calculated for representative species for multiple soil samples at seven locations; the samples were analyzed for 119 inorganic and organic chemicals. Most of the HQs that exceed 1.0 are less than 10, indicating that the potential for toxicity is relatively low. HQs for beryllium, cadmium, chromium, lead, and zinc are in the medium toxicity range (10 to 100). The frequencies of detection for chemicals with HQs greater than 1.0 were high (100 percent), with the exception of cadmium (13 percent) and diesel (47 percent).

HQs for two preliminary sediment COPECs, barium and 4,4'-DDT, exceed 1.0 (Figure 2-23). HQs exceed 1.0 for barium at sample locations 2, 3, and 7 and for 4,4'-DDT at sample station 3. All HQs that exceed 1.0 are less than 10, indicating that potential toxicity is relatively low. The highest HQ is 6.2 for barium at station 7, but barium concentrations are less than those detected at a reference area (R8) located upstream from Site 27 and are considerably less than soil background levels for the Santa Margarita Basin.

HQs for five preliminary surface-water COPECs (barium, copper, iron, zinc, and diesel) exceed 1.0 for chronic exposure by aquatic organisms. HQs that exceed 1.0 are all less than 10, with the exception of barium at sample stations 1 and 3, where HQs are in the medium toxicity range (10 to 100). HQs for barium at sample stations 1 and 3 and zinc at sample station 3 exceed 1.0 for acute exposure but are close to 1.0, indicating that the potential for acute toxicity is relatively low. Chemicals exceeding aquatic water quality criteria (AWQC) include iron at station 2 and copper and zinc at station 3. Iron exceeded chronic AWQC only once. Copper was detected in only one of four samples and did not exceed the acute AWQC. Zinc was detected in all four samples collected from the station, but only one sample exceeded chronic and acute AWQC values. This sample was collected in 1994, and the subsequent sample collected in 1995 contained much lower zinc concentrations. The HQs for terrestrial representative species exposed to surface water are all less than 1.0.

Birds, small mammals, reptiles, and aquatic invertebrates were observed at the site. The least Bell's vireo (a special-status species) could use the site but is not expected to establish territories or nests because of the limited suitable habitat. Representative species for this site with HQs exceeding 1.0 include plants, terrestrial invertebrates, deer mouse, raccoon, least Bell's vireo, and Swainson's hawk for soil and aquatic organisms for sediment and surface water.

None of the preliminary COPECs in soil were retained as final COPECs because the potential for exposure and effects is considered low. Additional confirmation sampling of the soils was conducted at Site 16 for lead and TPH, including leachability testing. The results indicated that these chemicals do not have a significant potential for leaching and transport.

The total lead concentration at the highest soil location (16B-05) was originally reported as 465 mg/kg. Two subsequent soil sampling events at the same location resulted in 35 and 17 mg/kg, respectively. Boring 16B-04, which originally had a lead concentration of

80.5 mg/kg, was resampled and a concentration of 12.6 mg/kg was detected. This indicates that the concentrations and extent of lead contamination at the site are not as high as indicated by the initial sampling.

Other preliminary COPECs with HQs exceeding 1.0 include beryllium, cadmium, chromium, copper, and zinc. HQs for these chemicals are in the low and medium toxicity ranges. Soil leachability testing demonstrated that leaching of these chemicals from soil into sediments and surface water is insignificant. The actual areas of the site where contamination is present is likely a limited proportion of the overall site area. These areas are generally smaller than the home range sizes of representative bird and mammal species. Given the relative lack of suitable habitat compared with surrounding areas, ecological receptors would not likely be sufficiently exposed to preliminary COPECs at the site to result in adverse effects.

None of the preliminary COPECs in sediment were retained as final COPECs because the potential for exposure and effects is considered low. Barium was not retained as a final COPEC because concentrations were less than upstream reference concentrations and soil background levels, indicating that barium concentrations in the ditches are reflective of background conditions for the area. The pesticide 4,4'-DDT was not retained because HQs were low and it was detected only once on site. This compound was not detected in aquatic invertebrate (crayfish) tissues collected from the on-site drainage ditches or in crayfish samples collected from a downstream location at Site 27.

None of the preliminary COPECs in surface water were retained as final COPECs because the potential for exposure and effects is considered low. The HQs indicated low potential toxicity, and barium and diesel were the only chemicals exceeding PLEs at more than one sample station within the site. Barium and diesel were not retained as final COPECs because concentrations of barium could be reflective of underlying sediment concentrations or ambient conditions for the area and the HQs for diesel were generally in the low toxicity range (1 to 10). Diesel was detected in only two surface-water samples. The source of the diesel contamination likely is attributable to storm-water runoff from roadway areas at the different sites that contribute drainage to the ditch. Potential sources that may have contributed to the diesel detections in the stormwater runoff near Site 16 include the motor transportation/maintenance facility immediately northeast of the site and the asphalt parking lot south of the site. Soil leachability studies demonstrated that residual contamination in on-site soils is probably not a significant contributor

to surface water at the site. Three preliminary COPECs exceeded PLEs based on AWQC (iron, copper, and zinc). These constituents were not retained as final COPECs because they were detected at concentrations exceeding AWQC only once and at only one location within the site. Subsequent samples were either below AWQC or were nondetects, indicating that concentrations are not consistently at potentially toxic levels. In addition, the ditch is only seasonally wet and, as such, does not support higher tropic level aquatic organisms (e.g., fish).

2.6.9.5 Description of the No Action Alternative

The no action alternative selected for Site 16 soil, sediment, and surface water includes no institutional controls. Site 16 is considered protective of human health and the environment for the following reasons:

- The human health HI for maximum detected soil concentrations is less than 1.0.
- The incremental cancer risk for representative concentrations at the site that exceed background is less than $1x10^{-6}$.
- Although a few chemicals pose a potential ecological risk at Site 16, the overall potential risk is low. The potential for exposure and adverse effects is considered low for soil, surface water, and sediment.

2.6.10 Site 17 - 22 Area Building 22187 Marsh and Ditch

Site 17 consists of a marsh and ditch near Building 22187 in 22 Area.

2.6.10.1 Site Name, Location, and Description

Site 17 - 22 Area Building 22187 Marsh and Ditch, consists of an unlined, densely vegetated ditch located about 0.25 mile southeast of the MCAS and approximately 1 mile from the Santa Margarita River (Figure 1-2). Seasonal surface water flows in the unlined ditch, which is approximately 10 feet wide and 2 to 8 feet deep.

Site 17 is bordered on the west and northwest by light to moderate vegetation, on the cast by grass, and on the south by Building 22187. An elevated concrete walkway traverses the ditch. The site is situated in a flat part of the floodplain, is drained by two northwest-flowing ditches, and receives runoff from the Building 22187 area. The confluence of several ditches widens and creates a marsh at the site. Site 16 is north and Site 27 is downstream to the west of the marsh and ditch. Ridges to the cast and south rise 350 feet above the site (Figure 2-24).

No perennial surface water is present in the immediate vicinity of Site 17. The area receives only low annual rainfall, primarily during winter months. Surface water at the site is generally ephemeral and follows the gently sloping ground surface to the southwest. The Site 17 ditch drains into Site 16 and Site 27 ditches, which eventually discharge southwest into the Santa Margarita River. Any surface water that does not drain to the ditches either percolates into the subsurface or evaporates.

Land use in the vicinity of Site 17 consists of activities associated with major warehousing and food storage functions for the base. Structures in the area include maintenance shops, motor pools, fueling facilities, administrative buildings, scrap yards, recreation areas, troop housing, and industrial and warehouse buildings. Military and civilian personnel are present in the immediate vicinity of the site on a daily basis. An elevated walkway crosses Site 17 and Site 16 to the north. The nearest designated troop housing areas are in the Chappo (22) Area, approximately 500 feet from the site. The nearest family housing, the Ranch House, is about 1.25 miles northeast of Site 17. The nearest base production well (10S/05W-13R02) is approximately 1 mile northwest of Site 17.

Site 17 contains predominantly nonnative grassland habitat. Dominant grass species include ripgut brome and wild oat. The two ditches that traverse the site contain remnant strips of riparian habitat, including cottonwood, willow, and cattail. No special-status species were observed during the site surveys. A least Bell's vireo was tentatively identified on the site but could not be confirmed. During ecological surveys, 19 bird species were identified on site, including song sparrow, red-winged blackbird, Anna's hummingbird, and red-shouldered hawk. House mice and California ground squirrels were caught in live-traps during the March 1995 survey. No reptiles were observed. Aquatic and terrestrial invertebrates were observed at the site during the March, June, and October 1995 surveys.

2.6.10.2 Site History and Enforcement Activities

Site 17 consists of a naturally occurring drainage ditch that could have received hazardous materials. The ditch received runoff from the Building 22187 area. Building 22187 is a steam generation plant that was built in 1952. POLs and corrosives (descalers) were used during previous operations and are currently stored in the Building 22187 area. A diesel spill reportedly flowed into the drainage ditch immediately north of Building 22187. In addition, thousands of gallons of diesel from an overflowing UST reportedly spilled into the ditch in the late 1980s. In

March 1992, two USTs were removed from the area as part of the Navy's UST program. The tanks stored diesel and had capacities of 12,000 and 6,000 gallons. No additional information is available on the quantities of other contaminants received by the ditch.

An initial study of two diesel USTs near Site 17 was conducted in 1985. Organic vapor concentrations in borings and wells ranged from 200 ppm to more than 1.000 ppm, as measured using a flame-ionization detector (FID). Petroleum hydrocarbon concentrations were 15,000 and 19,000 ppm at approximately 15 feet below ground surface. No other analyses were performed on these samples during the initial study (Dames and Moore, 1986). A later investigation resulted in the installation of two soil borings and three groundwater wells after the removal of the USTs (SWDIV, 1993c). A maximum petroleum hydrocarbon concentration of 9,900 ppm was detected in the soil samples collected as part of the UST removal program.

2.6.10.3 Summary of Site Characteristics

Site 17 was investigated during the RI for Group C sites and was initially reported in the Group C RI report (SWDIV, 1996a). Additional ecological sampling was conducted during the RI for Group D sites (SWDIV, 1997b). The results of the Rl indicated that soil contaminants were limited to petroleum hydrocarbons. Site 17 soil was excluded from CERCLA and will be addressed under the base UST program as documented in an amendment to the FFA (EPA, 1996b). Groundwater at Site 17 is included in OU4.

Three surface-water samples were collected from two locations at Site 17 and were analyzed for metals, VOCs, SVOCs, TPH as diesel and gasoline, and general chemistry. Three sediment samples were collected from three locations at Site 17 and were analyzed for metals, PCBs, and pesticides. Sample locations are shown in Figure 2-24.

A habitat and receptor survey was conducted and dominant vegetative habitats were identified at Site 17 during March 1995. Bird and general wildlife surveys were conducted to evaluate the potential presence of special-status wildlife species. Mammal trapping (using Sherman live-traps) was conducted to identify small mammal use of the site.

2.6.10.3.1 Geology and Hydrogeology

The Building 22187 marsh and ditch area is within the Santa Margarita River floodplain. The geology of Site 17 consists primarily of stream-deposited alluvium of Holocene age overlying La

Jolla Group bedrock of Eocene age. Soil at this site consists of alluvial sand, silt, and clay deposited as discontinuous lenses. The predominant lithology in the area is poorly graded to well-graded sand, with discontinuous lenses of lower permeability silty sand, silt, and clay. Poorly graded sand and less abundant lenses of low-permeability silty sand, clayey sand, silt, and clay underlie the ditch confluence area.

The alluvium at Site 17 extends to depths of at least 84 feet. The La Jolla Group was encountered at a depth of 71 feet below ground surface in one well close to the eastern hillslope, suggesting a thickening of alluvium downstream. The La Jolla Group crops out on hillsides surrounding 22 Area and consists of fine- to medium-grained sandstone interbedded with silty sandstone, clayey sandstone, siltstone, and claystone. Boring logs and geologic cross-sections for Site 17 are presented in the draft final RI report for Group C sites (SWDIV, 1996a).

Site 17 is located on the alluvial plain of the Santa Margarita Basin, on the south edge of the Chappo subbasin. The regional groundwater flow direction is primarily southwest, parallel to the long axis of the basin. Depth to the water table at Site 17 ranges from 5 to 10 feet below ground surface. Local groundwater flows west-southwest, parallel to the long axis of the Chappo subbasin and consistent with regional groundwater flow.

2.6.10.3.2 Surface-Water and Sediment Results

Because no pathways for human exposure exist for surface water or sediment, the contaminants detected in these media are of concern only for ecological receptors. Accordingly, the results are not compared against human health evaluation criteria. The analytical results are summarized in Figure 2-24.

2.6.10.4 Summary of Risks Associated with Site 17

An EcoRA was conducted for Site 17 using data collected during the Group C and Group D RIs. Risk assessment methodology is summarized in Section 2.4.1.4.

HQs for four preliminary sediment COPECs (barium, cadmium, 4.4'-DDE, and 4,4'-DDT) exceed 1.0 (Figure 2-24). Three sediment samples were collected and analyzed for 119 inorganic and organic chemicals. HQs for cadmium exceed 1.0 at one location (sample station 1). HQs for barium exceed 1.0 at sample stations 1, 2, and 3. HQs for 4,4'-DDE and 4,4'-DDT exceed 1.0 at sample station 1. All HQs that exceed 1.0 are very close to 1.0, indicating that the potential for

toxicity is relatively low. Barium concentrations detected at all stations are less than those at the reference area upstream from Site 27 and are considerably less than soil background levels for the Santa Margarita Basin.

HQs for two preliminary surface-water COPECs (barium and silver) exceed 1.0 for chronic exposure by aquatic organisms (Figure 2-24). The HQs for barium are in the medium toxicity range (10 to 100) at sample stations 1 and 4. Silver was detected only once, at sample station 1, with an HQ in the high toxicity range (100 to 1,000) based on comparison with the chronic AWQC. Both chemicals also exceed PLEs for acute exposure by aquatic organisms, but all HQs are less than 10, indicating that the potential for toxicity is relatively low. The frequencies of detection for the preliminary COPECs with HQs exceeding 1.0 are low for both barium and silver at sample station 1 (one detect out of three samples) and only one sample was collected at location 4. The HQs for terrestrial representative species exposed to surface water are all less than 1.0.

Birds, small mammals, reptiles, and aquatic invertebrates were observed at the site. The least Bell's vireo (a special-status species) could use the site but is not expected to establish territories or nests. Representative species for this site with HQs exceeding 1.0 for sediment and surface water consist of aquatic organisms.

None of the preliminary sediment COPECs were retained as final COPECs. The potential for exposure to and effects/toxicity from all preliminary COPECs with HQs exceeding 1.0 is considered low. Barium was not retained as a final COPEC because concentrations are less than the upstream reference concentrations and soil background levels, indicating that barium concentrations in the ditches could reflect background conditions for the area. Cadmium was not retained because it was detected at only one station, with an HQ indicating a low potential for toxicity. The organochlorine pesticides 4,4'-DDE and 4,4'-DDT were not retained as final COPECs because they were detected at only one sample station. These constituents were not detected in sediment collected from upstream or downstream sample locations and were not detected in crayfish collected from downstream sites, indicating that bioaccumulation is not occurring, consistent with the risk characterizations for Sites 16 and 27 (Sections 2.6.9.4.2 and 2.6.12.4.2).

None of the preliminary surface-water COPECs were retained as final COPECs. Silver exceeded the AWQC in a duplicate sample but could not be verified through subsequent sampling because the station was dry. In addition, silver was detected only once at the site and was not detected in underlying sediment samples, suggesting a potential artifact of sampling. Barium was not retained because the potential for exposure and effects is considered low and concentrations of barium could reflect underlying sediment concentrations or ambient conditions for the area.

2.6.10.5 Description of the No Action Alternative

The no action alternative selected for Site 17 sediment and surface water includes no institutional controls. Site 17 surface water and sediment are considered protective of human health and the environment for the following reasons:

- There is no complete human exposure pathway.
- Although a few chemicals pose a potential ecological risk, the overall potential risk is low. The potential for exposure and adverse effects is considered low for surface water and sediment.

2.6.11 Site 18 - 13/16 Area Building 1687 Spill and Ditch

Site 18 consists of ditches and spill areas near Building 1687 in 13/16 Area.

2.6.11.1 Site Name, Location, and Description

Site 18 - 13/16 Area Building 1687 Spill and Ditch, is located in the southern part of the Headquarters Area, approximately 1,250 feet west of Vandegrift Boulevard (Figure 1-2). The ditch is an ephemeral drainage that runs southward down a slight hill, away from two motor pool areas, a large parking area, and an oil/water separator. The drainage ditch runs along "B" Street, into a concrete-lined ditch approximately 200 feet north of the intersection of 6th and "B" Streets. In the vicinity of Site 18, the concrete-lined ditch runs west to east, parallel to 6th Street. The area receives only low annual rainfall, primarily during winter months. The concrete-lined ditches drain east into Pilgrim Creek (approximately 1 mile to the east), flow southwest into Windmill Lake, and eventually discharge into the San Luis Rey River.

No perennial surface water is present in the vicinity of Site 18. Any surface water that does not drain to the ditch either percolates into the subsurface or evaporates. No drinking water wells are located within a 1-mile radius of Site 18.

Structures in the vicinity of Site 18 include maintenance shops, motor pools, fueling facilities, administrative buildings, and troop housing. Military and civilian personnel are present in the immediate vicinity of the ditches on a daily basis. Designated troop housing areas are located within 13/16 Area. The nearest family housing, Serra Mesa Housing, is about 0.5 mile east of Site 18.

Site 18 consists primarily of defined drainages, most of which are concrete-lined. However, one section is vegetated with freshwater emergent wetland species such as bulrush and cattail. Young willows and cottonwoods also grow in this section of the ditch. No special-status species are expected to be present on this site. Wildlife species observed during the reconnaissance survey include cliff swallow, American crow, and California ground squirrel.

2.6.11.2 Site History and Enforcement Activities

Site 18 was added to the RI/FS after a visit by the Navy and Jacobs Engineering Group Inc. (Jacobs) team in May 1990. Base personnel reported a history of fuel spills at this site. In addition, the spill ditch near Building 1687 received runoff from two motor pool areas that housed battery shops, storage areas, and a bulk fuel area. POLs, solvents, and corrosives represent typical waste types spilled at this site.

2.6.11.3 Summary of Site Characteristics

Site 18 was investigated in June and July 1996 during the RI for Group D sites. A total of 20 soil samples were collected from eight boring locations (Figure 2-25). The samples were analyzed for metals, VOCs, and SVOCs. Poor recovery precluded the collection of groundwater samples. No surface-water or sediment samples were collected because no surface water was present on site.

2.6.11.3.1 Geology and Hydrogeology

Surface geology at Site 18 consists primarily of alluvium of Holocene age overlying the La Jolla Group bedrock of Eocene age. The predominant lithology at the site is poorly graded sand, with discontinuous lenses of lower permeability silty sand, clayey sand, and silt. Bedrock was not encountered in boring 18B-02; alluvium extends to a depth of at least 23 feet at this location. The La Jolla Group was encountered at depths of 9 and 13 feet in borings 18B-03 and 18B-06, respectively. These two borings are located near opposing south and north hillslope walls. The

La Jolla Group crops out on hillsides surrounding 13/16 Area and consists of fine- to medium-grained sandstone interbedded with silty sandstone, clayey sandstone, siltstone, and claystone.

Based on site geology, groundwater is assumed to flow to the south, following surface topography. Soil borings were drilled to a maximum depth of 40 feet below ground surface at Site 18; perched groundwater was encountered at a depth of 9.2 feet in boring 18B-04. Field observations indicated that the continuous water-bearing aquifer at Site 18 is more than 40 feet below ground surface.

2.6.11.3.2 Soil Results

This section discusses analytical results from soil sampling at Site 18. Results are summarized in Figure 2-25, which presents detected organics and any inorganics that exceed risk/hazard criteria.

Organics

No organics were detected in Site 18 soil at concentrations exceeding PRGs (Figure 2-25). Acetone, benzoic acid, 2,4-dinitrotoluene. bis(2-ethylhexyl)phthalate, butylbenzylphthalate, and di-n-octylphthalate were detected at low concentrations; the highest concentration detected was 0.52 mg/kg for bis(2-ethylhexyl)phthalate.

Inorganics

Arsenic was detected in 9 of 22 samples and beryllium was detected in 19 of 22 samples at concentrations exceeding PRGs but below background (Figure 2-25).

Summary

No organics were detected in soil at concentrations exceeding PRGs; arsenic and beryllium were the only inorganics that exceeded PRGs, but concentrations were below background. Despite attempts to collect water samples, groundwater was not encountered at Site 18. Based on soil concentrations and the deep water table, groundwater is not expected to be impacted. No significant site-related contamination exists at Site 18.

2.6.11.4 Summary of Risks Associated with Site 18

Human health and ecological risk assessments were conducted for Site 18 using data collected during the RI. Risk assessment methodologies are summarized in Section 2.4.1.4. Risk assessment summaries are presented in this section.

26.11.4.1 Human Health Risk Characterization

Detected COPCs in soil include metals, VOCs, and SVOCs. Current/future workers and future residents could be exposed to soil contaminants through incidental ingestion, dermal contact, and inhalation of VOCs or particulates.

The cumulative residential risk from maximum detected COPCs is 3.4×10^{-5} and is primarily attributable to arsenic (approximately 83 percent of the total risk) and beryllium (approximately 17 percent of the total risk). The maximum concentrations of arsenic (10.6 mg/kg) and beryllium (0.91 mg/kg) are less than their respective background concentrations. Excluding background concentrations, the incremental residential site risk is 2.1×10^{-9}.

The cumulative residential HI from maximum detected COPCs in soil is 1.5 and is primarily attributable to aluminum (approximately 21 percent of the total hazard), arsenic (approximately 34 percent of the total hazard), barium (approximately 20 percent of the total hazard), and manganese (approximately 17 percent of the total hazard). Excluding the portion of total noncarcinogenic hazard attributable to background metals, the incremental residential site hazard for maximum detected COPCs is 0.5.

Based on the results of the HHRA, the incremental residential risk for soil is below the lower end of the risk management range and the incremental residential hazard is less than the threshold criterion of 1.0. In addition, the maximum lead concentration (29.6 mg/kg) is below the residential screening criteria. Therefore, Site 18 soil is considered protective of human health.

Groundwater is not considered a complete exposure pathway for either current/future workers or future residents. Groundwater sampling was not performed at Site 18 during the RI because drilling refusal occurred in weathered bedrock less than 50 feet below ground surface, before encountering sufficient groundwater for sampling purposes. Perched groundwater encountered at 9.2 feet below ground surface did not supply sufficient quantities to sample. The site is not located above a shallow aquifer associated with any of the four major groundwater basins at MCB Camp Pendleton (i.e., San Mateo, San Onofre, Las Flores, or Santa Margarita Basin). The site is topographically higher than, and isolated from, the aquifers associated with these major basins. Therefore, groundwater at Site 18 was not evaluated further in the HHRA and is considered protective of human health.

2.6.11.4.2 Ecological Risk Assessment

HQs for seven preliminary COPECs exceed 1.0 (Figure 2-25) for one or two representative species; HQs are less than 1.0 for the other species. HQs were calculated for representative species for each of 11 soil samples, which were analyzed for 119 inorganic and organic chemicals. Most of the HQs exceeding 1.0 are less than 10, indicating that the potential for toxicity is relatively low. Aluminum, barium, and mercury had HQs in the medium toxicity range (10 to 100). The highest HQs for barium (12) and for aluminum (12) were calculated for the American robin. Aluminum and barium also had high frequencies of detection (100 percent). The highest HQ calculated for mercury was 20 for the deer mouse, indicating potentially high toxicity; however, mercury was detected in only 1 of 11 samples and most of the other HQs were less than 1.0.

Site 18 consists primarily of concrete-lined ditches that have low habitat value for terrestrial receptors. One section is unlined and characterized by emergent wetland species. No special-status species are expected to be present on site. Representative species for this site with HQs exceeding 1.0 include terrestrial invertebrates, deer mouse, and American robin.

None of the preliminary COPECs were retained as final COPECs because the potential for exposure and effects is considered low. The HQs for most of the chemicals detected are less than 1.0, indicating little or no toxicity. Aluminum, barium, and mercury had HQs greater than 10, but the frequency of detection for mercury was low and the remaining HQs are generally less than 1.0. In addition, the site is mostly developed and the available habitat is very limited. The home ranges of the representative mammal and bird species are generally larger than the available site habitat in which contaminants were detected. Given the limited on-site habitat and relatively good habitat surrounding the site, representative wildlife species would likely only be present on site for limited periods of time. Therefore, exposure of wildlife receptors to the preliminary COPECs at the site is not expected to result in any adverse effects.

2.6.11.5 Description of the No Action Alternative

The no action alternative selected for Site 18 soil and groundwater includes no institutional controls. Site 18 soil and groundwater are considered protective of human health and the environment for the following reasons:

- The incremental cancer risk for soil is less than $1x10^{-6}$.

- Excluding background, the HI for soil is less than 1.0.
- The human exposure pathway to groundwater is not complete based on the poor recovery from the geological formation below the site.
- Although a few chemicals present a potential ecological risk, the overall potential risk is low. The potential for exposure and adverse effects is considered low for soil based on the frequency at which risk contributors were detected and the limited site habitat.

2.6.12 Site 27 - 22 Area Ditches Behind Building 22210

Site 27 consists of ditches behind Building 22210 in 22 Area.

2.6.12.1 Site Name, Location, and Description

Site 27 - 22 Area Ditches Behind Building 22210, is approximately 0.25 mile southeast of the MCAS and approximately mile from the Santa Margarita River (Figure 1-2). Seasonal surface water flows in the highly vegetated drainage ditches at this site. The ditches are approximately 10 feet wide and 5 to 8 feet deep; they begin behind Building 22210 and flow northwest until they converge into a southwest-flowing ditch along the southeast side of Avenue D. The ditches are unlined and receive runoff from various maintenance facilities and hazardous material transfer and storage lots in 22 Area. The site ditches drain the area and eventually discharge southwest into the Santa Margarita River. Surface water not drained through the ditches either percolates into the subsurface or evaporates. No perennial surface water is present in the immediate vicinity of Site 27.

Land use in the vicinity of Site 27 consists of activities associated with major warehousing and food storage functions for the base. Structures in the area include maintenance shops, motor pools, fueling facilities, administrative buildings, scrap yards, recreation areas, troop housing, and industrial and warehouse buildings. Military and civilian personnel are present on roads and in buildings in the vicinity of the ditches on a daily basis. The nearest designated troop housing areas are in the Chappo (22) Area, approximately 200 feet from the site. The nearest family housing is the Ranch House, about 1.5 miles northeast of Site 27. The nearest base production well is approximately 4,200 feet northwest of Site 27.

Site 27 contains a 30-foot-wide strip of riparian habitat that runs parallel to Avenue D. Cottonwood and willow are the dominant tree species; mulefat, tree tobacco, and cattail are found in the understory. Nonnative grassland habitat surrounds the riparian strip and is mowed

along Avenue D. Southeast of the riparian strip is a small patch of coastal sage scrub. Sagebrush, coyote brush, and deerweed are the dominant species in this habitat. During the surveys, 24 bird species were identified. Common species include European starling, common yellowthroat, and California towhee. A least Bell's vireo (a special-status species) was observed in the riparian strip parallel to Avenue D. During the March survey, deer mice, western harvest mice, and house mice were caught in live-traps. Audubon cottontails were observed throughout the site. No amphibians were observed. A western diamondback rattlesnake was found in a rock pile near the riparian strip. Aquatic and terrestrial invertebrates were observed at the site during the March, June, and October 1995 surveys.

2.6.12.2 Site History and Enforcement Activities

Site 27 consists of naturally occurring drainage ditches that could have received hazardous materials from various facilities in the 22 Area. Site 27 is downstream from the Site 16 and Site 17 ditches, from storm-water discharge pipes entering the drainage from the 22 Area, and from previously detected contamination. Facilities in the area include warehouses and industrial operations. No information is available on the quantities of contaminants received by the ditches.

Previous investigations at Site 27 were limited to a sampling visit (SV) conducted as part of the RFA for SV Site 111. The SV analysis included six surface soil samples and four subsurface soil samples from six hand-augered soil borings that were advanced in the 22 Area drainage ditches to investigate potential contamination associated with runoff entering the ditches. The SV borings were advanced during the summer when the ditches were dry. Groundwater was encountered in all borings at depths of 2 to 6 feet below surface. No groundwater samples were collected as part of the SV. Chlorinated solvents detected in two soil borings included 1,1-dichloroethene (DCE), TCE, chlorobenzene, methylene chloride, and PCE (SWDIV, 1993a).

2.6.12.3 Summary of Site Characteristics

Site 27 was investigated with the Group C sites (SWDIV, 1996a). Additional ecological sampling was conducted during the RI for Group D Sites (SWDIV, 1997b). Site 27 groundwater is part of OU4. Eight surface-water and eight sediment samples were collected from the Site 27 ditches (Figure 2-26) and were analyzed for metals, VOCs, SVOCs, TPH as diesel and gasoline, and pesticides and PCBs. The surface-water samples were also analyzed for general chemistry. No soil samples were collected because the ditches were saturated.

During March 1995, a habitat and receptor survey was conducted and dominant vegetative habitats were identified. Bird and general wildlife surveys were conducted to evaluate the potential presence of special-status wildlife species. Mammal trapping (using Sherman live-traps) was conducted to identify small mammal use of the site.

One aquatic invertebrate (crayfish) sample and one terrestrial invertebrate (mixed insects) sample were collected in June 1995 and two aquatic invertebrate (crayfish) samples (one sample and one duplicate) were collected in June 1996 from the areas containing the highest inorganic and organochlorine pesticide concentrations (27SD001 and 27SD002) (Figure 2-26). In October 1995, terrestrial invertebrates (sowbugs and grasshoppers) were collected from the seasonally flooded playground area along 10th Street, southeast of Phase 1 RI sampling location 27SD001.

2.6.12.3.1 Geology and Hydrogeology

The geology of Site 27 consists primarily of stream-deposited alluvium of Holocene age overlying the La Jolla Group bedrock of Eocene age. The alluvium is predominantly silt and poorly graded sand containing varying amounts of silt and interbedded clay lenses. The thickness of the alluvium at Site 27 was not fully penetrated during drilling; however, alluvium near well cluster 6W-06, approximately 2,000 feet southwest of 27W-02, extends to a depth of at least 142 feet. Depth to bedrock decreases significantly toward the hills south of the site. The La Jolla Group crops out on hillsides surrounding 22 Area and consists of fine- to medium-grained sandstone interbedded with silty sandstone, clayey sandstone, siltstone, and claystone.

Site 27 is located on the alluvial plain of the Santa Margarita Basin, on the south edge of the Chappo subbasin. The regional groundwater flow direction is primarily southwest, parallel to the long axis of the basin. Depth to the water table at Site 27 ranges from 5 to 10 feet below ground surface. Local groundwater flow is west-southwest, parallel to the long axis of the Chappo subbasin and consistent with regional groundwater flow.

2.6.12.3.2 Surface-Water and Sediment Results

A summary of analytical results is presented in Figure 2-26. Because no pathways for human exposure exist for surface water or sediment, the contaminants detected in these media are of concern only for ecological receptors. Accordingly, the results are not compared against human health evaluation criteria, but rather against ecological risk criteria.

2.6.12.3.3 Biota Results

Biota collected from the site included terrestrial and aquatic invertebrates. The maximum detected tissue concentrations were compared with similar biota collected from reference areas. Tissue concentrations in terrestrial invertebrates exceeded reference values at sample station 1 (seven inorganics), sample station 3 (seven inorganics), and sample station 4 (two inorganics). The reference quotients are all less than 10 and most are very close to 1.0, indicating that tissue levels are very similar to those found in unaffected areas. Organochlorine pesticides were not detected in terrestrial invertebrates.

Tissue concentrations in aquatic invertebrates (crayfish) were compared with reference values from two different reference areas (R8 and R4) and with PLEs for ingestion by raccoons. The following preliminary COPECs exceeded values for both reference areas: aluminum, barium, chromium, cobalt, copper, iron, manganese, nickel, silver, zinc, and 4,4'-DDE. Vanadium exceeded only R8 reference values. All reference HQs are less than 10, indicating that tissue levels are relatively close to those at unimpacted reference areas.

Crayfish tissue concentrations were also compared with PLEs for ingestion by raccoons. This comparison indicated that crayfish tissue concentrations could be reflective of local ambient conditions because PLEs were exceeded by the same chemicals in tissues collected on site and from the R4 reference area.

2.6.12.4 Summary of Risks Associated with Site 27

Human health and ecological risk assessments were conducted for Site 27 using data collected during the Group C and Group D RIs. Risk assessment methodologies are summarized in Section 2.4.1.4. Risk assessment summaries for Site 27 are presented in this section.

2.6.12.4.1 Human Health Risk Characterization

The exposure pathways for surface water and sediment are incomplete for human receptors. Humans are not present at the site frequently enough to support a chronic exposure. Therefore, site surface water and sediment are considered protective of human health.

2.6.12.4.2 Ecological Risk Assessment

HQs for 12 preliminary sediment COPECs (8 inorganics and 4 organics) exceed 1.0 (Figure 2-26) but are generally less than 10, indicating a low potential for toxicity, with the following

exceptions: 4,4'-DDE at sample stations 1 and 2, 4,4'-DDT at sample stations 1 and 4, and barium at sample stations 5 and 6. Barium, 4,4'-DDE, and 4,4'-DDT were the only preliminary COPECs detected at several of the stations along the main portion of the ditch, but only one or two samples were collected at each sample station. Concentrations of barium, cadmium, manganese, and nickel are within soil background levels for the Santa Margarita Basin and could represent local background conditions. In addition, barium concentrations are less than those detected at a reference area upstream from Site 27. Concentrations of the remaining inorganics (copper, iron, lead, and zinc) exceed soil background levels but resulted in HQs close to 1.0 (ranging from 1.1 to 2.5).

HQs for 11 preliminary surface-water COPECs (8 inorganics and 3 organics) exceed 1.0 for chronic exposure by aquatic organisms (Figure 2-26). HQs are generally less than 10. The exceptions are barium at sample stations 1, 2, 6, 7, 8, and 9; mercury at sample station 1; and silver at sample station 7. The HQs for preliminary COPECs at these sample stations are in the medium toxicity range (10 to 100). Preliminary COPECs exceeding chronic AWQC include aluminum. chloride, cyanide, iron, mercury, and silver. Aluminum, cyanide, mercury, and silver were detected only once (out of three or four samples). Chloride and iron were detected in all samples (for a particular sample station) but exceeded AWQC values only once. Preliminary COPECs with HQs exceeding 1.0 for acute exposure by aquatic organisms include barium, cyanide, and silver, but all HQs are less than 10, indicating a low potential for toxicity. The frequencies of detection for the preliminary COPECs with HQs exceeding 1.0 ranged from 30 to 100 percent (within each sample station). The HQs for terrestrial representative species exposed to surface water are all less than 1.0.

None of the preliminary sediment COPECs were retained as final COPECs because the potential for exposure and effects is considered low. The HQs for most of the preliminary COPECs are close to 1.0; only a few HQs exceed 10. Inorganics were not retained because concentrations are less than or close to background soil levels and could reflect background conditions for the area. Organochlorine pesticides were not retained because most of the associated HQs are less than 10, indicating low potential toxicity. In addition, the crayfish collected from Site 27, as well as those from upstream (Site 16 and R8 [reference area]), showed very little bioaccumulation of 4,4'-DDT or its metabolites in the aquatic food web.

None of the preliminary surface-water COPECs were retained as final COPECs because the potential for exposure and effects is considered low. The HQs indicated low potential toxicity for most preliminary COPECs based on chronic comparisons and for all preliminary COPECs based on acute comparisons. Preliminary COPECs exceeding PLEs based on AWQC values were not retained as final COPECs because the chemicals were either detected only once or exceeded AWQC values only once, indicating that they are not present at high concentrations on a consistent basis. In addition, the ditches are only seasonally wet and chemicals exceeding acute AWQC were detected only once. Other preliminary COPECs exceeding acute PLEs had HQs very close to 1.0, indicating low potential toxicity.

2.6.12.5 Description of the No Action Alternative

The no action alternative selected for Site 27 surface water and sediment includes no institutional controls. Site 27 surface water and sediment are considered protective of human health and the environment for the following reasons:

- There is no complete exposure pathway for human receptors.
- Although a few chemicals in surface water and sediments pose a potential ecological risk, the overall potential risk is low based on the low potential for bioaccumulation, the frequency at which risk contributors were detected, and the background contribution to risk.

2.6.13 Site 32 - Drum Storage Area and Drainage Between Buildings 41303 and 41366

Site 32 consists of a drum storage area and drainage in 41 Area.

2.6.13.1 Site Name, Location, and Description

Site 32 - Drum Storage Area and Drainage Between Buildings 41303 and 41366, is located within the Las Flores Area, approximately 1,000 feet northeast of Stuart Mesa Road and immediately east of its intersection with El Camino Real (Figure 1-2). The site consists of an inactive waste oil UST, lube rack, wash rack, oil/water separator, hazardous waste drum storage area, and partially lined drainage ditch. The ditch is approximately 1,500 feet long and runs along the northern side of, and parallel to, El Camino Real. The wash rack, lube rack, oil/water separator, and drum storage area are immediately adjacent to the drainage at various points along the ditch. In addition, some petroleum-stained soil was observed approximately 200 feet

northeast of the eastern end of the ditch. The flow direction of the ditch is southeast to northwest. Pulgas Creek is approximately 0.75 mile northwest of Site 32. The surrounding area is characterized by rolling hills.

A small vegetated area is present at the eastern end of the drainage. Dominant plant species include willow, fennel, sage, mulefat, mustard, and curly dock. Special-status species, if present, would likely be limited to least Bell's vireo and would be confined primarily to the eastern end of the site. Bird species observed during the reconnaissance survey include common raven and mourning dove.

No perennial surface water is present in the immediate vicinity of Site 32. The area receives only low annual rainfall, primarily during winter months. Surface water at the site is generally ephemeral and follows the gently sloping ground surface to the southwest and eventually discharges into the Pacific Ocean. During significant rainfall events, surface water percolates into the subsurface, evaporates, or runs off site.

The Las Flores Area contains an industrial area (tank park, maintenance, and supply), a troop housing area, medical and training facilities, and tank training ranges in the north and recreation areas in the south. Military and civilian personnel are present on roads and at buildings in the vicinity of the site on a daily basis. The nearest designated troop housing areas are located 300 to 600 feet south of the site, within the Las Flores Area. The nearest family housing, Stuart Mesa Housing, is approximately 3 miles southeast of Site 32. The nearest base production well is approximately 1 mile west of Site 32.

2.6.13.2 Site History and Enforcement Activities

Site 32 has been used solely as a vehicle maintenance area. Past maintenance operations reportedly resulted in oil/water separator overflows, spills, and discharges to the ditch. Although the area is still used for maintenance, the practices that led to its inclusion in the RI have ended. As a general practice, wastes that had been containerized on site were later transported to the base hazardous waste disposal office for disposal. However, no specific information is available on the quantities of waste or the disposal location. This area was recommended for RI during the preliminary review (PR) (PR Sites 200, 203, and 204) and, thus, no sampling was conducted during the RFA.

2.6.13.3 Summary of Site Characteristics

Prior to 1995, no sampling had been conducted at this site; however, in late 1995, Bechtel collected a surface soil sample and a groundwater sample from the locations shown in Figure 2-27. The purpose of this sampling effort was to support SWDIV in estimating and prioritizing funding needs for future environmental restoration work. The samples were analyzed for VOCs, SVOCs, and metals. The groundwater sample was not filtered but was preserved with acid; as a result, the analytical results for metals were not usable. No other analytes were detected at concentrations exceeding MCLs or PRGs.

Site 32 was investigated during the RI for Group D Sites (SWDIV, 1997b). A total of 40 soil samples were collected from eight boring locations and one surface location, including the Bechtel 1995 samples. The samples were analyzed for metals, VOCs, and SVOCs. A groundwater sample was collected using a direct-push method during the 1995 sampling event. Groundwater samples could not be collected from permanent wells during the 1996 RI because sufficient water was not encountered to a depth of approximately 50 feet below ground surface. No surface water was present on site.

A habitat and receptor survey was conducted at Site 32 during June 1996. Dominant vegetation types and corresponding wildlife habitats were identified. Wildlife observed and evidence of wildlife use (i.e., scat or tracks) were also noted.

2.6.13.3.1 Geology and Hydrogeology

Geology at this site is primarily marine terrace deposits. These materials consist predominantly of interbedded fine-grained sand, silty and clayey sand, and clay and gravel lenses and were probably deposited in near-shore marine and/or estuarine conditions during periods of fluctuating sea levels.

Based on site geology, groundwater is assumed to flow to the southwest, following surface topography. During the 1995 investigation, Bechtel collected a hydropunch sample at 47 feet below ground surface. During the RI, soil borings were drilled to a maximum depth of 50 feet below ground surface at Site 32; groundwater was encountered at a depth of 37.5 feet in boring 32B-01. However, data from the boring indicate that shallow groundwater is present only within small, localized, discontinuous perched zones and a distinct continuous water-bearing zone (aquifer) does not exist above 50 feet below grade at this site.

2.6.13.3.2 Soil Results

This section discusses analytical results from soil sampling at Site 32. Results are summarized in Figure 2-27, which presents detected organics and any inorganics that exceed risk/hazard criteria.

Organics

No organic compounds were detected in soil at concentrations exceeding PRGs (Figure 2-27). However, 2-butanone and 2-methyinaphthalene were detected at concentrations of 0.001 and 0.27 mg/kg, respectively, in the upper 5 feet of boring 32B-03.

Inorganics

Concentrations of three metals exceeded PRGs: arsenic, beryllium, and chromium VI (Figure 2-27). All beryllium detections were below the background concentration of 1.52 mg/kg. Arsenic concentrations were generally close to the background concentration of 2.67 mg/kg; the highest arsenic concentration was 3.7 mg/kg. No background value was available for chromium VI, which was detected at concentrations above the PRG only at depths between 10 and 30 feet in three samples from boring 32MW-01. The maximum concentration was 1.2 mg/kg.

2.6.13.3.3 Groundwater Results

No organics were detected at concentrations exceeding MCLs or tap-water PRGs in the groundwater sample from Site 32 (hydropunch sample 104CP61; approximate groundwater level of 47 feet below ground surface). The only organic compound detected was di-n-butylphthalate at a concentration of 1.3 µg/l (Figure 2-27).

The groundwater sample was not filtered and was preserved with acid. As a result, metals concentrations were partially attributable to dissolved particles suspended in the sample. Accordingly, this sample was rejected from the inorganics data set.

2.6.13.3.4 Summary

No organics were detected in soil at concentrations exceeding PRGs. Of the inorganics detected, arsenic and beryllium concentrations were either below or not significantly higher than background. No background is available for chromium VI, but this constituent was detected only at low concentrations between depths of 10 to 30 feet in one boring. Therefore, soil contamination is not considered a problem. Despite attempts to collect water samples during the

1996 investigation, groundwater was not encountered to a depth of 50 feet. Based on the 1995 hydropunch sample (104CP61), none of the contaminant data exceed evaluation criteria. Based on the soil concentrations and the deep water table, groundwater contamination is not of concern.

2.6.13.4 Summary of Risks Associated with Site 32

Human health and ecological risk assessments were conducted for Site 32 using data collected during the Group D RI. Risk assessment methodologies are summarized in Section 2.4.1.4. Risk assessment summaries for Site 32 are presented in this section.

2.6.13.4.1 Human Health Risk Characterization

Soil COPCs include metals, VOCs, and SVOCs. Current/future workers and future residents could be exposed to soil contaminants through incidental ingestion of soil, dermal contact with soil, and inhalation of VOCs or soil particulates.

The cumulative residential risk from the maximum detected COPCs is $1.4x10^{5}$. The primary risk drivers are arsenic (approximately 54 percent of the total risk) and beryllium (approximately 26 percent of the total risk). The maximum concentration of beryllium is less than the background concentration for the basin, and the maximum arsenic concentration is only slightly higher than the background concentration. Excluding the portion of total risk attributable to background metals, the incremental residential site risk from maximum detected COPCs is $2.7xl0^{-6}$. Assuming that metals are distributed lognormally throughout the soil, the 95 percent UCL for arsenic, 2.7 mg/kg, is less than the background value. Excluding the portion of total risk attributable to background metals, the incremental residential risk from the more representative soil concentrations (e.g., 95 percent UCLs) is less than $1x10^{6}$.

The cumulative residential HI from the maximum detected COPCs is 1.4 and is primarily attributable to aluminum (approximately 25 percent of the total hazard), arsenic (approximately 12 percent of the total hazard), manganese (approximately 30 percent of the total hazard), and vanadium (approximately 11 percent of the total hazard). Excluding the portion of total hazard attributable to background, the incremental residential site hazard is 0.2, which is below the threshold criterion of 1.0.

The results of the HHRA for Site 32 indicate that the incremental residential cancer risk is below the lower end of the risk management range and the incremental residential noncarcinogenic

hazard is below the threshold criterion of 1.0. In addition, the maximum lead concentration (10.7 mg/kg) is below the screening criteria. Therefore, Site 32 soil is considered protective of human health.

Groundwater is not considered a complete exposure pathway for either current/future workers or future residents. However, a hydropunch sample was collected in 1995 as part of another study. No organic compounds were detected at concentrations exceeding PRGs, and the inorganic sample results were rejected. Groundwater sampling was not performed at Site 32 during the 1996 investigation because drilling refusal occurred in weathered bedrock at less than 50 feet below ground surface, before encountering sufficient groundwater for sampling purposes. Site 32 is not located above a shallow aquifer associated with any of the four major groundwater basins at MCB Camp Pendleton (i.e., San Mateo, San Onofre, Las Flores, or Santa Margarita Basin). The site is topographically higher than, and isolated from, the aquifers associated with these major basins.

Based on the results of the groundwater sample collected in 1995, the depth to groundwater, the lack of soil contamination, and the incomplete exposure pathway from groundwater to humans, Site 32 groundwater is considered protective of human health.

2.6.13.4.2 Ecological Risk Assessment

The HQs for six preliminary COPECs (aluminum, arsenic, chromium, iron, nickel, and vanadium) exceed 1.0 (Figure 2-27). HQs were calculated for representative species for each of 17 soil samples, which were analyzed for 119 inorganic and organic chemicals. Most of the HQs that exceed 1.0 are less than 10, indicating that the potential for toxicity is relatively low. The HQs for aluminum and chromium are in the medium toxicity range (10 to 100). All preliminary COPECs with HQs exceeding 1.0 also had high frequencies of detection (100 percent in 17 samples).

Representative species for this site with HQs exceeding 1.0 include plants, terrestrial invertebrates, deer mouse, raccoon, and least Bell's vireo.

None of the preliminary COPECs were retained as final COPECs because the potential for exposure and effects is considered low. The HQs for most of the chemicals detected are less than 10, indicating low potential toxicity, with the exception of aluminum and chromium for

raccoons. The maximum detected concentrations of all preliminary COPECs with HQs exceeding 1.0 are close to background levels, and concentrations for most of the remaining samples are close to or less than background levels. In addition, the habitat at the site is primarily mowed, and only a small portion east of the site could provide adequate habitat for special-status species. The limited available habitat at the site is generally smaller than the home ranges for the representative bird and mammal species. Given the developed nature of the site, representative wildlife species are not expected to be on site for significant periods of time. Therefore, exposure of these receptors is probably minimal and is not likely to result in adverse effects.

2.6.13.5 Description of the No Action Alternative

The no action alternative selected for Site 32 soil and groundwater includes no institutional controls. Site 32 soil and groundwater are considered protective of human health and the environment for the following reasons:

- There is no complete pathway for exposure of human receptors to groundwater.
- The incremental cancer risk under the residential scenario using representative concentrations is less than $1x10^{-6}$.
- The incremental HI under the residential exposure scenario using maximum concentrations is less than 1.0 and the maximum lead concentration is less than the screening criteria.
- Although a few chemicals pose a potential ecological risk, the overall potential risk is low. The potential for exposure and adverse effects is considered low for soil based on frequency at which risk contributors were detected, the background contribution to risk, and the low potential for exposure in the developed site area.

2.6.14 Site 34 - Combat Engineers Maintenance Facility, Buildings 62580-62583

Site 34 is a maintenance facility near Buildings 62580-62583.

2.6.14.1 Site Name, Location, and Description

Site 34 - Combat Engineers Maintenance Facility, Buildings 62580-62583, is located in 62 Area, approximately 0.5 mile southeast of the intersection of San Mateo and Cristianitos Roads (Figure 1-2). The facility consists of a lube rack, several wash racks, a large maintenance and motor transport area, a former hazardous waste storage area, and an adjacent drainage. The wash

rack, lube rack, and maintenance and motor transport areas are located south of Building 62580, and the former hazardous waste storage area is located to the north. Two storm-water drains adjacent to the wash racks and lube rack discharge storm water toward the drainage ditch that flows east to west at the southern end of Site 34. The site is bordered on the west by Sewage Treatment Plant No. 12, on the south by an unpaved access road and San Mateo Creek, and on the north and east by 62 Area buildings. Site 34 is 1,200 feet due south of Site 11. Cristianitos Creek is west of the site.

No perennial surface water is present in the vicinity of Site 34. Surface water at this site is ephemeral and follows the gently sloping topography to the south. The area receives only low annual rainfall, primarily during winter months, and surface flow is generally intermittent. During significant rainfall events, surface water percolates into the subsurface, evaporates, or runs off the site and discharges into San Mateo Creek, which eventually discharges into the Pacific Ocean approximately 3 miles downstream from the site.

A large portion of Site 34 has been disturbed. Remnant vegetation types include coastal sage scrub, nonnative grassland, and freshwater emergent wetland. Plant species in the coastal sage scrub include sage and coyote bush. Wild oat is the dominant grass species in the nonnative grassland habitat. Bulrush is the dominant plant species in the freshwater emergent wetland habitat. No special-status species are expected to be present on this site. Black phoebes and western kingbirds were observed during the reconnaissance survey. The nearest base production well is approximately 1 mile southwest of Site 34.

The Combat Engineers Maintenance Facility is currently active and is expected to remain so. Military and civilian personnel use the site frequently. The San Mateo (62) Area, where Site 34 is located, is used for personnel training, recreation, troop housing, vehicle maintenance, mess, and administration. An undeveloped area north of the site across San Mateo Road is classified as a maneuver area and is covered by natural vegetation. The nearest designated troop housing is in the San Mateo (62) Area, approximately 800 feet from the site. No family housing is located within several miles of the site and none is planned.

2.6.14.2 Site History and Enforcement Activities

Site 34 has been operated as a large maintenance facility for approximately 28 years and has a history of spills. Wastes include waste oil, used vehicle fluids, and solvents. This facility was

recommended for RI during the PR (PR Site 275) and, thus, no sampling was conducted during the RFA.

2.6.14.3 Summary of Site Characteristics

Prior to scheduled RI fieldwork for Group D sites in 1996, eight borings (34B-0 1 through 34B-08) were drilled in the vicinity of three wash racks that were used throughout the history of Site 34 and the nearby lube rack and maintenance area. This sampling was conducted during March through May 1993 to support scheduled construction at Site 34. The data were also used for RI characterization. A total of 43 soil samples were collected and analyzed for metals, VOCs, and SVOCs. Sample locations are shown in Figure 2-28.

2.6.14.3.1 Geology and Hydrogeology

Shallow geology at this site consists of a cobble zone overlain by alluvial silty sands, clayey sands, and thin, discontinuous lenses of fine-grained sand. Groundwater was encountered at a depth of 11 feet below ground surface in boring 34B-11 and at a depth of 13 feet in monitoring well 34MW-01. Based on site geology, groundwater is assumed to flow to the south, following surface topography; however, because groundwater measurements were taken on separate dates, consistent data are not available to confirm this assumption.

2.6.14.3.2 Soil Results

This section discusses analytical results from soil sampling at Site 34. Results are summarized in Figure 2-28, which presents detected organics and any inorganics that exceed risk/hazard criteria.

Organics

No organic compounds were detected at concentrations exceeding PRGs in Site 34 soil (Figure 2-28). However, diesel was detected in the 2-foot sample from boring 34B-03 and the surface sample from boring 34B-04 at concentrations of 290 and 150 mg/kg, respectively; these concentrations exceed the 100-mg/kg screening level.

The following 14 organics were detected in Site 34 soil at concentrations below evaluation criteria: acetone, 2-butanone, methylene chloride, carbon disulfide, toluene, 1,1,1-TCA, bis(2-ethylhexyl)phthalate, 2-methylnaphthalene, benzo(a)pyrene, fluorene, diethylphthalate, dimethylphthalate, di-n-butylphthalate, and total volatile hydrocarbons (TVH). The highest concentration was 0. 18 mg/kg for bis(2-ethylhexyl)phthalate.

Inorganics

Arsenic and beryllium concentrations consistently exceeded PRGs (Figure 2-28). However, beryllium concentrations were below background (1.42 mg/kg), and arsenic concentrations were generally not significantly higher than background (4.25 mg/kg). The maximum concentration for arsenic was 8 mg/kg.

26.14.3.3 Groundwater Results

No organic compounds were detected in Site 34 groundwater (Figure 2-28).

Manganese (2,050 µg/1) and arsenic (8.4 µg/1) concentrations in well 34 GWT-01 (approximate groundwater level of 11 feet below ground surface) exceeded tap-water PRGs (Figure 2-28). Chromium VI (4 µg/l), arsenic (11.8 µg/l), and beryllium (0.04 µg/l) also exceeded tap-water PRGs in the sample from well 34MW-01 (approximate groundwater level of 13 feet below ground surface). However, the result for chromium VI was higher than for total chromium (1.9 µg/l) and was rejected during data validation. No other inorganics were detected at concentrations exceeding evaluation criteria.

As discussed for Site 1A, the elevated manganese result is likely due to relatively poor filtration of silts and small suspended particles in undeveloped hydropunch and temporary well samples. In contrast, the sandpack and well development activities for permanent wells are much more efficient in keeping the smallest suspended particles outside the well screen. Nondissolved particles of manganese could pass through the 0.45-micron filter used in the field, which would result in higher manganese concentrations for samples with higher TSS (i.e., temporary well samples, see Section 4.1.1.2). The groundwater data from temporary well 340WT-01 and nearby permanent well 34MW-01 clearly depict this variation (Figure 2-28). Manganese was detected at 2,050 µg/l in 34GWT-01 but was not detected in the permanent monitoring well. Furthermore, the detected concentration from 34GWT-01 is not significantly higher than the tapwater PRG for manganese.

2.6.14.3.4 Summary

No organics were detected in soil at concentrations exceeding PRGs. Although diesel was detected in soil at potentially leachable concentrations (greater than 100 mg/kg), no volatile or semivolatile organic compounds were detected in the soil above PRGs indicating that the toxic constituents of diesel are not a concern. Arsenic and beryllium were the only inorganics detected

above PRGs, but concentrations were either below or only slightly above background. Therefore, significant site-specific soil contamination does not exist at Site 34. No volatile or sernivolatile organic compounds were detected in groundwater. Therefore, the diesel concentrations detected in soil are not considered a threat to groundwater or human health. Accordingly, Site 34 groundwater does not appear to be impacted.

2.6.14.4 Summary of Risks Associated with Site 34

Human health and ecological risk assessments were conducted for Site 34 using data collected during the RI. Risk assessment methodologies are summarized in Section 2.4.1.4. Risk assessment summaries for Site 34 are presented in this section.

2.6.14.4.1 Human Health Risk Characterization

Soil COPCs include metals, VOCs, and SVOCs (PAHs). Current/future workers and future residents could be exposed to soil contaminants through incidental ingestion, dermal contact, inhalation of VOCs, and inhalation of particulates.

The cumulative residential risk from maximum detected soil COPCs is $2.7x\ 10^{5}$. The primary risk drivers are arsenic (approximately 78 percent of the total risk) and beryllium (approximately 21 percent of the total risk). Site-specific background was not available; therefore, Santa Margarita Basin background levels were used as surrogate values. Arsenic exceeds and beryllium is less than the respective surrogate background concentrations. Neither metal is related to the waste streams associated with the maintenance facility. Excluding the portion of total risk attributable to background metals, the incremental residential site risk from maximum detected COPCs is $1x10^{-5}$. Assuming that metals are distributed lognormally throughout the soil, the 95 percent UCL soil concentration of arsenic is 4.4 mg/kg, which is essentially the same as the background concentration (4.25 mg/kg). Excluding the portion of total risk attributable to background metals, the incremental residential risk from the more representative soil concentrations is less than $1x10^{6}$.

The cumulative residential hazard from the maximum detected COPCs is 1.4 and is primarily attributable to metals. Excluding the portion of total hazard attributable to background metals, the incremental residential site hazard from the maximum detected COPCs is less than 1.0.

The results of the Site 34 HHRA indicate that the incremental residential cancer risk is below the lower end of the risk management range and the incremental residential noncarcinogenic hazard is below the threshold criterion of 1.0. In addition, the maximum lead concentration (29.5 mg/kg) is below the screening criteria. Based on the results of the HHRA, soil at Site 34 is considered protective of human health.

Future residents could be exposed to groundwater contaminants through ingestion. The cumulative residential cancer risk from ingestion of groundwater is 2.6×10^{4} and is completely attributable to arsenic and beryllium. However, the maximum concentrations of arsenic (11.8 µg/l) and beryllium (0.04 µg/l) are below the respective MCLs of 50 and 4 µg/l, respectively. Furthermore, because arsenic and beryllium in soil are within background concentrations, groundwater concentrations of arsenic and beryllium are also likely due, at least in part, to background concentrations.

The total noncarcinogenic hazard associated with ingestion of groundwater is 3.4 and is primarily attributable to manganese (1.2) and arsenic (1.1). The HIs for individual target organs exceed 1.0 for the central nervous system and skin due to manganese (1.2) and arsenic (1.1). Arsenic and manganese are within background concentrations for soil and are also likely within naturally occurring background concentrations for groundwater. Some uncertainty is associated with the RfD used to calculate the PRG for manganese and could result in an overestimation of the hazard. Manganese was not detected in the permanent monitoring well located within 200 feet of the temporary well in which the manganese concentration of concern was detected. Some uncertainty is associated with the results from the temporary well even though samples from both wells were filtered in the field. Groundwater samples from temporary wells usually contain higher TSS (the samples are muddy) due to the disturbance associated with the sampling method. Permanently installed wells are developed prior to sampling; as a result, samples typically have much lower TSS prior to filtering than temporary well samples. Because temporary well samples contain more particles, nondissolved particles could pass through the filter. Some manganese particles could be small enough to pass through the 0.45-micron filter used in the field (Hem, 1985) and could result in a higher concentration of manganese in the temporary well sample. Many of the other detected metals are also naturally occurring and may be within background.

Groundwater at Site 34 is considered protective of human health for the following reasons:

- The calculated incremental residential cancer risk is 2.6×10^4 and is completely attributable to arsenic and beryllium.
- Detected concentrations of arsenic and beryllium are less than the respective MCLs.
- Residential HIs due to manganese and arsenic exceed the 1.0 criterion only slightly for individual target organs; uncertainty could result in an overestimation of hazard due to manganese.
- At least some portions of the metals of concern (arsenic, beryllium, and manganese) are assumed to be within background.

2.6.14.4.2 Ecological Risk Assessment

HQs for nine preliminary COPECs (all inorganics) exceed 1.0 (Figure 2-29). HQs were calculated for representative species for all 29 soil samples, which were analyzed for 119 inorganic and organic chemicals. Most of the HQs are less than 10, indicating that the potential for toxicity is relatively low. HQs for aluminum, boron, and chromium are in the medium toxicity range (10 to 100). The frequencies of detection for preliminary COPECs with HQs exceeding 1.0 ranged from 20 to 100 percent. Both aluminum and chromium were detected in all samples collected, but concentrations exceeded background in only one sample for aluminum and two samples for chromium. Representative species for this site with HQs exceeding 1.0 include plants, terrestrial invertebrates, deer mouse, raccoon, California gnatcatcher, and Savannah sparrow.

None of the preliminary COPECs were retained as final COPECs because the potential for exposure and effects is considered low. Maximum detected concentrations are close to background levels, and concentrations in the remaining samples are similar to or less than background. Aluminum and chromium, which had potential toxicity in the medium range, exceeded background levels in only 1 or 2 of the 29 samples analyzed. In addition, most of the site is disturbed and has limited habitat. Because the habitat conditions of the surrounding areas are of higher quality, wildlife receptors are not likely to spend much time on the site. The potentially contaminated areas of the site are generally smaller than the home range sizes of the representative species. For these reasons, wildlife receptors are not expected to be exposed to the preliminary COPECs at the site long enough to result in adverse effects.

2.6.14.5 Description of the No Action Alternative

The no action alternative selected for Site 34 soil and groundwater includes no institutional controls. Site 34 soil and groundwater are considered protective of human health and the environment for the following reasons:

- The incremental cancer risk for soil under the residential scenario using representative concentrations is less than 1 $x10^{-6}$.
- The incremental HI for soil under the residential exposure scenario using maximum concentrations is less than 1.0 and the maximum lead concentration is less than the screening criteria.
- The potential risk from groundwater is due to metals that are considered background, and maximum concentrations are below drinking water standards (MCLs).
- Although a few chemicals pose a potential ecological risk, the overall potential risk is low. The potential for exposure and adverse effects is considered low for soil based on the frequency at which risk contributors were detected, the background contribution to risk, and the low potential for exposure.

2.6.15 Site 35 - Former Sewage Treatment Plant Facility in 25 Area

Site 35 consists of a former sewage treatment plant facility in 25 Area.

2.6.15.1 Site Name, Location, and Description

Site 35 - Former Sewage Treatment Plant Facility in 25 Area, is located approximately 0.9 mile north of the intersection of Basilone Road and Vandegrift Boulevard (Figure 1-2). This site is an abandoned wastewater treatment facility area that was reportedly subject to overflows. The site is approximately 160 feet long and 140 feet wide. Adjacent to the treatment facility are four abandoned drying beds, each approximately 100 feet long and 60 feet wide. These beds were probably used in conjunction with the treatment facility. Three of the four borings drilled at the drying beds showed a clay or silt layer about 10 feet below ground surface, suggesting that this site may have been lined. Both the facility and drying beds are on a level surface. The facility is partially fenced, and the drying beds are completely surrounded by fencing.

The only perennial surface water in the vicinity of Site 35 is the Santa Margarita River. The current main channel of the river is approximately 600 feet east of the site. Water is often visible in the drying beds. The area receives only low annual rainfall, primarily during winter months.

Excess surface water from significant rainfall events percolates into the subsurface, evaporates, or runs off the site and discharges into the Santa Margarita River.

The Santa Margarita River is a perennial braided stream that flows southwesterly. At the Basilone Road bridge in the immediate vicinity of Site 35, the banks of the river are 10 to 15 feet high and are artificially maintained by loose riprap. The bridge is approximately 25 feet above the stream bottom and typically does not restrict surface flow in the channel, even during winter months. The banks of the Santa Margarita River are not artificially maintained upstream or downstream of Site 35.

The 25 Area former sewage treatment plant facility is no longer in operation. Military and civilian personnel are on site only occasionally. The Vado Del Rio (25) Area is used for personnel training, recreation, troop housing, vehicle maintenance, mess, and administration. The undeveloped area north of the 25 Area is classified as a maneuver area and consists of gently rolling hills covered by natural vegetation (Innis-Tennebaum Architects, Inc., 1990). The nearest family housing is the Ranch House, located about 1 mile south of the site. The nearest designated troop housing is in the Vado Del Rio (25) Area, approximately 200 feet from the site. No other family housing is located within several miles of the site and none is planned. The nearest base production well is less than 1 mile downgradient from Site 35.

Dominant habitats at Site 35 include nonnative grassland and southern willow scrub. Coastal sage scrub habitat is found southwest of the former sewage treatment plant. The willow scrub habitat is dominated by willow, tree tobacco, and mulefat. Nonnative grassland species include wild oat, brome, prickly sowthistle, and black mustard. White sage and coyote brush are the dominant plant species in the coastal sage habitat. Bird species observed at Site 35 during the March 1995 survey include Anna's hummingbird, bushtit, common yellowthroat, red-tailed hawk, and greater roadrunner. Deer mice, San Diego pocket mice, brush mice, and house mice were trapped during the March survey. No reptiles or amphibians were observed during the surveys. Aquatic and terrestrial invertebrates were observed during March, June, and October 1995 surveys.

2.6.15.2 Site History and Enforcement Activities

Operations at former Sewage Treatment Plant No. 7 began in 1951 and ended in the late 1970s or early 1980s. The facility overflowed in the past, but no staining is present. AC/S,ES office staff

indicated that samples were not collected when the facility overflowed, and no additional information is available on the chemistry, extent, or date of such incidents. After RI sampling of other portions of the site, the drying beds were discovered by base personnel while clearing brush in the area.

Site 35 was investigated in 1991 and 1992 as part of the RFA SV for Site 129. Two surface and three subsurface samples were collected from two soil borings advanced around the site perimeter. Groundwater was encountered at a depth of 6 to 11 feet below surface. No groundwater samples were collected. Arsenic and antimony were detected in soil at concentrations of 7.1 and 35.6 ppm, respectively (SWDIV, 1993a).

2.6.15.3 Summary of Site Characteristics

Site 35 was investigated in 1995 during the Group C RI (SWDIV, 1996a). A total of 84 soil samples were collected from 13 borings for metals analysis. A groundwater sample was also collected at one of the beds by hydropunch methods for metals analysis. Sample locations are shown in Figure 2-30.

A habitat and receptor survey was conducted and dominant vegetative habitats were identified at Site 35 during March 1995. Bird and general wildlife surveys were conducted to evaluate the potential presence of special-status wildlife species. Mammal trapping (using Sherman live-traps) was conducted to identify small mammal use of the site. During May through July 1997, additional biological surveys were conducted at Site 35 to evaluate whether special-status species (i.e., California gnatcatcher and Least Bell's vireo) were present.

2.6.15.3.1 Geology and Hydrogeology

The geology of Site 35 consists of older Quaternary alluvium underlain by pre-Tertiary granitic basement complex rocks. The alluvium consists of poorly graded to well-graded sand, sand with varying amounts of silt, and lenses of silt and clay. No borings were advanced to bedrock at Site 35. Borings at Site 29, approximately 1,500 feet north of the site, encountered granitic basement rock approximately 15 feet below ground surface. Similar geologic conditions are expected at Site 35. The thickness of the alluvium at Site 35 was not determined during drilling but is assumed to be more than 50 feet.

Groundwater was encountered at a depth of approximately 50 feet below ground surface at Site 35. Based on site geology, groundwater is assumed to flow to the southwest, following surface topography. No groundwater monitoring wells were installed at this site because, at the time, depth to groundwater was unknown but was estimated to be 30 to 100 feet.

26.15.3.2 Soil Results

This section discusses analytical results from soil sampling at Site 35. Results are summarized in Figure 2-30, which presents detected organics and any inorganics that exceed risk/hazard criteria.

Organics

The only organic compound that exceeded PRGs was benzo(a)pyrene in 35SS012 (Figure 2-30). Acenaphthene, benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, benzo(a)pyrene, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene were detected at concentrations ranging from 35 to 350 mg/kg. Acenaphthene and pyrene were detected in the intermediate soil zone (5 to 10 feet), each at a maximum concentration of 38 mg/kg. Most of the PAHs were detected primarily at or near surface soil sample 35SS012.

Acetone and methylene chloride were detected in the lower drying bed area of Site 35. Acetone was detected only once, at a depth greater than 10 feet. Methylene chloride was detected at all depth intervals.

Benzoic acid was detected at depths greater than 10 feet at a maximum concentration of 120 mg/kg. Samples 35SS011 and 35SS012 contained 4-chloroanaline at concentrations of 180 and 2,200 mg/kg, respectively. N-nitroso-di-n-propylamine was detected at a concentration of 36 mg/kg at 7.5 feet in soil boring 35B-10. Phthalates were detected at depths greater than 10 feet at concentrations of up to 81 mg/kg.

Inorganics

The following metals exceeded PRGs: arsenic, beryllium, chromium, and manganese. Arsenic and chromium concentrations in most soil borings exceeded PRGs and background at all depth intervals. Beryllium exceeded the PRG in 35B-05, 35B-11, and 35B-12 but exceeded background only in 35B-05 at a depth greater than 10 feet. Manganese exceeded the PRG only at depths greater than 10 feet. Analytical results for soil borings 35B-01, 35B-02, 35B-03, and

35B-04 are not included in Figure 2-30 because they were used for site-specific background analysis.

2.6.15.3.3 Groundwater Results

No background values were calculated for Site 35 because there are no upgradient wells near the site and few data points are available for comparison. One groundwater hydropunch sample was collected at Site 35 during the second quarter 1995.

Because of the recent discovery of a lower area previously covered by dense vegetation, the work plan addendum for additional work at Site 35 (SWDIV, 1995c) specified the collection of one hydropunch groundwater sample to assess whether mobile COCs in soil are migrating to groundwater. Although groundwater was originally estimated to be within 20 feet of ground surface (soil sampling range) in this lower area, groundwater was not encountered within the 20-foot-depth interval. Instead, a boring was advanced to 40 feet and a groundwater sample was collected.

Benzene exceeded the tap-water PRG, and bis(2-ethylhexyl)phthalate exceeded the tap-water PRG and MCL. Di-n-butylphthalate was detected at a concentration of 0.6 μg/l; 2-butanone was detected at a concentration of 3 μg/l; 4-methylphenol, benzene, and toluene were each detected at a concentration of 1 μg/l. Bis(2-ethylhexyl)phthalate, a common laboratory contaminant, was the only organic compound detected in both soil and groundwater samples.

Of the 12 metals detected in groundwater, the following exceeded PRGs and MCLs: aluminum, chromium, barium, lead, cadmium, and nickel. The following metals exceeded tap-water PRGs but have no established MCLs: manganese, molybdenum, vanadium. A review of the request for analysis and field logs indicated that the groundwater sample was not filtered in the field and was preserved with hydrochloric acid. The high metals concentrations evidently are a result of suspended solids reacting with the acid preservative prior to analysis. No inorganics detected in soil at concentrations that exceeded PRGs and background (arsenic) or organics detected at concentrations that exceeded PRGs (benzo[a]pyrene) were detected in the groundwater sample, indicating that these compounds have not migrated from soil to groundwater. As previously stated, bis(2-ethylhexyl)phthalate was the only organic compound detected in both soil and groundwater samples.

2.6.15.4 Summary of Risks Associated with Site 35

Human health and ecological risk assessments were conducted for Site 35 using data collected during the RI. Risk assessment methodologies are summarized in Section 2.4.1.4. Risk assessment summaries for Site 35 are presented in this section.

2.6.15.4.1 Human Health Risk Characterization

Metals (inorganics, including cyanide), SVOCs, and one VOC were detected in Site 35 soil. Maximum concentrations for inorganics were detected at soil depth intervals extending from ground surface to 1 foot and from 8.5 to 10 feet. Organics were detected primarily in the depth interval from ground surface to 1 foot, with the exception of benzoic acid (9.5 to 10 feet), acenaphthene (5.5 to 7 feet), and N-nitrosodi-n-propylamine (5.5 to 7 feet).

Representative concentrations for a residential exposure scenario, with consideration for background, yielded a summed site-related risk of $4x10^{-6}$ ILCR and a hazard of less than 1.0 HI. The same concentrations under the commercial/industrial scenario resulted in a risk of less than 1 $x10^{-6}$. There are no plans to use this site for residential purposes, and the risk for residential receptors was determined to be acceptable.

The groundwater pathway to humans is not currently complete, but groundwater could be used as a drinking water source in the future. However, no site-related contaminants were detected in groundwater at Site 35 and there is no indication that soil contaminants are leaching to groundwater. Therefore. groundwater is considered protective of human health and the environment.

2.6.15.4.2 Ecological Risk Assessment

The final risk screening results indicated that modified PLEs were exceeded for plants and the California mouse. HQs for the following COPECs exceed 1.0, as shown in Figure 2-30: barium, copper, lead, mercury, benzo(a)pyrene, and benzo(g,h,i)perylene.

Barium was not retained as a COEC because HQs for the California mouse are close to 1.0 (1.6, 2.5, and 1.9, respectively). The background concentration of barium (97.7 mg/kg) contributed more than half of the HQs. The incremental HQs above background are less than or close to 1.0, indicating low potential risk.

Copper was not retained as a COEC because the average concentration is less than background levels and the HQ for the average concentration is less than 1.0.

Lead was not retained as a COEC because the only HQ exceeding 1.0 was for the California mouse (1.9) and is close to 1.0, indicating low potential risk. HQs for all other representative species are less than 1.0. The average concentration of lead in the depth interval extending from ground surface to 5 feet is less than background and the HQ for the average concentration is less than 1.0.

Mercury was not retained as a COEC because the only HQ exceeding 1.0 was for the California mouse. HQs for all other representative species are less than 1.0. The average concentration of mercury results in an HQ of 2.8 and indicates a low potential risk.

Benzo(a)pyrene and benzo(g,h,i)perylene were detected only once. The maximum detected concentrations resulted in HQs of 6.5 and 5.3, respectively, indicating a low to medium potential risk. The detected concentrations were flagged by the laboratory with a "J" qualifier, indicating that the concentrations were estimated. The detected values were estimated at levels below the CRDL (330 μg/kg). Based on the uncertainty associated with the detected concentrations, the frequency of detection (one of four samples), and the low potential exposure to maximum concentrations, benzo(a)pyrene and benzo(g,h,i)peryiene were not retained as COECs.

No COECs were identified because COPECs generally were not detected at concentrations exceeding background and/or resulted in low potential risk to the environment.

2.6.15.5 Description of the No Action Alternative

The no action alternative selected for Site 35 soil and groundwater includes no institutional controls. Site 35 soil and groundwater are considered protective of human health and the environment for the following reasons:

- The incremental cancer risk for soil using representative concentrations is $4x10^{-6}$ under the future residential scenario and less than $1x10^{-6}$ under the current commercial industrial scenario.
- The incremental HI for soil using representative concentrations is less than 1.0 under the residential exposure scenario.

- There is no current pathway to groundwater at the site. Future risk to humans from groundwater is unlikely because concentrations of contaminants detected in groundwater were determined not to pose a threat to human health and the environment.

- Although a few chemicals pose a potential ecological risk, the overall potential risk is low. The potential for exposure and adverse effects is considered low for soil based on the frequency at which risk contributors were detected, the background contribution to risk, and the low potential for exposure.

26.16 Site 36 -Debris Pile Area Behind Ponds at Sewage Treatment Plant 11

Site 36 consists of debris piles at Sewage Treatment Plant No. 11.

26.16.1 Site Name, Location, and Description

Site 36 - Debris Pile Area Behind Ponds at Sewage Treatment Plant 11, is an area of debris piles containing glass bottles and scrap metal (Figure 1-2). Glass and metal debris appear to have been dumped down a nearby hillside and scattered between the trash piles. A geophysical survey and SV sampling performed in this area indicated that the depth of debris between the piles is very shallow and that the debris piles are 2 to 3 feet high. The maximum depth of debris is approximately 2 feet below ground surface. Groundwater was encountered at approximately 6.5 feet below ground surface. Vegetation in this area is quite dense and includes sensitive plant species such as willows.

2.6.16.2 Site History, Enforcement Activities, and Site Characteristics

Little is known about the history of Site 36. Bottles dating from the 1950s and scrap metal were found in the debris piles. The actual debris piles were not discovered until a fire exposed them in 1990.

Sampling was conducted at Site 36 during the RFA (SV Site 207). SV soil samples were collected from three borings adjacent to the two largest debris piles and in the area between the piles (Figure 2-31).

SV soil samples were analyzed for VOCs, SVOCs, and metals. Except for low concentrations of toluene (less than 200 mg/kg), no VOCs or SVOCs were detected. Chromium, cadmium, lead, and mercury were detected at concentrations below risk-based levels (SWDIV, 1993a). The only analyte detected at a concentration exceeding PRGs was arsenic, at 4.3 mg/kg in one sample.

The PRG for arsenic is 0.38 mg/kg for the cancer endpoint and 22 mg/kg for the noncancer endpoint.

The background concentration of arsenic for the Santa Margarita Basin is 4.25 mg/kg (SWDIV, 1996a). The Santa Margarita Basin background data set is the largest and most representative of the base and is used as background for sites for which no background data are available. Two of the three soil samples analyzed for metals during the RFA SV contained no detectable concentrations of arsenic (Figure 2-31). The one soil sample concentration of 4.3 mg/kg is considered representative of natural occurring conditions. Based on the visual inspection of the site during the SV and the soil sample analytical results, the debris at this site appears to be municipal waste and past disposal of hazardous waste in this area is considered unlikely.

2.6.16.3 Summary of Risks Associated with Site 36

No risk assessment was necessary for Site 36 because constituent concentrations were within background or were less than the RFA screening criteria.

2.6.16.4 Description of the No Action Alternative

The no action alternative selected for Site 36 soil and groundwater includes no institutional controls. Site 36 soil and groundwater are considered protective of human health and the environment because detected constituent concentrations are below risk screening criteria or are within background.

2.6.17 Site 37 - Pesticide- and POL-Handling Areas at San Clemente Ranch

Site 37 is part of an agricultural lease area at MCB Camp Pendleton.

2.6.17.1 Site Name, Location, and Description

Site 37 - Pesticide- and POL-Handling Areas at San Clemente Ranch, is located in the 61 Area, approximately 0.5 mile southeast of Cristianitos Road (Figure 1-2) and consists of a pesticide-handling area and a POL-handling area. The pesticide-handling area contains a sump that was previously used for rinsing pesticide containers and other equipment. The POL-handling area includes a stained spill area adjacent to the former locations of pure product fuel USTs.

No perennial surface water is present in the vicinity of Site 37. Surface water at the site is ephemeral and follows the gently sloping ground surface to the southwest. During significant-

rainfall events, surface water percolates into the subsurface, evaporates, or runs off the site and drains into San Mateo Creek, which eventually discharges into the Pacific Ocean approximately 1 mile downstream from the site.

Land use in the vicinity of Site 37 consists of activities associated with agricultural farmland. The site is crossed frequently by civilian personnel associated with farm operations. Land surrounding Site 37 includes agricultural fields and natural vegetation. The area south of the site is undeveloped and contains coastal wetland vegetation. The nearest designated troop housing area is San Mateo (62) Area, approximately 2 miles north-northwest of the site. The nearest base production well is approximately 1 mile southwest of Site 37.

No special-status species are expected to be present on the site because the site area consists of bare ground and an assortment of buildings and storage areas. Wildlife species observed near the site during the reconnaissance survey include western kingbird, American crow, cliff swallow, cottontail, and California ground squirrel.

2.6.17.2 Site History and Enforcement Activities

Chemicals associated with farming operations at the San Clemente Ranch are the probable source of contamination at Site 37. This site was added to the list of RI/FS sites following the RFA (SWDIV, 1993a). In addition, in 1994, a hand-dug well from which farm workers regularly drank was discovered near the pesticide mixing area. This well and another were abandoned on 15 May 1996, in accordance with State and County codes and under San Diego County Department of Environmental Health Permit Nos. W63158 and W63159.

Sampling was conducted at the San Clemente Ranch during the RFA as SV Site 255. Soil samples from the pesticide-handling area were analyzed for VOCs, SVOCs, pesticides and PCBs, and chlorinated herbicides. Samples were analyzed using a mobile laboratory, and confirmation analysis was provided by an off-site laboratory. Both pesticides and herbicides were detected in soil at concentrations exceeding PRGs. A water sample was also collected from the nearby hand-dug well. The water sample was analyzed for pesticides and PCBs, chlorinated herbicides, and general chemistry, but no contaminants were detected. Depth to groundwater in this well was 20 feet below ground surface.

During the RFA, a sediment sample (SV255B-05) was also collected in the drainage ditch at Site 37 to evaluate runoff. This sample location was recommended for no further action because detected metals and pesticides were below screening levels.

The POL-handling area contained a fuel dispensing area and underground fuel tanks. The contaminants in this area were limited to petroleum product constituents. This area has been addressed under the UST program at the base (SWDIV, 1993c).

2.6.17.3 Summary of Site Characteristics

Site 37 was investigated in June and July 1996 during the RI for Group D sites (SWDIV, 1997b). A total of 27 soil samples were collected from six borings and two surface locations. Samples were analyzed for metals, PCBs, pesticides, and chlorinated herbicides. Groundwater was sampled from three temporary well locations and one permanent well. Groundwater was analyzed for the same parameters as soil, plus general chemistry. Sample locations are shown in Figure 2-32.

2.6.17.3.1 Geology and Hydrogeology

Shallow geology at this site is characterized by poorly consolidated alluvium consisting of silty sand overlying very fine grained to fine-grained sand. Groundwater was encountered at a depth of 15 feet below ground surface at Site 37. Based on site geology, groundwater is assumed to flow to the southwest, following surface topography.

2.6.17.3.2 Soil Results

This section discusses soil analytical results from RI activities at Site 37. Results are summarized in Figure 2-32, which presents detected organics and any inorganics that exceed risk/hazard criteria.

Organics

The chlorinated pesticides 4,4'-DDE and 4,4'-DDT exceeded PRGs in surface samples from borings 37B-01, 37B-03, and 37B-04. In addition, 4,4'-DDE exceeded the PRG in surface sample 37SS001, as did 4,4'-DDT in surface sample 37SS002 (Figure 2-32). The maximum detected concentrations of 4,4'-DDE and 44'-DDT were 1.7 and 3.8 mg/kg, respectively.

Toxaphene was detected in the surface sample from 37MW-01 at a concentration (4.7 mg/kg) exceeding the PRG (0.4 mg/kg). The chlorinated pesticide 4,4'-DDD was also detected in a few samples but at concentrations below the evaluation criterion. The maximum detected concentration of 4,4'-DDD was 0.43 mg/kg. Nine other organic compounds were detected in the surface sample from boring 37MW-01 at concentrations below evaluation criteria: gamma-chlordane, alpha-chlordane, endosulfan I, endosulfan II, endrin, endrin aldehyde, endrin ketone, aldrin, and methoxychlor. Of these compounds, endosulfan I had the highest concentration at 0.19 mg/kg.

Inorganics

Arsenic was detected in 24 samples and beryllium was detected in 18 out of 30 samples at concentrations exceeding PRGs in Site 37 soil (Figure 2-32). All beryllium detections were below the background concentration of 1.42 mg/kg. In general, detected arsenic results only slightly exceeded the background concentration of 4.25 mg/kg; the maximum arsenic concentration was 6 mg/kg.

2.6.17.3.3 Groundwater Results

This section discusses groundwater analytical results from RI activities at Site 37.

Organics

No organics were detected at concentrations exceeding MCLs; however, the dieldrin concentration of 0.0065 µg/l in the sample from well 37MW-01 (approximate groundwater level of 16 feet below ground surface) exceeds the tap-water PRG of 0.0042 µg/l (Figure 2-32). Six other organics were detected in well 37MW-01 at concentrations below evaluation criteria: 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, endosulfan I, endosulfan II, and endosulfan sulfate. Endosulfan I was also detected in the sample from temporary well 37GWT-03 (approximate groundwater level of 16 feet below ground surface) at a concentration of 0.026 µg/l, which is the highest organic concentration measured in Site 37 groundwater.

Inorganics

No inorganics were detected at concentrations exceeding MCLs (Figure 2-32) or tap-water PRGs. A detection of chromium VI, reported at 7 µg/l in well 37MW-01. was rejected during data evaluation because it exceeds the total chromium concentration by approximately one order of magnitude.

2.6.17.3.4 Summary

Chlorinated pesticides 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT generally were found in the upper 5 feet of soil throughout the site; however, 4,4'-DDE and 4,4'-DDT exceeded PRGs only in surface samples. Arsenic and beryllium were the only inorganics detected at concentrations exceeding PRGs, but concentrations were either below or only slightly above background. None of the parameters detected in Site 37 groundwater exceeded MCLs.

2.6.17.4 Summary of Risks Associated with Site 37

Human health and ecological risk assessments were conducted for Site 37 using data collected during the RI. Risk assessment methodologies are summarized in Section 2.4.1.4. Risk assessment summaries for Site 37 are presented in this section.

2.6.17.4.1 Human Health Risk Characterization

Current/future workers and future residents could be exposed to soil contaminants through incidental ingestion, dermal contact, and inhalation of particulates. The cumulative residential risk from the maximum detected COPCs in soil is $4x10^{-5}$ and is primarily attributable to arsenic (approximately 40 percent of the total risk), beryllium (approximately 10 percent of the total risk), and pesticides (approximately 40 percent of the total risk). Excluding the portion of total risk attributable to background metals, the incremental residential site risk from maximum concentrations detected is $2.1x10^{-5}$. Using more representative concentrations (95 percent UCL), the incremental residential cancer risk is $1.8x10^{-5}$, with the majority of risk attributable to pesticides (approximately 89 percent of the risk).

The cumulative residential HI from the maximum detected COPCs is 1.1 and is primarily attributable to metals (approximately 86 percent of the total hazard). Excluding the portion of total hazard attributable to background metals, the incremental residential site hazard from maximum detected COPCs is 0.2.

The cumulative industrial cancer risk from maximum detected COPCs in soil is $7.4x10^{-6}$ and is primarily attributable to arsenic (approximately 34 percent of the total risk), beryllium (approximately 7 percent of the total risk), and pesticides (approximately 51 percent of the total risk). Excluding the portion of risk attributable to background metals, the incremental industrial site risk from maximum detected COPCs in soil is $4.5x10^{-6}$. The incremental industrial site hazard is 0.02. Using the more representative soil concentration for arsenic and excluding the

portion of total risk and hazard attributable to background metals, the incremental industrial site risk and hazard are $4x10^{-6}$ and 0.01, respectively.

The results of the HHRA indicate that the incremental residential ($1.8x10^{5}$) and industrial ($4x10^{-6}$) cancer risks at Site 37 are within the risk management range and the incremental residential (0.2) and industrial (0.01) hazard indices are below the threshold criterion of 1.0. The maximum lead concentration (40.1 mg/kg) is below the residential screening criteria. The main risk contributors are pesticides associated with the current use of the site as a farm. Toxaphene is the main contributor to risk but was detected in only 1 of 20 samples, in the surface sample from boring 37MW-01.

The site is currently used as a farm and there are no plans to change the land use. The risk for the current commercial/industrial scenario is $4x10^{-6}$ for the pesticide-handling area. Receptors are not expected to be in the pesticide-handling area their entire time on site. Therefore, the soil is considered protective of human health.

Future residents could be exposed to groundwater contaminants through ingestion, although there is no current complete pathway. The residential risk from ingestion of groundwater using maximum detected concentrations is $5.8x10^{-5}$ and is primarily attributable to arsenic (approximately 97 percent of the total risk). Arsenic detections in Site 37 soil were approximately within the background concentration. The 95 percent UCL concentration of arsenic in soil at Site 37 was calculated to be 4.9 mg/kg and the background concentration is 4.25 mg/kg. Arsenic is expected to be naturally occurring in groundwater as well. The maximum reported groundwater concentration of arsenic (2.5 µg/l) is below the MCL (50 µg/l). The majority of the risk from groundwater is likely due to naturally occurring arsenic and is not a site-related threat to human health. Pesticides represent an incremental risk of $2x10^{6}$. The pesticide contributors include 4,4'-DDD, along with its isomers, and dieldrin. These pesticides were detected in only one of the four groundwater samples collected at Site 37 (37MW-01). The total noncarcinogenic health hazard associated with ingestion of groundwater is 0.8, which is below the threshold criterion of 1.0.

Groundwater at Site 37 is considered protective of human health because there is no current pathway for human receptors to groundwater. The risk above background is at the lower end of the risk management range ($2x10^{-6}$) and is due to pesticides, as would be expected given the

current farming practices at the site. Furthermore, groundwater COCs were not detected consistently (one of four samples). Potential future use of groundwater would most likely be from locations upgradient of the site. Topographically, the ocean is less than 1 mile downgradient from the farm.

2.6.17.4.2 Ecological Risk Assessment

Site 37 was not carried through the quantitative or qualitative ecological evaluations because suitable wildlife habitat is not available on site and none of the potential exposure pathways are expected to be complete. Site 37 includes a pesticide-handling area located amid agricultural fields at the San Clemente Ranch. No surface water was observed in the pesticide-handling area at the site. An ephemeral surface-water drainage runs through the POL-handling area downstream from the pesticide-handling area and was sampled during the RFA (SWDIV, 1993a). The sediment sample collected in the drainage area contained contaminant concentrations below the risk screening action levels. Based on the RFA, no further action was recommended for the drainage area and it was not evaluated during the RI.

2.6.17.5 Description of the No Action Alternative

The no action alternative selected for Site 37 soil and groundwater includes no institutional controls. Site 37 soil and groundwater are considered protective of human health and the environment for the following reasons:

- The incremental HI for soil under the residential exposure scenario using maximum concentrations is less than 1.0.
- The incremental cancer risk for soil is within the risk management range. The cancer risk is 1.8×10^{-5} under the future residential scenario using representative concentrations and 4×10^{6} under the current commercial industrial scenario.
- Human exposure is limited because receptors are not expected to be in the pesticide-handling area an entire day.
- There is no current pathway to groundwater at the site. Future risk to humans is unlikely because following the destruction of the hand-dug well discussed in Section 2.5.18.2, the San Clemente Ranch water supply was connected to the base water supply system.

- Wildlife habitat does not exist at the site, which is used for farm operations and is surrounded by agricultural fields. There are no complete pathways for ecological receptors. As such, the site is considered protective.

2.6.18 Sites 38, 39, 41, and 42

Sites 38, 39, 41, and 42 were recommended for inclusion in the MCB Camp Pendleton RI/FS because elevated concentrations of arsenic were detected along sewer lines in several base areas, as reported in the draft final RFA report (SWDIV, 1993a). Because arsenic is the only COPC at these sites and the selected alternative is the same, the discussion/rationale presented in this section pertains to the sites collectively.

2.6.18.1 Site Name, Location, Description, and History

The sewer lines include the following:

- Site 38 - 52 Area Sewer Line, Building 52188
- Site 39 - 41 Area Sewer Line, Buildings 41300 and 41346
- Site 41 - 13 Area Sewer Line, Building 13128
- Site 42 - 13 Area Sewer Line, Building 13129.

Site locations are shown in Figure 1-2. These sites were selected during the RFA to represent potential impact to human health and the environment from sewer line breaks. Locations were selected near industrial facilities and where sewer lines crossed major roads. Sewer line sites in the 13 Area were selected where previous unauthorized discharges were reported.

Soil samples were collected along sewer lines during the RFA because interviews indicated that chemicals, although not specifically arsenic, could have been disposed of in sewer lines in the past. The soil samples were analyzed for VOCs, SVOCS, and metals. No COPCs were identified other than arsenic, which exceeded the calculated PRG. Because, at that time, background concentrations of metals had not yet been determined for any base area, the sites with elevated arsenic concentrations were recommended for further investigation under CERCLA. No interviews or other evidence indicated any disposal of arsenic-containing chemicals in sewer lines and no evidence, past or present, was found to suggest that arsenic-containing chemicals were disposed of in the sewer lines.

2.6.18.2 Summary of Site Characteristics

Arsenic results and sample locations investigated during the RFA are shown in Figure 2-33 for Site 38, Figure 2-34 for Site 34, and Figure 2-35 for Sites 41 and 42. Site-specific background concentrations of metals in soil were not determined. The RFA data were compared against Santa Margarita Basin background during preparation of the revised work plan for Group D RI sites. The Santa Margarita Basin background data set is considered representative of Sites 38, 39, 40, 41, and 42 because it is the largest background data set for the base and is in geographic proximity to these sites, which are located in the San Luis Rey Basin. Background for the latter basin had not yet been determined.

As part of the RI for Group C sites (SWDIV, 1996a), Santa Margarita Basin background for arsenic in soil was determined statistically to be 4.25 mg/kg. The average detected concentration of arsenic in the RFA soil samples for Sites 38, 39, 41, and 42 is 4.0 mg/kg. This value was determined by assigning a value of one-half the reporting limit (reporting limit is 3.0 mg/kg for arsenic) for samples reported as "nondetects." On this basis, arsenic concentrations appear to be within background.

No consistency was observed in the data relative to the depth of the sewer lines. If elevated concentrations of arsenic were due to disposal of arsenic-containing materials in sewer lines and sewer line leakage to the surrounding soil, higher concentrations of arsenic should be found at or below the depth of the sewer line, not above the line. However, this is not the case. Six of the samples containing detectable concentrations of arsenic were collected above the sewer line. This suggests that the concentrations of arsenic are not due to disposal of arsenic-containing chemicals in the sewer lines.

2.6.18.3 Summary of Risks Associated with Sites 38, 39, 41, and 42

A risk assessment was not conducted for Sites 38, 39, 41, and 42. The only chemical that did not meet the risk screening criteria of the RFA was arsenic, which was shown to be within background concentrations. Ecological pathways were determined to be incomplete because the sewer line sites are located in developed areas where there is little or no wildlife habitat. Soil and groundwater at Sites 38, 39, 41, and 42 were determined to be protective of human health for the following reasons:

- The concentrations of arsenic in RFA soil samples are due to naturally occurring processes, not to any site-specific disposal practices, past or present.

- The concentrations of arsenic in soil are found above and below the depth of the sewer lines, thus indicating that the sewer lines are not the source.

- No evidence was found to suggest that any past or present operations in these areas could have been responsible for elevated concentrations of arsenic in soil.

- Using the noncancer endpoint of 22.0 mg/kg, the only sample exceeding an HI of 1.0 is 264B2 (Site 41), which was collected at a depth of 13 to 15 feet and below the 10-foot depth generally accepted as the maximum for human exposure under a future residential scenario. Using an industrial scenario, the noncancer endpoint for arsenic in soil is 380 mg/kg.

- The lack of soil contamination eliminates the potential for impact to groundwater. Therefore, groundwater is considered protective of human health.

2.6.18.4 Description of the No Action Alternative

The no action alternative selected for Sites 38, 39, 41, and 42 soil and groundwater includes no institutional controls. Sites 38, 39, 41, and 42 soil and groundwater are considered protective of human health and the environment for the following reasons:

- The detected soil concentrations were less than risk screening criteria or were within background concentrations.

- The lack of soil contamination eliminates the potential for impact to groundwater from these sites.

- The sewer line sites are in developed areas with little or no wildlife habitat and no complete pathway to ecological receptors.

2.6.19 Site 40 - 13 Area Sewer Line, Building 13103

Site 40 consists of the sewer line near Building 13103.

2.6.19.1 Site Name, Location, and Description

Site 40 - 13 Area Sewer Line, Building 13103, is located approximately 0.25 mile east of the intersection of 14th Street and Vandegrift Boulevard (Figure 1-2). The site is on the north side of

14th Street, directly in front of Building 13182, approximately 1,200 feet from the crest of a hill. The surface of the site slopes gently to the cast and drains toward Vandegrift Boulevard.

Site 40 consists primarily of a buried sewer pipeline and an aboveground manhole adjacent to Building 13182 and the surrounding parking lot. A limited amount of landscaping (lawn) surrounds the site. The site contains no habitat suitable for special-status species and no such species are expected to be present. Wildlife species observed near the site during the reconnaissance survey include American crow and western kingbird; no animals were seen directly on site.

No perennial surface water is present in the vicinity of Site 40. Surface water at the site is generally ephemeral and follows the gently sloping ground surface to the east. The area receives only low annual rainfall, primarily during winter months. During significant rainfall events, surface water percolates into the subsurface, evaporates, or runs off the site.

The 13 Area is used for training activities, recreation, troop housing, vehicle maintenance, mess, and administration. The nearest family housing, Serra Mesa Housing, is about 0.75 mile southeast of the site. The nearest designated troop housing is within the 13 Area. No base production wells are located in the San Luis Rey Basin or within a 1-mile radius of Site 40.

2.6.19.2 Site History and Enforcement Activities

Sewer line sites were selected during the RFA to represent potential impact to human health and the environment from sewer line breaks. Locations were selected near industrial facilities and where sewer lines crossed major roads. Sewer line sites in the 13 Area were selected where previous unauthorized discharges were reported.

Soil samples were collected along sewer lines during the RFA because interviews indicated that chemicals, although not specifically arsenic, could have been disposed of in sewer lines in the past. The soil samples were analyzed for VOCs, SVOCS, and metals. No COPCs were identified other than arsenic, which exceeded the PRG. Because, at that time, background concentrations of metals had not yet been determined for any base area, Site 40 was recommended for further investigation under CERCLA. Further evaluation of the RFA data comparing results with background levels calculated during the RI for Group C sites (SWDIV,

1996a) indicated that the arsenic concentration in one soil sample from Site 40 significantly exceeded background.

2.6.19.3 Summary of Site Characteristics

Site 40 was investigated in June and July 1996 during the RI for Group D sites (SWDIV, 1997b). Seven soil samples were collected from one boring (Figure 2-36) and were analyzed for metals. Groundwater was not sampled because none was encountered prior to drilling refusal at 40 feet below ground surface. A habitat and receptor survey was conducted and dominant vegetation types and corresponding wildlife habitats were identified. Wildlife observed and evidence of wildlife use (e.g., scat or tracks) were also noted.

2.6.19.3.1 Geology and Hydrogeology

Shallow geology at Site 40 consists primarily of stream-deposited alluvium of Holocene age overlying the Eocene-age La Jolla Group bedrock. The alluvium consists of poorly graded to well-graded sand and varying amounts of silt.

Based on site geology, groundwater is assumed to flow to the east, following surface topography. Boring 40B-01 was drilled to a maximum depth of 40 feet below ground surface without encountering groundwater. Groundwater was consistently encountered at a depth of about 20 feet below grade in boreholes drilled for UST studies at the adjacent 12 and 13 Areas, approximately 0.2 mile north of Site 40 (SWDIV, 1996b). However, 12 and 13 Areas are topographically lower than Site 40 by about 80 feet. As such, groundwater at Site 40 is estimated to be more than 50 feet below grade.

2.6.19.3.2 Analytical Results

No organics were detected in soil; arsenic and beryllium were the only inorganic compounds detected, but concentrations were below background (Figure 2-36). Despite efforts to collect water samples, groundwater was not encountered at Site 40.

2.6.19.4 Summary of Risks Associated with Site 40

Human health and ecological risk assessments were conducted for Site 40 using data collected during the RI. Risk assessment methodologies are summarized in Section 2.4.1.4. Risk assessment summaries for Site 40 are presented in this section.

2.6.19.4.1 Human Health Risk Characterization

COPCs detected in soil are limited to metals. Current/future workers and future residents could be exposed to soil contaminants through incidental ingestion of soil, dermal contact with soil, and inhalation of soil particulates.

The cumulative residential risk from maximum detected soil COPCs is 5.0×10^{6} and is completely attributable to beryllium. The maximum concentration of beryllium (0.7 mg/kg) is less than the background concentration for beryllium in the San Luis Rey Basin. Excluding the portion of risk attributable to background metals, the incremental site risk is less than 1×10^{6}.

The cumulative residential HI from maximum detected metals is 0.35. Excluding the portion of total hazard attributable to background metals, the incremental residential hazard from the maximum detected COPCs is 0.03. The maximum lead concentration (12.6 mg/kg) is below residential screening criteria.

Site 40 soil is considered protective of human health because the incremental risk and hazard are less than 1×10^{-6} and 1.0, respectively.

Groundwater is not considered a complete exposure pathway for either current/future workers or future residents. Groundwater sampling was not performed at Site 40 during the RI because drilling refusal occurred in weathered bedrock at less than 50 feet below ground surface, before encountering sufficient groundwater for sampling purposes. Site 40 is not located above a shallow aquifer associated with any of the four major groundwater basins at MCB Camp Pendleton (i.e., San Mateo, San Onofre, Las Flores, or Santa Margarita Basin). The site is topographically higher than and isolated from the aquifers associated with these major basins. Based on the above, groundwater at Site 40 is considered protective of human health.

2.6.19.4.2 Ecological Risk Assessment

Site 40 was not carried through the quantitative or qualitative ecological evaluation because suitable wildlife habitat is not available on site and none of the potential exposure pathways are expected to be complete.

2.6.19.5 Description of the No Action Alternative

The no action alternative selected for Site 40 soil and groundwater includes no institutional controls. Site 40 soil and groundwater are considered protective of human health and the environment for the following reasons:

- The incremental cancer risk for soil is less than $1x10^{-6}$
- The incremental hazard index for soil is less than 1.0
- Site 40 has no suitable wildlife habitat and no complete pathways to ecological receptors.

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TABLE 2-1
Remedial Action Standards for Soil at
Sites 1A, 1D, 1E, 1F, and 2A
MCS Camp Pendleton
(Sheet 1 of 3)

Contaminant of Concern	Maximum Concentration(mg/kg)	Remediation Standard (mg/kg) (0-5 feet)	Remediation Standard (mg/kg) (5-10 feet)
Site 1 A			
Antimony	27	8.8[a]	-
Arsenic	51	17[a]	22[b]
Barium	704	133[a]	-
Boron	42	3.6[c]	-
Chromium	61	I6[a]	-
Copper	25,000	12[c]	2800[b]
Iron	148,000	20,200[a]	-
Lead	8,800	12[C]	130[b]
Manganese	12,100	199[a]	-
Mercury	4.9	0.2[c]	-
Thallium	6.8	1.4[a]	5.4[b]
Vanadium	93	40[a]	-
Zinc	7,390	56[a]	-
Site 1D[f]			
Antimony	35	8.8[a]	-
Arsenic	6.4	4.3[d]	-
Chromium	37	33[d]	-
Copper	739	26[a]	-
Iron	30,100	26,459[a]	-
Lead	1,100	29[a]	-
Zinc	2,880	111[a]	-
Site 1E			
Aluminum	47,200	20.999[a]	
Antimony	140	8.8[a]	31[b]
Arsenic	11	4.3[d]	4.3[d]
Cadmium	9.3	9[d]	9[b]
Chromium	104	33[d]	33[d]
Cobalt	25	13[a]	
Copper	1,660	26[a]	-

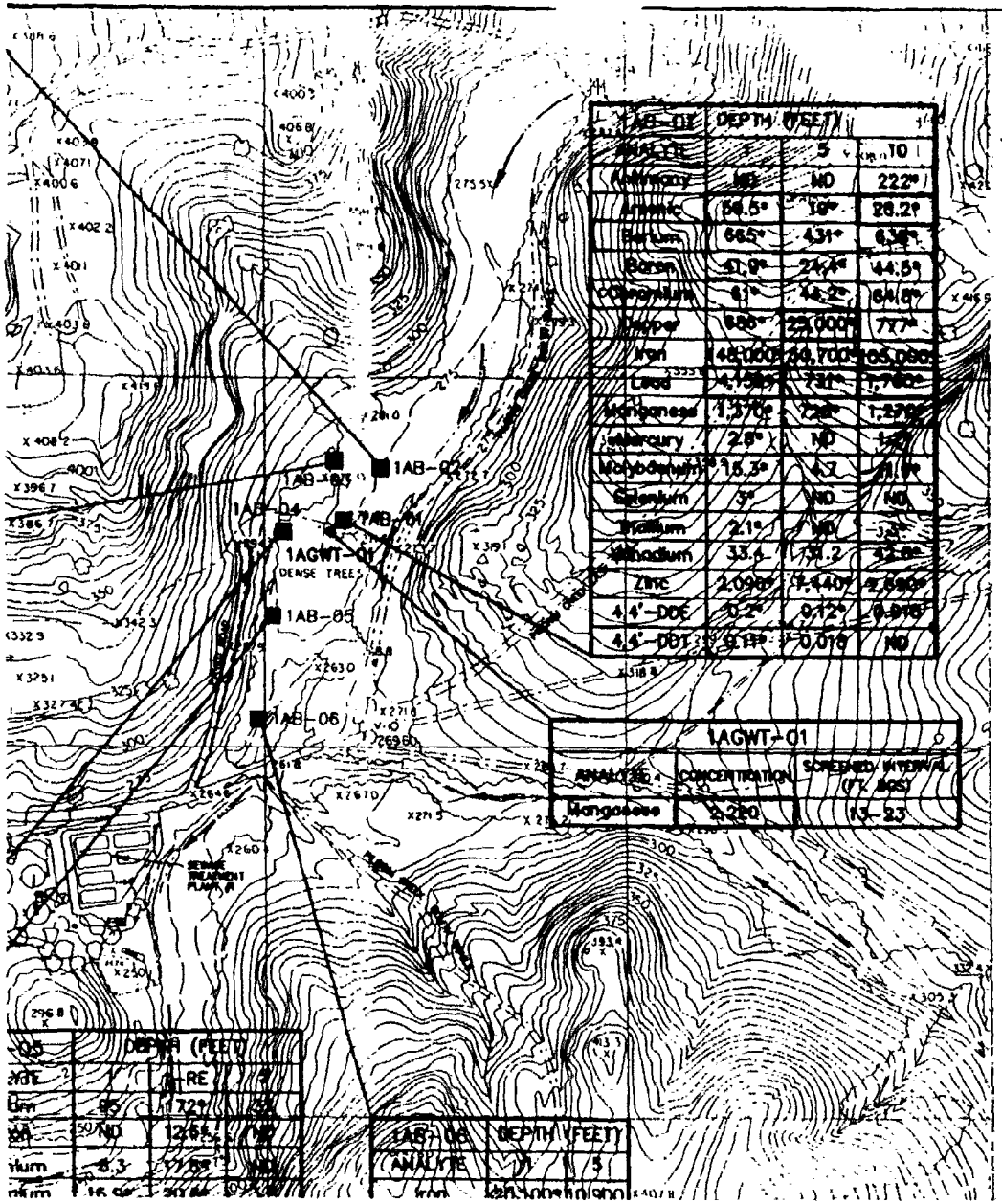
TABLE 2-1
Remedial Action Standards for Soil at
Sites 1A, 1D, 1E, 1F, and 2A
MBC camp Pendleton
(Sheet 2 of 3)

Contaminant of Concern	Maximum Concentration(mg/kg)	Remediation Standard (mg/kg) (0-5 feet)	Remediation Standard (mg/kg) (5-10 feet)
Iron	61,500	26,459[a]	--
Lead	1,610	29[a]	130[b]
Zinc	5,930	960[c]	
Site 1F			
Antimony	61	8.8[a]	30[a]
Arsenic	12	4.3[d]	4.3[d]
Copper	12,500	28[a]	2,800[b]
Iron	129,000	37,000[a]	-
Lead	1,260	15[a]	130[b]
Zinc	7,390	91[a]	-
Site 2A			
Antimony	64	8.8[a]	31[b]
Arsenic	16	16[a]	16[b]
Barium	1,530	133[a]	--
Cadmium	44	9[b,c]	9[b]
Chromium	890	16[a]	--
Cobalt	160	13[a]	--
Copper	8,790	12[c]	2,800[b]
Iron	99,500	20,200[a]	--
Lead	2,020	12[c]	130[b]
Manganese	345,000	783[c]	3,200[b]
Mercury	7.3	0.6[c]	-
Molybdenum	73	7.4[a]	-
Silver	120	5[c]	-
Thallium	144	1.4[a]	5.4[b]
Zinc	226,000	163[c]	23,000[b]
4,4'-DDD	1.9	1.9[b]	1.9[b]
4,4'-DDE	2.2	1.3[b]	1.3[b]

TABLE 2-1
Remedial Action Goals for Soil at
Site1A, 1D, 1E, 1F, and 2A
MCB Camp Pendleton
(Sheet 3 of 3)

[a]Remediation goal was set at background calculated for the 0- to 5-foot depth interval.
[b]Remediation goal was set at the risk-based PRG.
[c]Remediation goal was set at the most stringent PLE of the species evaluated for the site.
[d]Remediation goal was set at background calculated for the 0- to 10-foot depth interval.
[e]Remediation goal was set at a soil concentration estimated to be protective of groundwater.
[f]Although listed remediation goals are applicable to 5 feet, contamination is expected to be present only to 3 feet below ground surface at Site 1D.

mg/kg - Milligrams per kilogram.
PLE - Preliminary limit of exposure.
PRG - Preliminary remediation goal.
-- Denotes that the contaminant is not of concern at the specified depth range.



LEGEND

1AB-02 ■	SOIL BORING LOCATION
1AGWT-01 ●	TEMPORARY WELL SAMPLE LOCATION
——→	SURFACE-WATER FLOW DIRECTION
ND	NOT DETECTED
NA	NOT APPLICABLE
1-RE	REPEAT SAMPLE COLLECTED AT 1 FOOT

COMPOUND (mg/kg)	PRG	PLE	BACKGROUND
ANTIMONY	31	0.3	16.0
ARSENIC	22	0.3	16
BARIUM	5,300	65	133
BORON	5,900	3.6	NA
CADMIUM	9	9	1.5
CHROMIUM	77,000	1.5	13.2
COPPER	2,800	12	4.8
IRON	NA	32	19,883
LEAD	130	12	10
MANGANESE	3,200	109	199
MERCURY	100,000	0.2	0.05
MOLYBDENUM	380	6	7.4
SELENIUM	380	1	0.8
THALLIUM	5.4	0.4	1.4
VANADIUM	540	6	36
ZINC	23,000	14	56
BENZO(a)PYRENE	0.061	NA	NA
4,4'-DDE	1.3	0.037	NA
4,4'-DDT	1.3	0.074	NA

GROUNDWATER COMPOUND (µg/l)	MCL	TAP-WATER PRG
MANGANESE	–	1,700

NOTES:

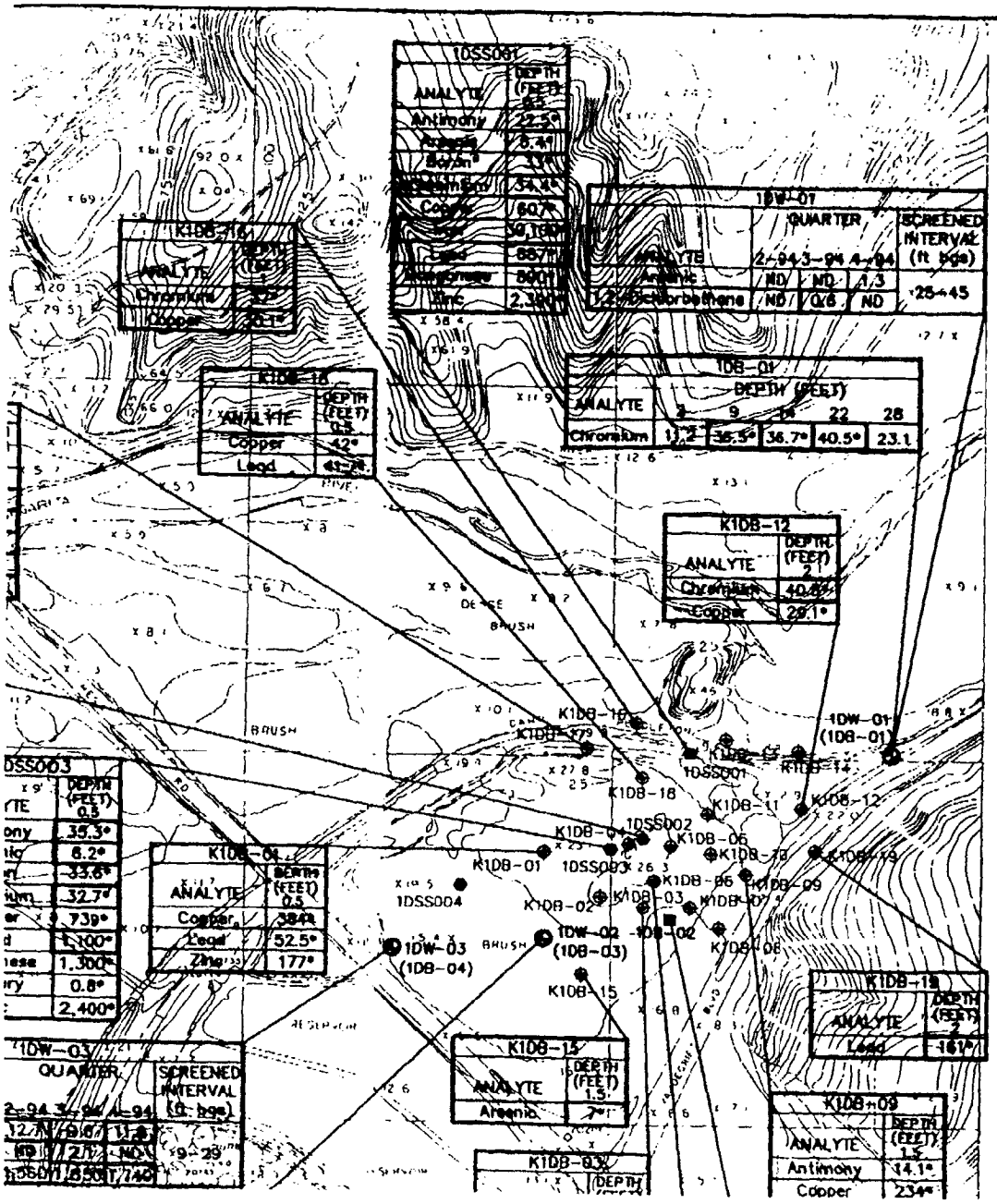
1. SOIL CONCENTRATIONS GIVEN IN MILLIGRAMS PER KILOGRAM. GROUNDWATER CONCENTRATIONS ARE GIVEN IN MICROGRAMS PER LITER.
2. THIS FIGURE PRESENTS CONSTITUENTS EXCEEDING PRGs OR PLEs AND BACKGROUND, AS APPLICABLE
3. SOIL CONCENTRATIONS OUTLINED IN BOLD EXCEED PRGs AND BACKGROUND.
4. SOIL CONCENTRATIONS DENOTED WITH AN ASTERISK (*) EXCEED PLEs AND BACKGROUND CONCENTRATIONS, AS APPLICABLE.
5. GROUNDWATER CONCENTRATION OUTLINED IN BOLD EXCEED PRGs.

SCALE

0 400 800 FEET

FIGURE 2-1

SITE 1A - REFUSE BURNING GROUND IN 14 AREA



LEGEND

K1DB-18 ⊕	LOCATION SAMPLED BY KLEINFELDER (1996)
1DSS001 ●	SURFACE SOIL SAMPLE
1DSB003 ■	BOREHOLE LOCATION
1DW-03 (1DB-04) ◉	MONITORING WELL LOCATION WITH BORING NUMBER IN PARENTHESES
—— →	SURFACE-WATER FLOW DIRECTION
⇦	APPROXIMATE GROUNDWATER FLOW DIRECTION (FROM POTENTIOMETRIC SURFACE CONTOUR MAP)
ND	NOT DETECTED
NA	NOT APPLICABLE

SOIL INORGANICS (mg/kg)	PRG	PLE	BACKGROUND
ANTIMONY	31	1.3	8.4
ARSENIC	0.38	2.0	4.3
BORON	5,900	21	NA
CHROMIUM	0.2	7	32.6
COPPER	2,800	13	26.0
IRON	NA	186	26,459
LEAD	130	13	21.7
MANGANESE	3,200	390	655
MERCURY	23	0.6	0.08
ZINC	23,000	80	104

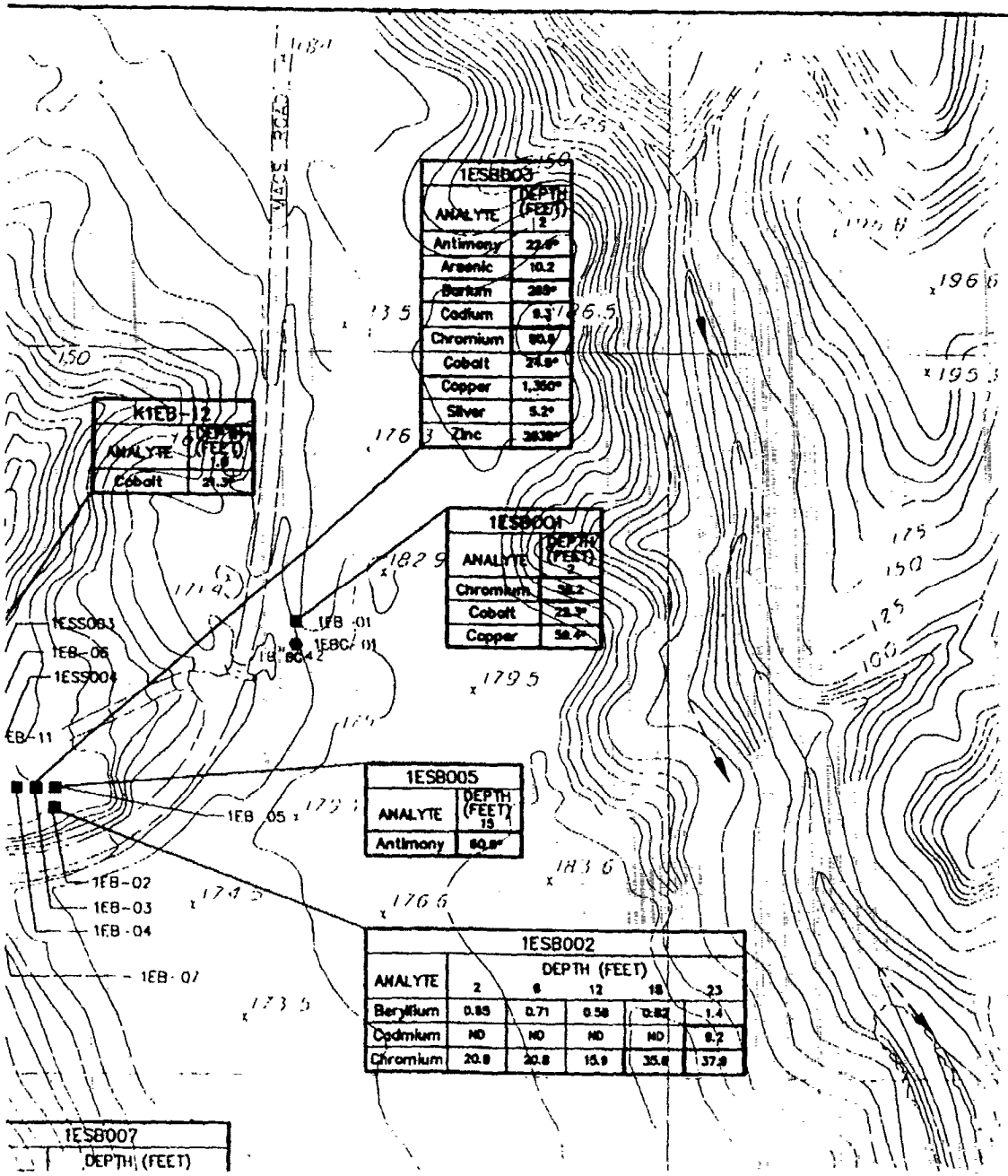
GROUNDWATER INORGANICS (µg/l)	TAP-WATER PRG	MCL	BACKGROUND
ARSENIC	0.045	50	10.1
BERYLLIUM	0.016	4	NA
MANGANESE	1,700	NA	6.74

GROUNDWATER ORGANICS (µg/l)	TAP-WATER PRG	MCL	BACKGROUND
1,2-DICHLOROETHANE	0.12	0.5	NA

NOTES:

1. SOIL CONCENTRATIONS GIVEN IN MILLIGRAMS PER KILOGRAM. GROUNDWATER CONCENTRATIONS GIVEN IN MICROGRAMS PER LITER.
2. THIS FIGURE REPRESENTS CONSTITUENTS EXCEEDING PRGs OR PLEs AND BACKGROUND, AS APPLICABLE
3. THIS FIGURE ONLY PRESENTS CHEMICALS WITH SOIL CONCENTRATIONS EXCEEDING BACKGROUND AND PRGs OR PLEs. ANALYTES WITH CONCENTRATIONS GREATER THAN OR EQUAL TO PRGs DURING AT LEAST ONE SAMPLING ROUND ARE SHOWN
4. CONCENTRATIONS OUTLINED IN BOLD EXCEED PRGs AND BACKGROUND, AS APPLICABLE.
5. SOIL CONCENTRATIONS DENOTED WITH AN ASTERISK (*) ARE GREATER THAN PLEs AND BACKGROUND, AS APPLICABLE.

FIGURE 2-2



LEGEND

K1EB-06 ●	LOCATION SAMPLED BY KLEINFELDER (1996)
1ESS003 ●	SURFACE SOIL SAMPLE
1EB-02 ■	BOREHOLE LOCATION
1EBG-01 BG ●	BACKGROUND SURFACE SOIL SAMPLE
- - - →	SURFACE-WATER FLOW DIRECTION (EPHEMERAL)
ND	NOT DETECTED
NA	NOT APPLICABLE

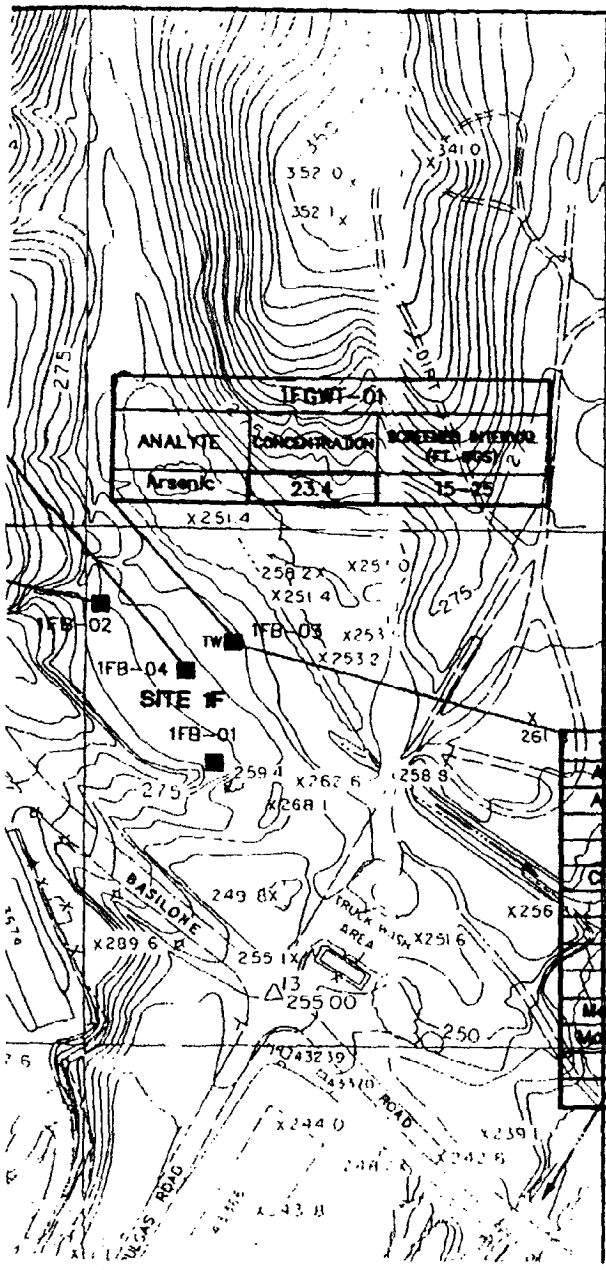
INORGANICS (mg/kg)	PRG	PLE	BACKGROUND
ALUMINUM	77,000	891	20,999
ANTIMONY	31	1.2	8.4
ARSENIC	0.38	37	4.3
BARIUM	5,300	59	261
BERYLLIUM	0.14	NA	1.4
BORON	5,900	91	NA
CADMIUM	9.0	NA	1.5
CHROMIUM	0.2	145	32.6
COBALT	4,600	3	12.8
COPPER	2,800	11	26.0
IRON	NA	437	26,459
LEAD	130	16	21.7
MOLYBDENUM	380	6	7.4
SILVER	380	5	1.36
ZINC	23,000	950	104

NOTES:

1. CONCENTRATIONS GIVEN IN MILLIGRAMS PER KILOGRAM.
2. THIS FIGURE PRESENTS CONSTITUENTS EXCEEDING PRGs AND PLEs AND BACKGROUND, AS APPLICABLE.
3. CONCENTRATIONS OUTLINED IN BOLD EXCEED PRGs AND BACKGROUND.
4. CONCENTRATIONS DENOTED WITH AN ASTERISK (*) EXCEED PLEs AND BACKGROUND

TOPOGRAPHIC REFERENCE:
MARINE CORPS BASE CAMP PENDLETON GENERAL DEVELOPMENT MAP 6C. DATE: DECEMBER 1987

FIGURE 2-3



COMPOUND (mg/kg)	PRG	PLE	BACKGROUND
ANTIMONY	31	1.0	8.8
ARSENIC	0.38	1.4	4.26
BORON	5,900	12	NA
CADMIUM	9	NA	1.6
CHROMIUM	77,000	4	34.6
COBALT	4,600	0.3	9.9
COPPER	2,800	12	27.9
IRON	NA	154	37,000
LEAD	130	12	15.1
MANGANESE	3,200	262	549
MOLYBDENUM	380	6.0	7.4
SILVER	380	5	1.4
ZINC	23,000	55	91

ANALYTE	CONCENTRATION	SCREENED INTERVAL (FT. BGS)
Arsenic	23.4	15-25

GROUNDWATER COMPOUND (µg/l)	MCL	TAP-WATER PRG
ARSENIC	50	0.045

1FB-03	DEPTH (FEET)		
ANALYTE	1	5	10
Antimony	ND	61.1*	ND
Arsenic	2	11.9*	5.3*
Boron	ND	75.4*	ND
Chromium	24.4	84.9*	22.9
Cobalt	6.5	15.7*	7.8
Copper	28.8*	1,820*	19.6
Iron	21,700	18,000*	19,600
Lead	18.5*	1,260*	80.4*
Manganese	125	1,560*	223
Molybdenum	ND	10.2*	ND
Silver	ND	5.5*	ND
Zinc	90	7,390*	ND

LEGEND

1FB-03 TW ■ SOIL BORING LOCATION (TW INDICATES GROUNDWATER SAMPLE)

SURFACE-WATER FLOW DIRECTION

ND NOT DETECTED

NA NOT APPLICABLE

NOTES:

1. SOIL CONCENTRATIONS GIVEN IN MILLIGRAMS PER KILOGRAM. GROUNDWATER CONCENTRATIONS GIVEN IN MICROGRAMS PER LITER.
2. THIS FIGURE PRESENTS CONSTITUENTS EXCEEDING PRGs OR PLEs AND BACKGROUND, AS APPLICABLE.
3. CONCENTRATIONS OUTLINED IN BOLD EXCEED PRGs AND BACKGROUND, AS APPLICABLE.
4. SOIL CONCENTRATIONS DENOTED WITH AN ASTERISK (*) EXCEED PLEs AND BACKGROUND.

TOPOGRAPHIC REFERENCE:

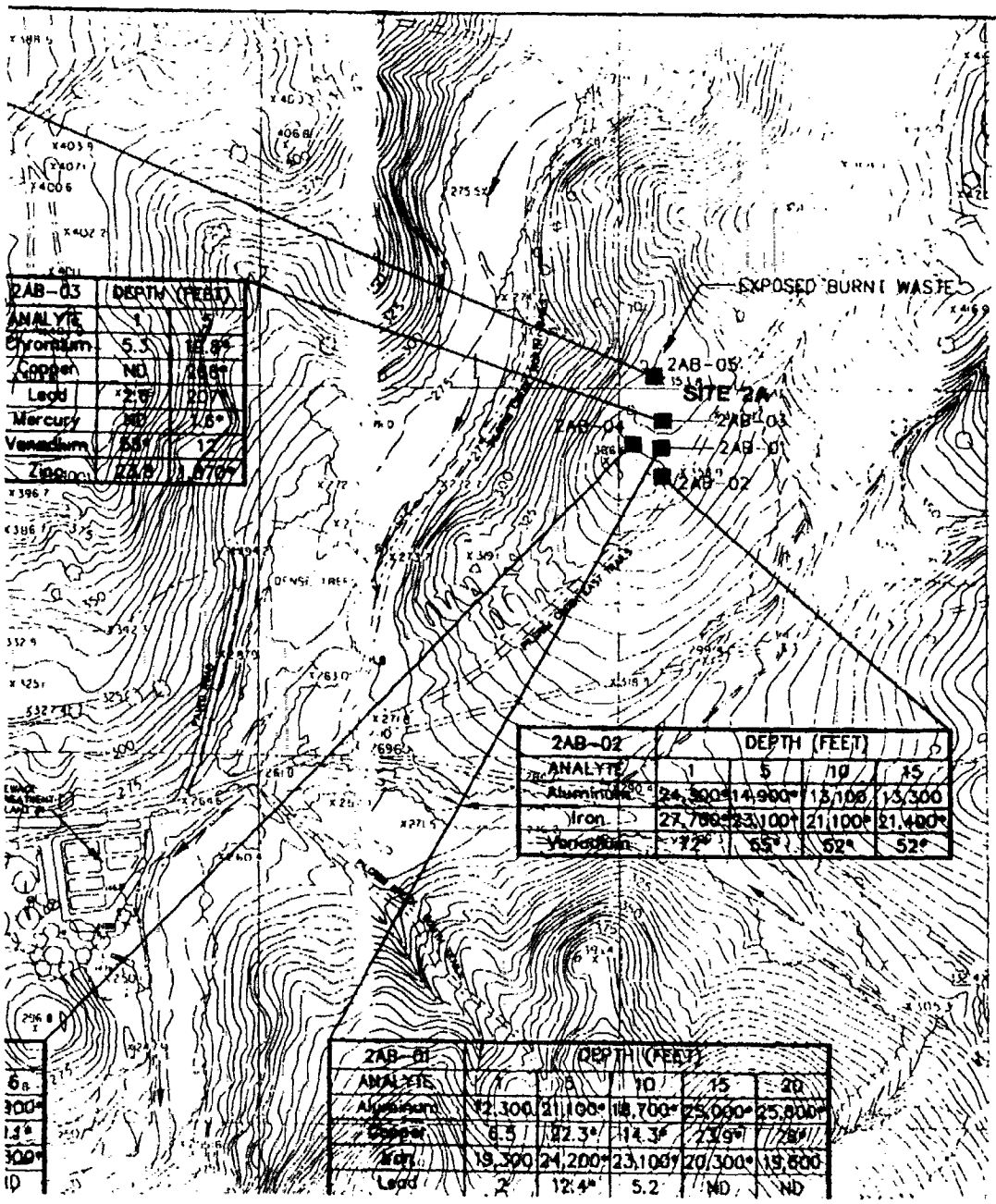
MARINE CORPS BASE CAMP PENDLETON GENERAL DEVELOPMENT MAPS 36B, 36D, AND 37A.
DATE: DECEMBER 1987

SCALE

0 300 600 FEET

FIGURE 2-4

SITE 1F - REFUSE BURNING GROUND IN 43 AREA



LEGEND

2AB-02 ■ SOIL BORING LOCATION

→ SURFACE-WATER FLOW DIRECTION

ND NOT DETECTED

NA NOT APPLICABLE

HPCDF HEPTACHLORODIBENZOFURANS

COMPOUND (mg/kg)	PRG	PLE	BACKGROUND
ALUMINUM	77,000	769	16,398
ANTIMONY	31	1.2	8.38
ARSENIC	0.38	NA	16
BARIUM	5,300	65	385
BORON	5,900	37	NA
CADMIUM	9	9	1.52
TOTAL CHROMIUM	77,000	12	13
COBALT	4,600	1.0	12.8
COPPER	2,800	12	4.8
IRON	NA	350	19,883
LEAD	130	12	10
MANGANESE	3,200	783	199
MERCURY	100,000	0.6	0.05
MOLYBDENUM	380	6	7.36
NICKEL	1,500	63	4.1
SILVER	380	5	1.36
THALLIUM	5.4	0.37	1.33
VANADIUM	380	7	40
ZINC	23,000	163	59.7
4,4'-DDD	1.9	90	NA
4,4'-DDE	1.3	0.6	NA
4,4'-DDT	1.3	1.1	NA
1,2,3,4,6,7,8-HPCDF	0.00038	NA	NA

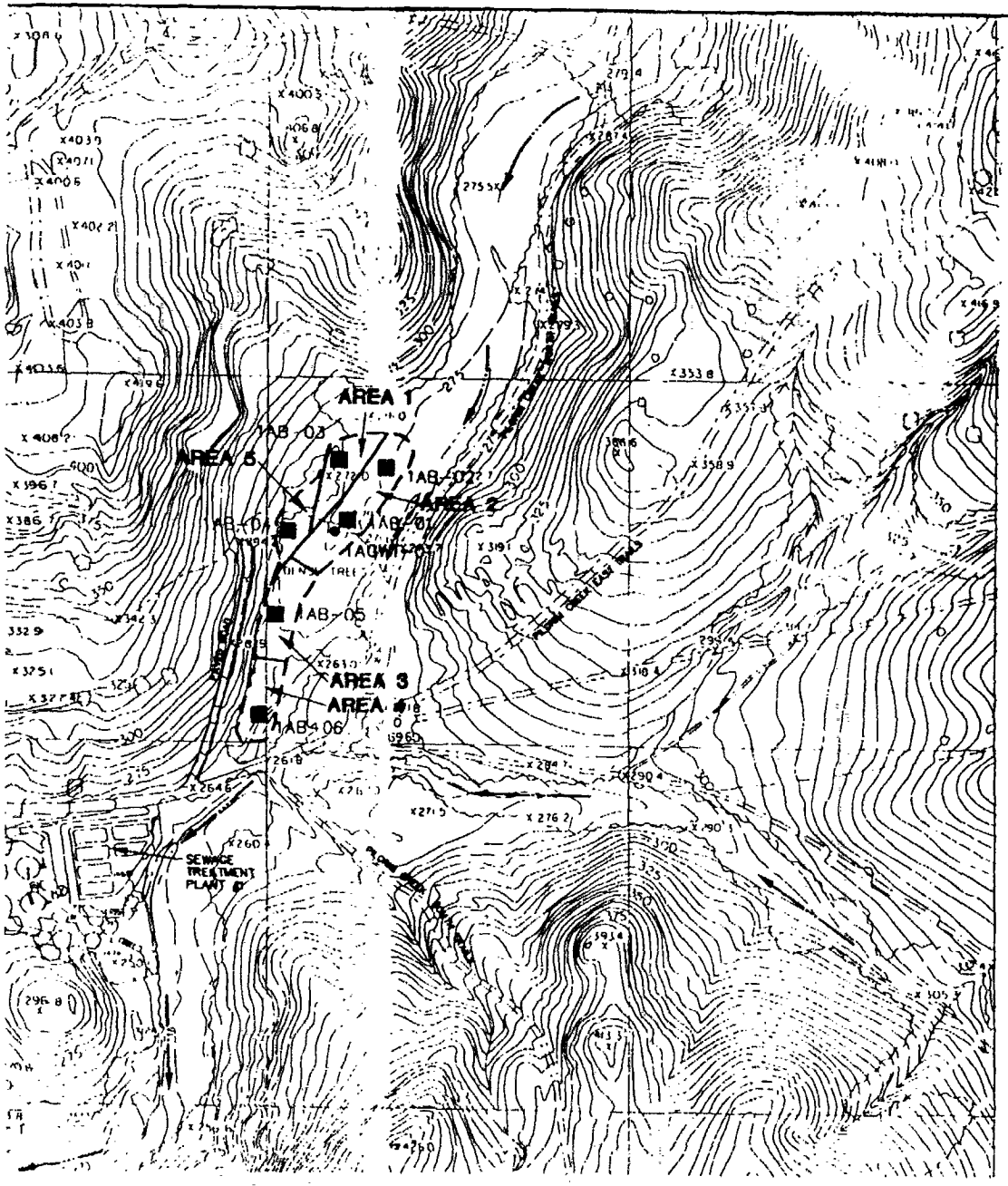
NOTES:

1. CONCENTRATIONS GIVEN IN MILLIGRAMS PER KILOGRAM.
2. THIS FIGURE PRESENTS CONSTITUENTS EXCEEDING PRGs OR PLEs AND BACKGROUND, AS APPLICABLE.
3. CONCENTRATIONS OUTLINED IN BOLD EXCEED PRGs AND BACKGROUND, AS APPLICABLE
4. CONCENTRATIONS DENOTED WITH AN ASTERISK (*) EXCEED PLEs AND BACKGROUND, AS APPLICABLE.
5. 1 (RE) IS A RESAMPLE AT 1 FOOT

SCALE

0 400 800 FEET

FIGURE 2-5



LEGEND

1AB 02 ■ SOIL BORING LOCATION

1AGWT-01 ● TEMPORARY WELL SAMPLE LOCATION

SURFACE-WATER FLOW DIRECTION

EXCAVATION AREA ESTIMATED BASED ON HISTORICAL AERIAL AND GEOPHYSICAL SURVEYS AND SITE-SPECIFIC FEATURES.

AREA #	AREA (acres)	EXCAVATION DEPTH (FT)	ESTIMATED VOLUME (YD^3)
1	0.4	5	3,264
2	0.9	10	14,815
3	0.6	5	5,000
4	0.4	5	2,963
5	0.7	5	5,647
TOTAL	3.0		31,689

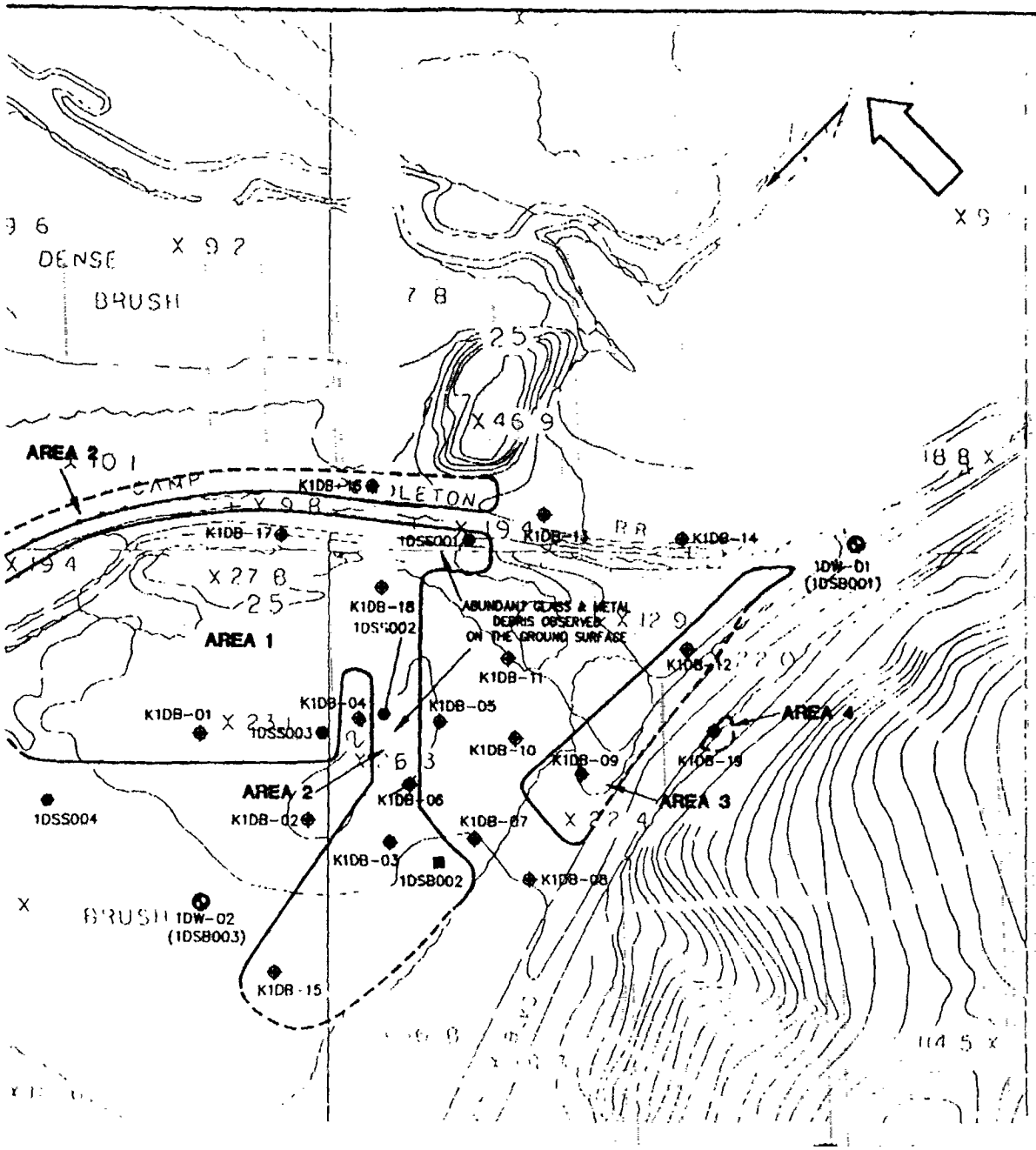
TOPOGRAPHIC REFERENCE:

MARINE CORPS BASE CAMP PENDLETON
GENERAL DEVELOPMENT MAP 24D
DATE: DECEMBER 1987

SCALE

0 400 800 FEET

FIGURE 2-6



LEGEND

K1DB-01 ◆	HAND-AUGER BOREHOLE BY KLEINFELDER (NOV 1996)
1DSS001 ●	SURFACE SOIL SAMPLE BY IT CORPORATION (1993)
1DSB003 ■	BOREHOLE LOCATION BY IT CORPORATION (1993)
1DW-03 (1DSB004) ⊙	MONITORING WELL LOCATION (BY IT CORPORATION, 1993) WITH BORING NUMBER IN PARENTHESES
⇦	APPROXIMATE GROUNDWATER FLOW DIRECTION
⟶	SURFACE-WATER FLOW DIRECTION
- - -	EXCAVATION AREA ESTIMATED BASED ON ANALYTICAL RESULTS AND SURFACE FEATURES. DASHED WHERE NO SAMPLES WERE COLLECTED OUTSIDE AREA.

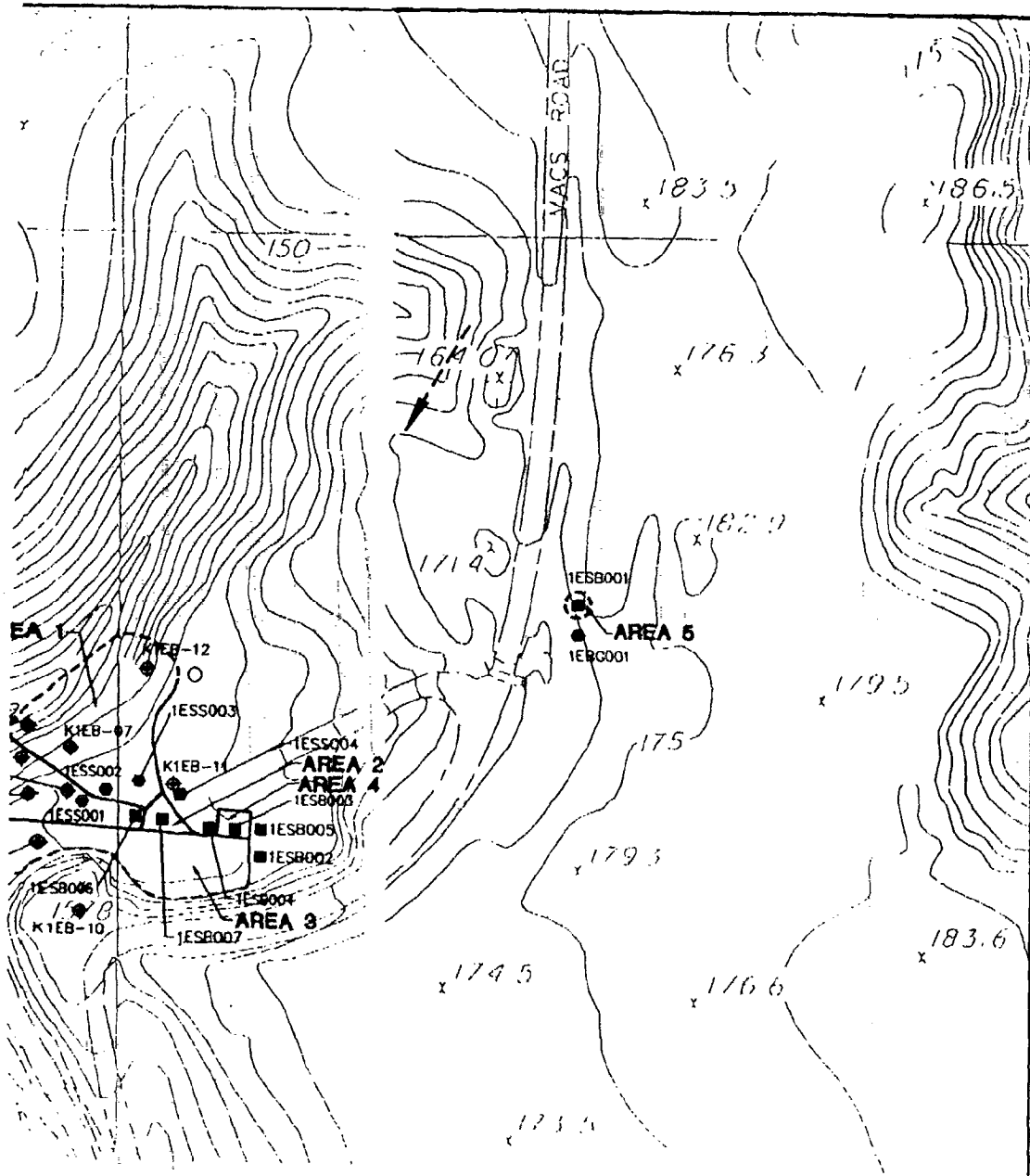
AREA#	AREA (acres)	EXCAVATION DEPTH (FT)	ESTIMATED VOLUME (YD^3)
1	6.3	3	30,492
2	0.8	3	3,800
3	1.1	3	5,556
4	0.02	3	109
TOTAL	8.2		39,957

TOPOGRAPHIC REFERENCES:

MARINE CORPS BASE CAMP PENDLETON GENERAL DEVELOPMENT MAPS 5B/6A. DATE. DECEMBER 1987

SOURCE:
MARINE CORPS BASE, CAMP PENDLETON, CALIFORNIA REMEDIAL INVESTIGATION / FEASIBILITY STUDY, DRAFT RI REPORT FOR GROUP C SITES, CLE-101-01F301-B7-0023, CTO 0301, REVISION 0, VOLUME 1. PREPARED BY IT CORP., APRIL 1996.

FIGURE 2-7



LEGEND

- K1EB-12 ◆ HAND AUGER BOREHOLE BY KLEINFELDER (NOV 96)
- 1ESS003 ● SURFACE SOIL SAMPLE BY IT CORP. (1993)
- 1EB-02 ■ BOREHOLE LOCATION BY IT CORP. (1993)
- 1EBG-01 ● BACKGROUND SURFACE SOIL SAMPLE BY IT CORP. (1993)
- SURFACE-WATER FLOW DIRECTION (EPHEREAL)
- EXCAVATION AREA ESTIMATED BASED ON ANALYTICAL RESULTS AND SURFACE CONTOURS; DASHED WHERE NO SAMPLES WERE COLLECTED OUTSIDE AREA.

AREA #	AREA (acres)	EXCAVATION DEPTH (FT)	ESTIMATED VOLUME (YD^3)
1	0.3	3	1,452
2	0.04	10	694
3	0.2	5	1,759
4	0.01	3	51
5	0.02	3	79
TOTAL	0.6		4,035

TOPOGRAPHIC REFERENCES:

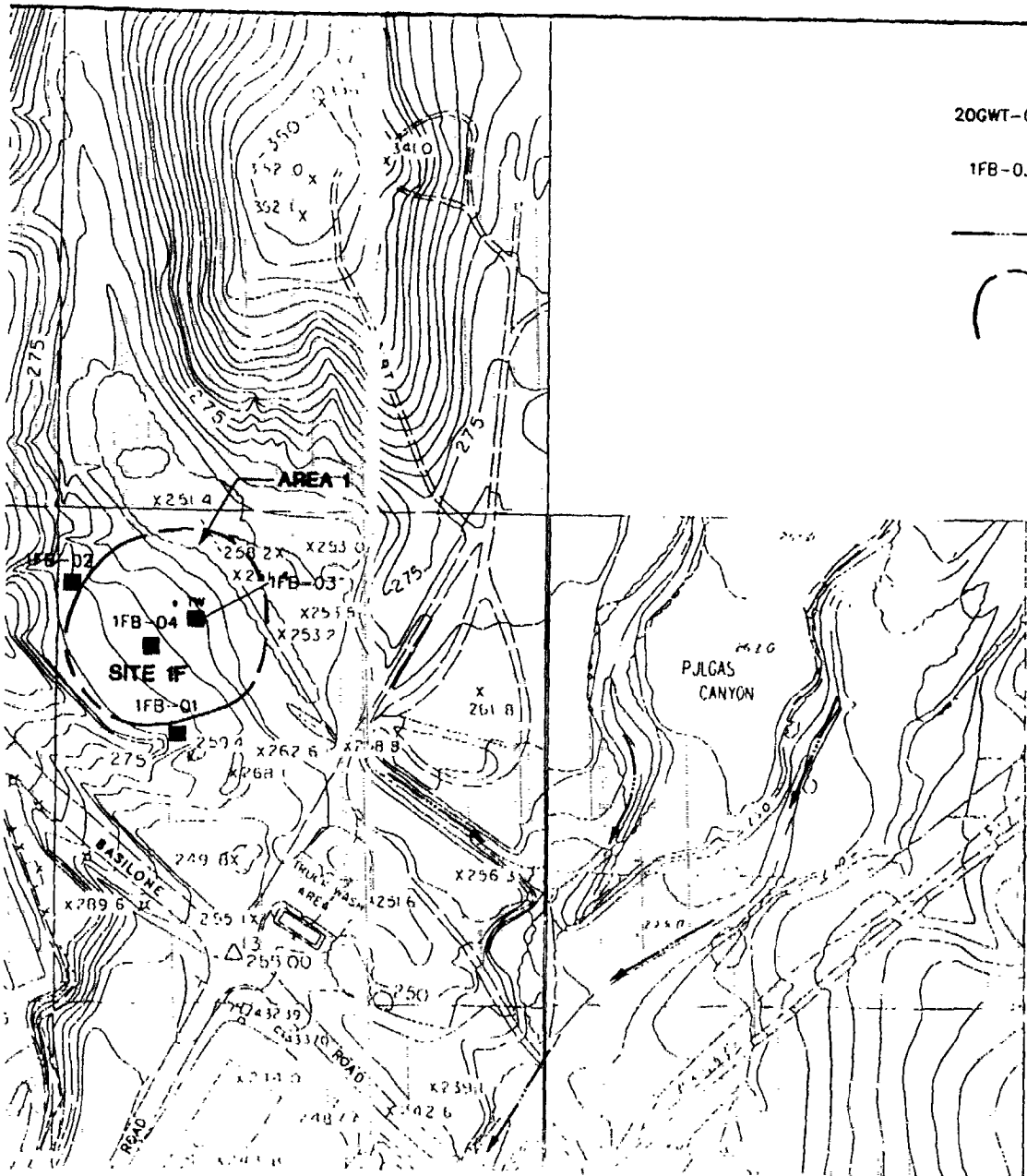
MARINE CORPS BASE CAMP PENDLETON GENERAL DEVELOPMENT MAPS 5B/6A. DATE DECEMBER 1987

SOURCE:
MARINE CORPS BASE, CAMP PENDLETON, CALIFORNIA REMEDIAL INVESTIGATION / FEASIBILITY STUDY, DRAFT RI REPORT FOR GROUP C SITES, CLE-101-01F301-B7-0023, CTO 0301, REVISION 0, VOLUME 1. PREPARED BY IT CORP. APRIL 1996.

SCALE

0 150 300 FEET

FIGURE 2-8



LEGEND

20GWT-01 ● TEMPORARY WELL SAMPLE LOCATION

1FB-03 ■ TW SOIL BORING LOCATION (TW INDICATES GROUNDWATER SAMPLE)

→ SURFACE-WATER FLOW DIRECTION

EXCAVATION AREA ESTIMATED BASED ON ANALYTICAL RESULTS, HISTORICAL AERIAL AND GEOPHYSICAL SURVEYS, AND SURFACE CONDITIONS; DASHED WHERE NO SAMPLES WERE COLLECTED OUTSIDE AREA.

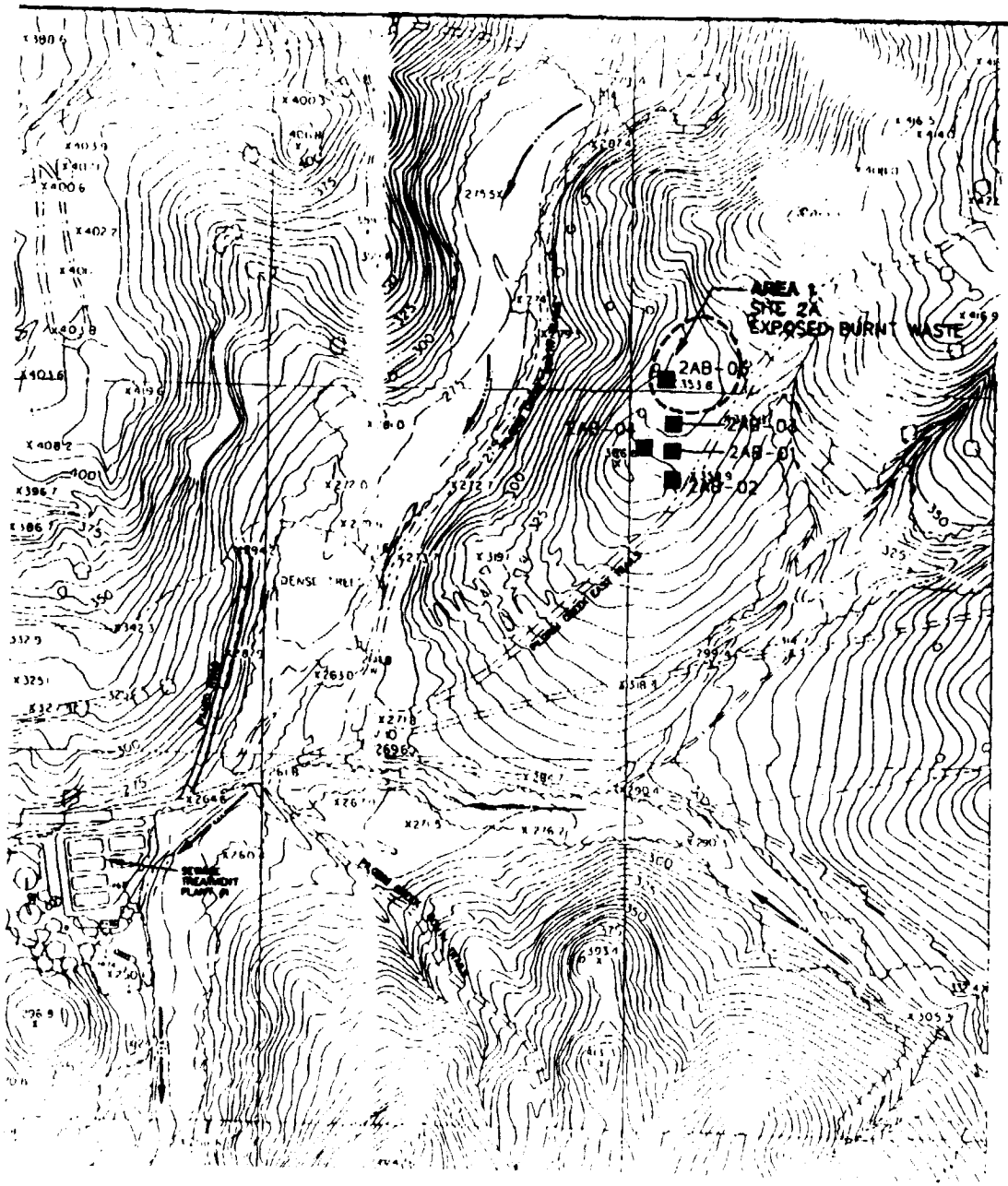
AREA #	AREA (acres)	EXCAVATION DEPTH (FT)	ESTIMATED VOLUME (YD^3)
1	3.0	7.5	36,300

TOPOGRAPHIC REFERENCE:

MARINE CORPS BASE CAMP PENDLETON GENERAL DEVELOPMENT MAPS 36B, 36D, AND 37A.
DATE: DECEMBER 1987

SCALE

0 300 600 FEET



LEGEND

2AB-02 ■ SOIL BORING LOCATION

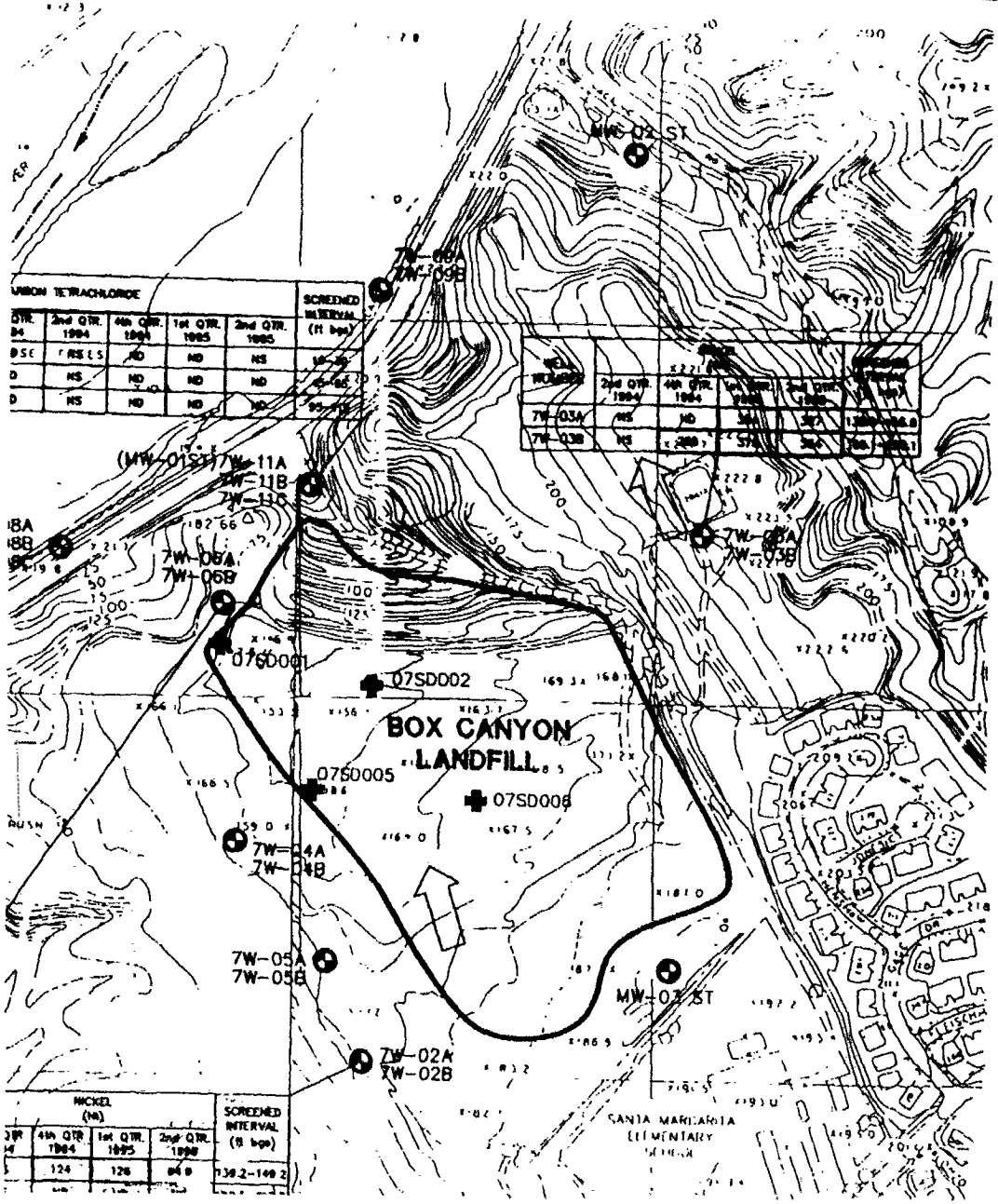
SURFACE-WATER FLOW DIRECTION

EXCAVATION AREA ESTIMATED BASED ON SURFACE CONDITIONS

AREA #	AREA (acres)	EXCAVATION DEPTH (FT)	ESTIMATED VOLUME (YD^3)
1	1.1	10	17,747

SCALE

0 400 800 FEET



LEGEND

7W-06A	GROUNDWATER MONITORING WELL LOCATION
MW-03 ST	GROUNDWATER MONITORING WELL INSTALLED OR MONITORED DURING SOLID WASTE ASSESSMENT TEST
	SURFACE SOIL SAMPLE LOCATION
	SURFACE-WATER FLOW DIRECTION
	ESTIMATED SHAPE OF ORIGINAL CANYON (FROM 1963 AND 1970 AERIAL PHOTOS AND 1995 TRENCHING)
	APPROXIMATE GROUNDWATER FLOW DIRECTION
300	CONCENTRATIONS THAT EXCEED OR EQUAL MCLS ARE OUTLINED IN BOLD

NOTES:

CONCENTRATIONS GIVEN IN MICROGRAMS PER LITER (µg/l)

ANALYTES WITH CONCENTRATIONS GREATER THAN OR EQUAL TO MAXIMUM CONTAMINANT LEVELS (MCLS) DURING AT LEAST ONE SAMPLING ROUND ARE SHOWN

J,B,D – ANALYTICAL DATA QUALIFIERS

ft bgs – FEET BELOW GROUND SURFACE

ND – NOT DETECTED

NS – NOT SAMPLED

SCALE

0 400 800 FEET

TOPOGRAPHIC REFERENCE:

MARINE CORPS BASE CAMP PENDLETON GENERAL DEVELOPMENT MAPS 6A AND 6B

DATE: DECEMBER 1987

FIGURE 2-11

SITE 7 - BOX CANYON LANDFILL

SOIL AND GROUNDWATER SAMPLE LOCATIONS

DRAWN BY	mbm 6-18-97	CHECKED BY		DRAWING NUMBER	771529 A9
		APPROVED BY			

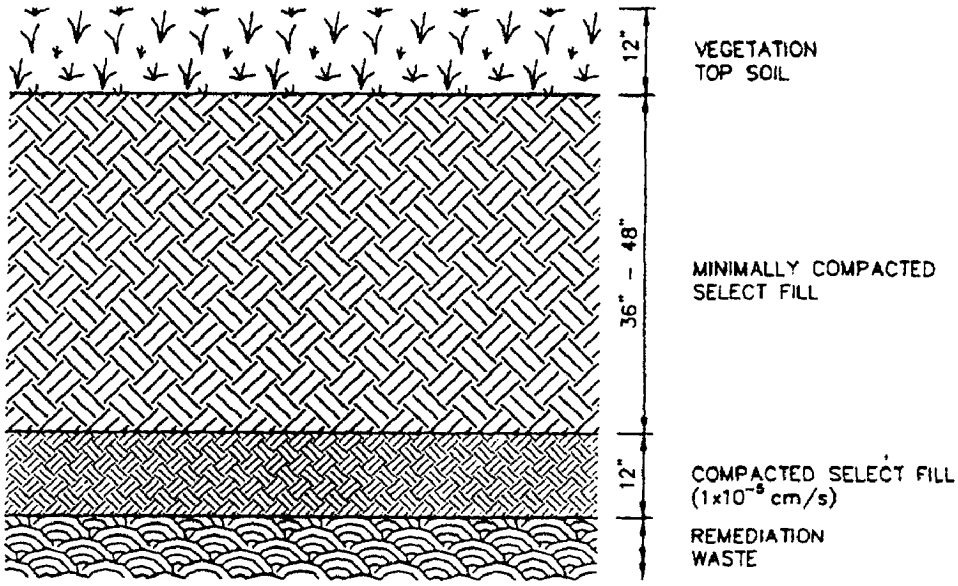


FIGURE 2-12

EVAPOTRANSPIRATION COVER SYSTEM PROFILE

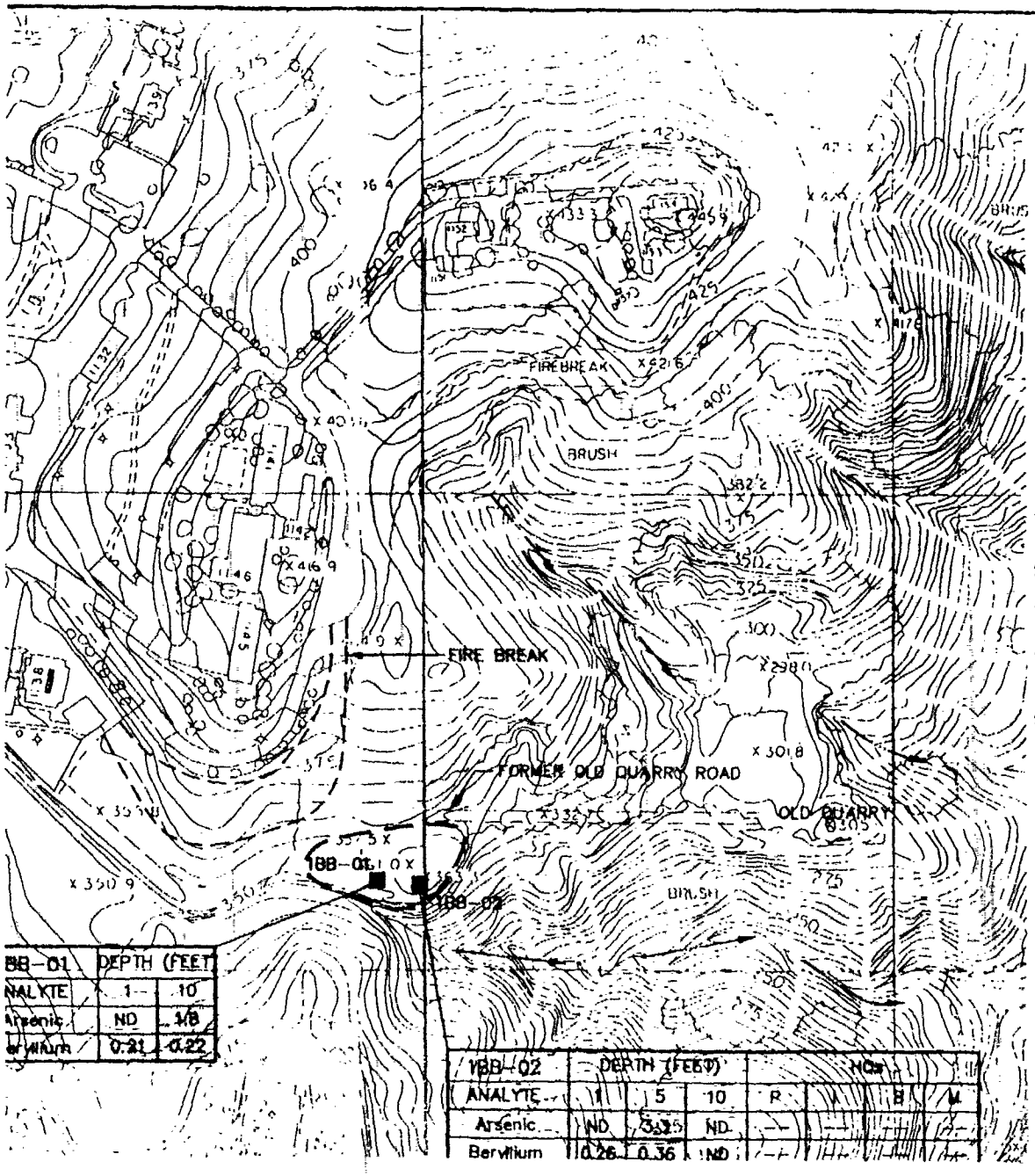
MCB CAMP PENDLETON, CALIFORNIA

PREPARED FOR

SOUTHWEST DIVISION
NAVAL FACILITIES ENGINEERING COMMAND

CONTRACT NO. N68711-89-D-9296
CLE-101-01F301-92-0009

INTERNATIONAL TECHNOLOGY CORPORATION



1BB-01	DEPTH (FEET)	
ANALYTE	1	10
Arsenic	ND	1.8
Beryllium	0.21	0.22

1BB-02	DEPTH (FEET)			HQs			
ANALYTE	1	5	10	P	I	B	M
Arsenic	ND	3.25	ND	--	--	--	--
Beryllium	0.26	0.36	ND	--	--	--	--

LEGEND

1BB-01 ■ SOIL BORING LOCATION

→ SURFACE-WATER FLOW DIRECTION

APPROXIMATE BOUNDARY OF REFUSE BURNING GROUND

ND NOT DETECTED

-- LESS THAN 1.0

COMPOUND (mg/kg)	PRG	BACKGROUND
ARSENIC	0.38	16
BERYLLIUM	0.14	1.42
LEAD	130	11.7

NOTES:

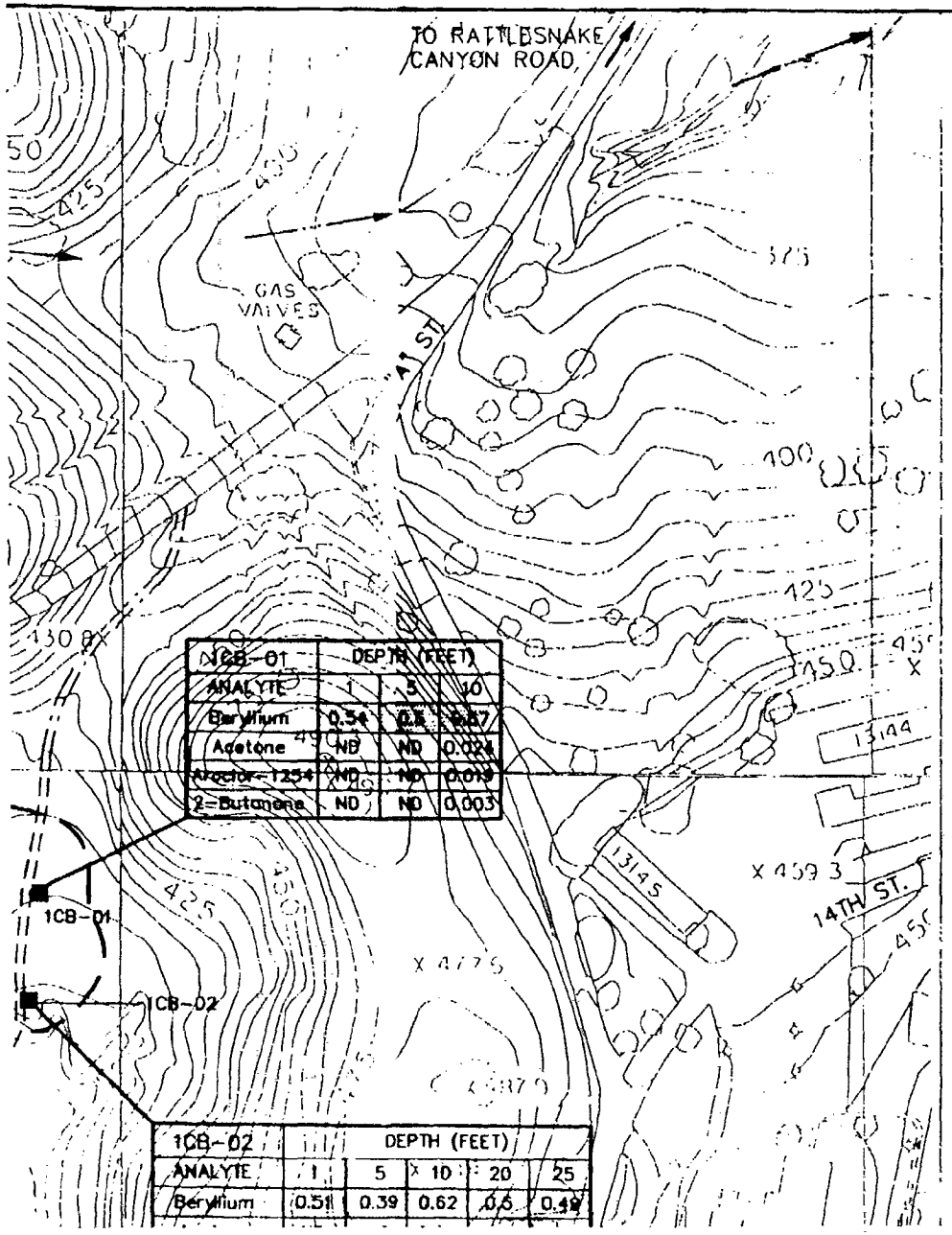
1. CONCENTRATIONS GIVEN IN MILLIGRAMS PER KILOGRAM (mg/kg).
2. CONCENTRATIONS EXCEEDING PRGs ARE SHADED.
3. ALL DETECTED ORGANICS ARE SHOWN IN THE FIGURE; ONLY INORGANICS EXCEEDING PRGs OR WITH HQs ≥1.0 ARE SHOWN.
4. DEPTH INTERVALS WITH NO ORGANIC DETECTIONS OR NO INORGANIC CONCENTRATIONS ABOVE PRGs ARE NOT SHOWN.
5. FOR EACH SAMPLE LOCATION, ECOLOGICAL HAZARD QUOTIENTS (HQs) ≥1.0 ARE GIVEN FOR THE MAXIMUM DETECTED CONCENTRATIONS FOR PLANTS (P), TERRESTRIAL INVERTEBRATES (I), BIRDS (B), OR MAMMALS (M).

TOPOGRAPHIC REFERENCE:

MARINE CORPS BASE CAMP PENDLETON GENERAL DEVELOPMENT MAPS 24A AND 24B DATE: DECEMBER 1987

FIGURE 2-13

SITE 1B - REFUSE BURNING GROUND IN



1CB-01	DEPTH (FEET)		
ANALYTE	1	5	10
Beryllium	0.54	0.5	0.67
Acetone	ND	ND	0.024
Aroclor-1254	ND	ND	0.019
2-Butanone	ND	ND	0.003

1CB-02	DEPTH (FEET)				
ANALYTE	1	5	10	20	25
Beryllium	0.51	0.39	0.62	0.5	0.49

LEGEND

1CB-02 ■ SOIL BORING LOCATION

SURFACE-WATER FLOW DIRECTION

APPROXIMATE BOUNDARY OF REFUSE BURNING GROUND

ND NOT DETECTED

COMPOUND (mg/kg)	PRG	BACKGROUND
BERYLLIUM	0.14	1.42

NOTES:

1. CONCENTRATIONS GIVEN IN MILLIGRAMS PER KILOGRAM (mg/kg).
2. CONCENTRATIONS EXCEEDING PRGs ARE SHADED.
3. ALL DETECTED ORGANICS ARE SHOWN IN THE FIGURE; ONLY INORGANICS EXCEEDING PRGs ARE SHOWN.
4. DEPTH INTERVALS WITH NO ORGANIC DETECTIONS OR NO INORGANIC CONCENTRATIONS EXCEEDING PRGs ARE NOT SHOWN.

TOPOGRAPHIC REFERENCE:

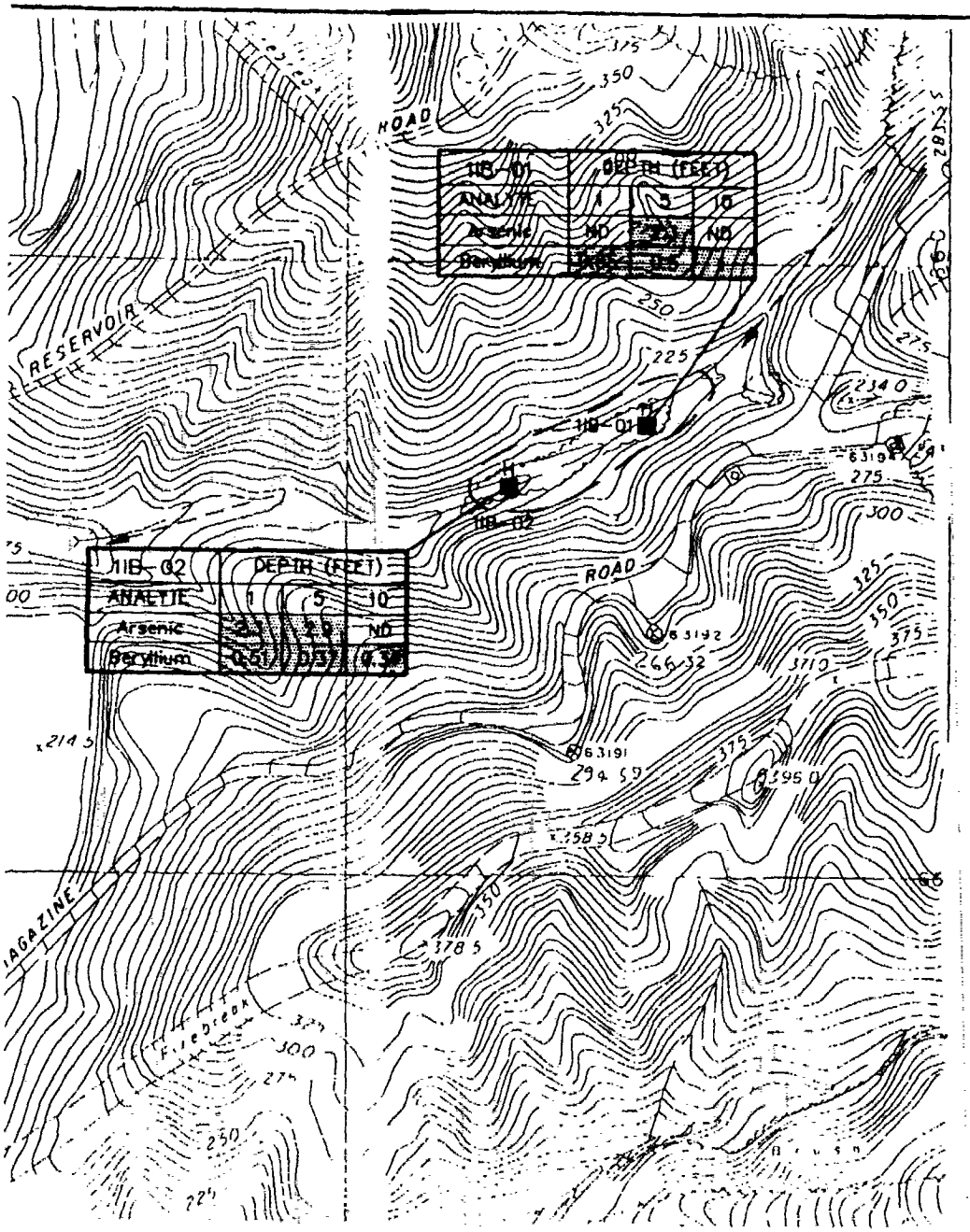
MARINE CORPS BASE CAMP PENDLETON GENERAL DEVELOPMENT MAPS 24A AND 24C. DATE: DECEMBER 1987

SCALE

0 200 400 FEET

FIGURE 2-14

SITE 1C - REFUSE BURNING GROUND



LEGEND

118-02 H — SOIL BORING LOCATION (H INDICATES HAND-AUGER SAMPLE)

SURFACE-WATER FLOW DIRECTION (EPHERMAL)

APPROXIMATE BOUNDARY OF REFUSE BURNING GROUND

ND — NOT DETECTED

COMPOUND (mg/kg)	PRG	BACKGROUND
ARSENIC	0.38	4.25
BERYLLIUM	0.14	1.42

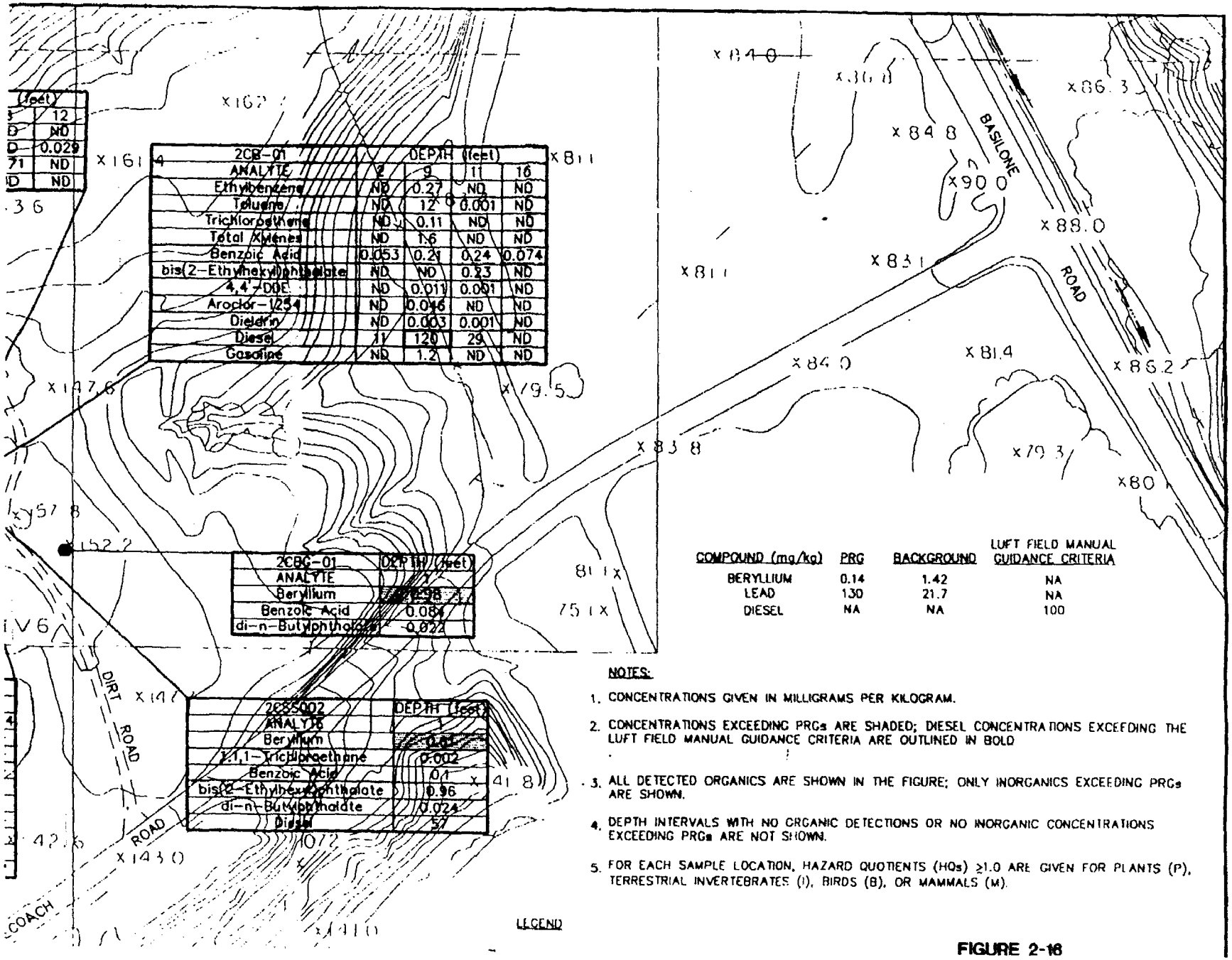
NOTES:

1. CONCENTRATIONS GIVEN IN MILLIGRAMS PER KILOGRAM.
2. CONCENTRATIONS EXCEEDING PRGs ARE SHADED.
3. ALL DETECTED ORGANICS ARE SHOWN IN THE FIGURE; ONLY INORGANICS EXCEEDING PRGs ARE SHOWN.
4. DEPTH INTERVALS WITH NO ORGANIC DETECTIONS OR NO INORGANIC CONCENTRATIONS EXCEEDING PRGs ARE NOT SHOWN.

SCALE

0 250 500 FEET

FIGURE 2-15



2CB-01	DEPTH (feet)			
ANALYTE	2	9	11	16
Ethylbenzene	ND	0.27	ND	ND
Toluene	ND	12	0.001	ND
Trichloroethene	ND	0.11	ND	ND
Total Xylenes	ND	1.6	ND	ND
Benzoic Acid	0.053	0.29	0.24	0.074
bis(2-Ethylhexyl)phthalate	ND	ND	0.23	ND
4,4'-DDE	ND	0.011	0.001	ND
Aroclor-1254	ND	0.046	ND	ND
Dieldrin	ND	0.003	0.001	ND
Diesel	11	120	29	ND
Gasoline	ND	1.2	ND	ND

2CBC-01	DEPTH (feet)
ANALYTE	7
Beryllium	1.98
Benzoic Acid	0.084
di-n-Butylphthalate	0.022

2CBS002	DEPTH (feet)
ANALYTE	1
Beryllium	0.61
1,1,1-Trichloroethane	0.002
Benzoic Acid	0.1
bis(2-Ethylhexyl)phthalate	0.96
di-n-Butylphthalate	0.024
Diesel	57

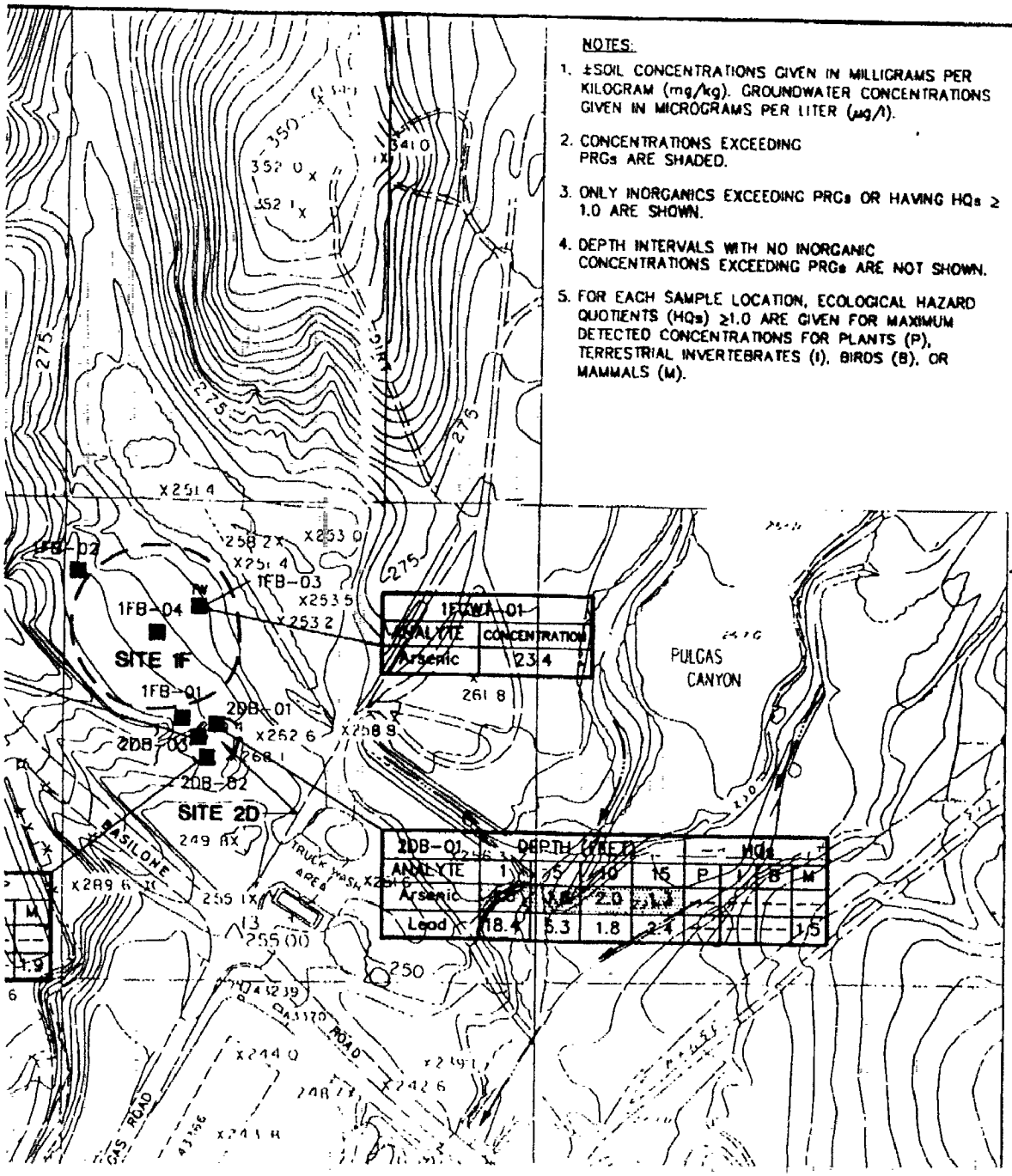
COMPOUND (mg/kg)	PRG	BACKGROUND	LUFT FIELD MANUAL GUIDANCE CRITERIA
BERYLLIUM	0.14	1.42	NA
LEAD	130	21.7	NA
DIESEL	NA	NA	100

NOTES:

1. CONCENTRATIONS GIVEN IN MILLIGRAMS PER KILOGRAM.
2. CONCENTRATIONS EXCEEDING PRGs ARE SHADED; DIESEL CONCENTRATIONS EXCEEDING THE LUFT FIELD MANUAL GUIDANCE CRITERIA ARE OUTLINED IN BOLD
3. ALL DETECTED ORGANICS ARE SHOWN IN THE FIGURE; ONLY INORGANICS EXCEEDING PRGs ARE SHOWN.
4. DEPTH INTERVALS WITH NO ORGANIC DETECTIONS OR NO INORGANIC CONCENTRATIONS EXCEEDING PRGs ARE NOT SHOWN.
5. FOR EACH SAMPLE LOCATION, HAZARD QUOTIENTS (HQs) ≥1.0 ARE GIVEN FOR PLANTS (P), TERRESTRIAL INVERTEBRATES (I), BIRDS (B), OR MAMMALS (M).

LEGEND

FIGURE 2-16



NOTES:

1. ±SOIL CONCENTRATIONS GIVEN IN MILLIGRAMS PER KILOGRAM (mg/kg). GROUNDWATER CONCENTRATIONS GIVEN IN MICROGRAMS PER LITER (µg/l).
2. CONCENTRATIONS EXCEEDING PRGs ARE SHADED.
3. ONLY INORGANICS EXCEEDING PRGs OR HAVING HQs ≥ 1.0 ARE SHOWN.
4. DEPTH INTERVALS WITH NO INORGANIC CONCENTRATIONS EXCEEDING PRGs ARE NOT SHOWN.
5. FOR EACH SAMPLE LOCATION, ECOLOGICAL HAZARD QUOTIENTS (HQs) ≥1.0 ARE GIVEN FOR MAXIMUM DETECTED CONCENTRATIONS FOR PLANTS (P), TERRESTRIAL INVERTEBRATES (I), BIRDS (B), OR MAMMALS (M).

SOIL COMPOUND (mg/kg)	PRG	BACKGROUND
ALUMINUM	77,000	40,000
ANTIMONY	31	8.8
ARSENIC	0.38	4.26
BERYLLIUM	0.14	1.2
CADMIUM	9	1.6
COLBALT	NA	9.85
COPPER	2,800	27.9
LEAD	130	15.1
IRON	NA	37,000
VANADIUM	540	102

GROUNDWATER COMPOUND (µg/l)	PRG	MCL
ARSENIC	50	0.045

LEGEND

1FGWT-01 TW — TEMPORARY WELL SAMPLE LOCATION

2DB-01 — SOIL BORING LOCATION

SURFACE-WATER FLOW DIRECTION

APPROXIMATE BOUNDARY OF REFUSE BURNING GROUND AND GREASE DISPOSAL PIT

ND — NOT DETECTED

-- — LESS THAN 1.0

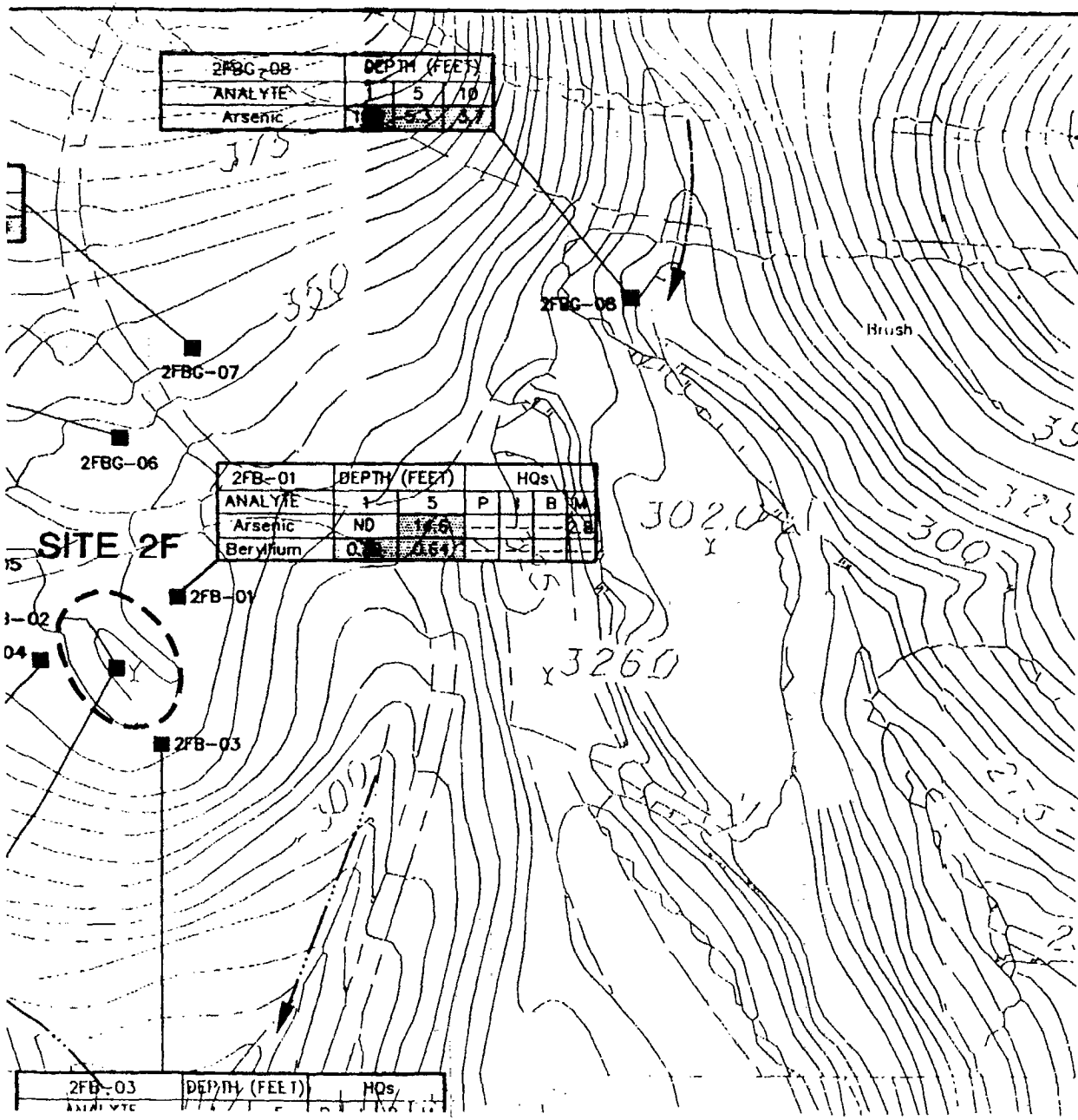
TOPOGRAPHIC REFERENCE:

MARINE CORPS BASE CAMP PENDLETON GENERAL DEVELOPMENT MAPS 36B, 36D, AND 37A.
DATE: DECEMBER 1987

SCALE

0 300 600 FEET

FIGURE 2-17



LEGEND

1HB-01 ■	SOIL BORING LOCATION
———	SURFACE-WATER FLOW DIRECTION
◯	APPROXIMATE BOUNDARY OF REFUSE BURNING GROUND OR GREASE DISPOSAL PIT
ND	NOT DETECTED
NA	NOT ANALYZED
--	LESS THAN 1.0

NOTES:

1. CONCENTRATIONS GIVEN IN MILLIGRAMS PER KILOGRAM (mg/kg).
2. CONCENTRATIONS EXCEEDING PRGs ARE SHADED.
3. ALL DETECTED ORGANICS ARE SHOWN IN THE FIGURE; ONLY INORGANICS EXCEEDING PRGs OR WITH HQs ≥1.0 ARE SHOWN.
4. DEPTH INTERVALS WITH NO ORGANIC DETECTIONS OR NO INORGANIC CONCENTRATIONS EXCEEDING PRGs ARE NOT SHOWN.
5. FOR EACH SAMPLE LOCATION, ECOLOGICAL HAZARD QUOTIENTS (HQs) ≥1.0 ARE GIVEN FOR THE MAXIMUM DETECTED CONCENTRATION FOR PLANTS (P), TERRESTRIAL INVERTEBRATES (I), BIRDS (B), OR MAMMALS (M).

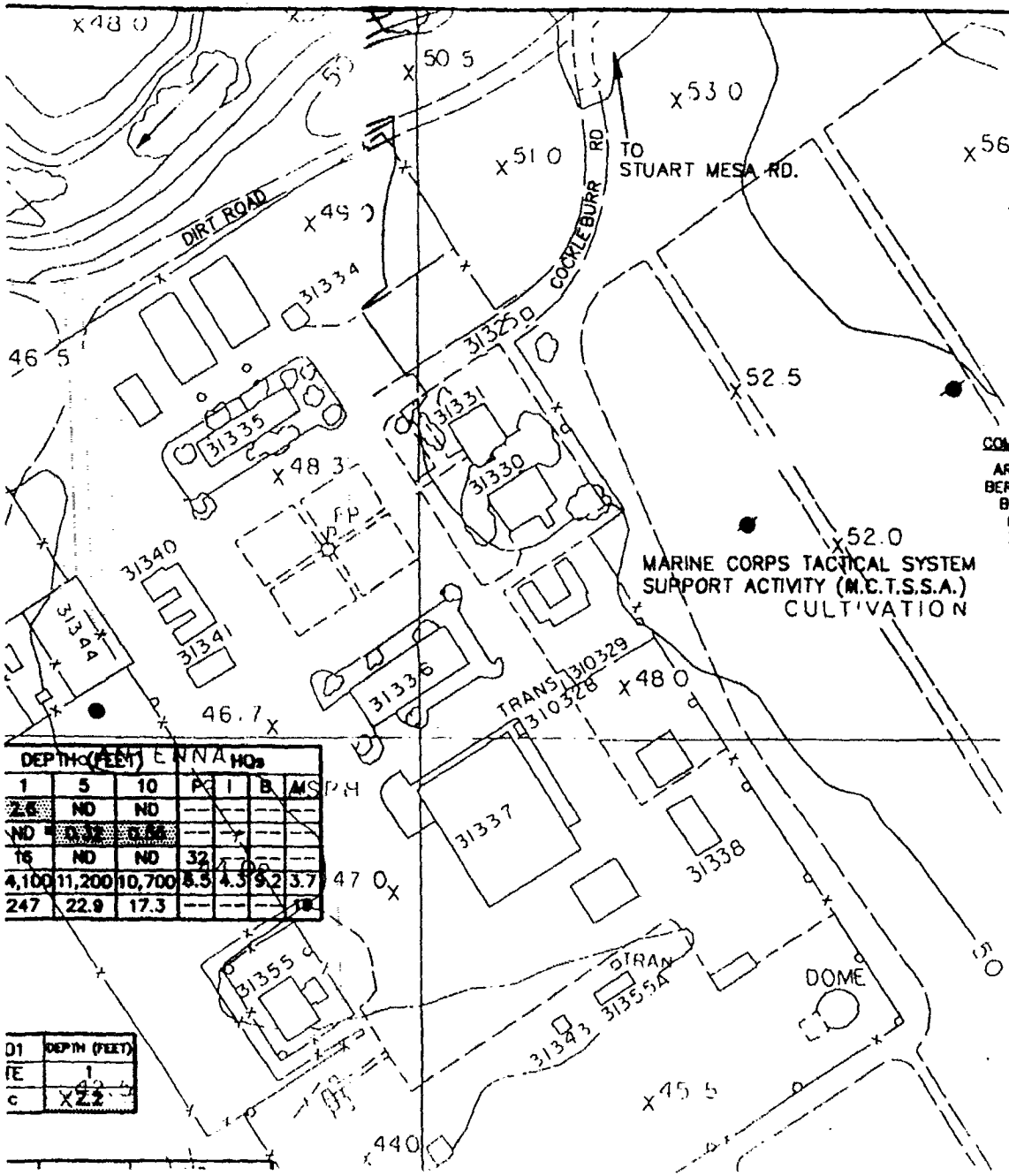
TOPOGRAPHIC REFERENCE:

MARINE CORPS BASE CAMP PENDLETON GENERAL DEVELOPMENT MAPS 57D, 58C, 67A, AND 66B. DATE: DECEMBER 1987

SCALE

0 100 200 FEET

FIGURE 2-18



LEGEND

2GB-03 ■	SOIL BORING LOCATION
2GSS001 ●	SURFACE SOIL SAMPLE LOCATION
2GGWT-01 ●	TEMPORARY WELL SAMPLE LOCATION
—— · —→	SURFACE-WATER FLOW DIRECTION
◯	APPROXIMATE BOUNDARY OF GREASE DISPOSAL PIT
ND	NOT DETECTED
--	LESS THAN 1.0
NA	NOT APPLICABLE

COMPOUND	SOIL PRG (mg/kg)	BACKGROUND (mg/kg)	TAP-WATER PRG (µg/l)	MCL (µg/l)
ARSENIC	0.38	2.67	0.045	50
BERYLLIUM	0.14	1.52	NA	NA
BORON	5,900	NA	NA	NA
IRON	NA	31,400	NA	NA
ZINC	23,000	67.4	NA	NA

NOTES:

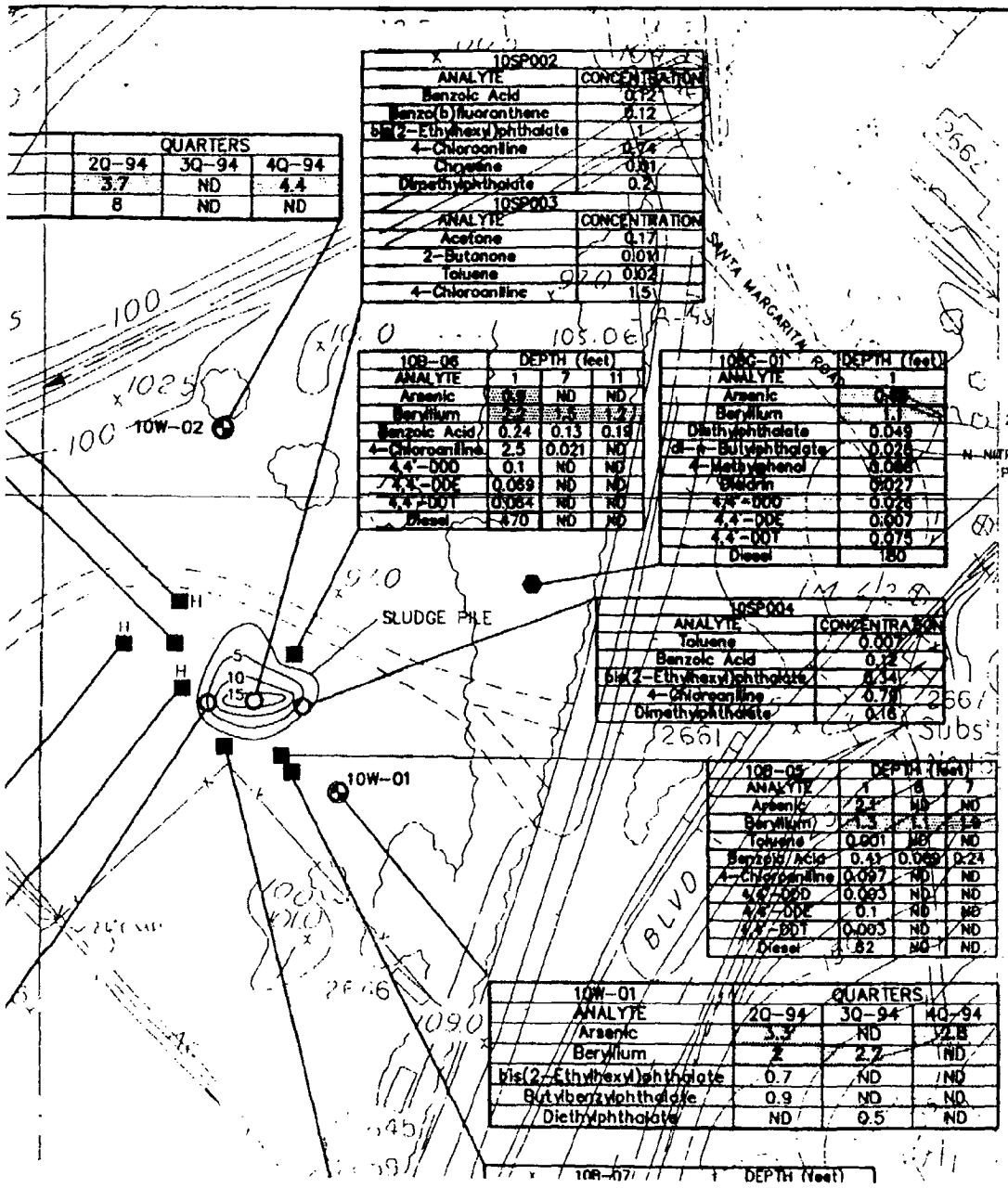
1. SOIL CONCENTRATIONS GIVEN IN MILLIGRAMS PER KILOGRAM. GROUNDWATER CONCENTRATIONS GIVEN IN MICROGRAMS PER LITER.
2. CONCENTRATIONS EXCEEDING PRGs ARE SHADED.
3. ALL DETECTED ORGANICS ARE SHOWN IN THE FIGURE; ONLY INORGANICS EXCEEDING PRGs OR HAVING HQs ≥1.0 ARE SHOWN.
4. DEPTH INTERVALS WITH NO ORGANIC DETECTIONS AND NO INORGANIC CONCENTRATIONS EXCEEDING PRGs ARE NOT SHOWN.
5. FOR EACH SAMPLE LOCATION, ECOLOGICAL HAZARD QUOTIENTS (HQs) ≥1.0 ARE GIVEN FOR THE MAXIMUM DETECTED CONCENTRATION FOR PLANTS (P), TERRESTRIAL INVERTEBRATES (I), BIRDS (B), OR MAMMALS (M).

TOPOGRAPHIC REFERENCE:

MARINE CORPS BASE CAMP PENDLETON GENERAL DEVELOPMENT MAPS 5C AND 9A. DATE: DECEMBER 1987

FIGURE 2-19

SITE 2G - GREASE DISPOSAL PIT



	QUARTERS		
	2Q-94	3Q-94	4Q-94
	3.7	ND	4.4
	8	ND	ND

10SP002	
ANALYTE	CONCENTRATION
Benzoic Acid	0.72
Benzo(b)fluoranthene	0.12
bis(2-Ethylhexyl)phthalate	1
4-Chloroaniline	0.74
Chrysene	0.01
Dimethylphthalate	0.2

10SP003	
ANALYTE	CONCENTRATION
Acetone	0.17
2-Butanone	0.01
Toluene	0.02
4-Chloroaniline	1.5

10B-06	DEPTH (feet)		
ANALYTE	1	7	11
Arsenic	[illegible]	ND	ND
Beryllium	2.2	1.5	1.7
Benzoic Acid	0.24	0.13	0.19
4-Chloroaniline	2.5	0.021	ND
4,4'-DDD	0.1	ND	ND
4,4'-DDE	0.069	ND	ND
4,4'-DDT	0.064	ND	ND
Diesel	470	ND	ND

10BG-01	DEPTH (feet)
ANALYTE	1
Arsenic	[illegible]
Beryllium	1.1
Diethylphthalate	0.049
di-n-Butylphthalate	0.026
4-Methylphenol	0.088
Dieldrin	0.027
4,4'-DDD	0.026
4,4'-DDE	0.007
4,4'-DDT	0.075
Diesel	180

10SP004	
ANALYTE	CONCENTRATION
Toluene	0.007
Benzoic Acid	0.12
bis(2-Ethylhexyl)phthalate	0.34
4-Chloroaniline	0.79
Dimethylphthalate	0.16

10B-05	DEPTH (feet)		
ANALYTE	1	6	7
Arsenic	2.4	ND	ND
Beryllium	1.3	1.1	1.9
Toluene	0.001	ND	ND
Benzoic Acid	0.43	0.069	0.24
4-Chloroaniline	0.097	ND	ND
4,4'-DDD	0.093	ND	ND
4,4'-DDE	0.1	ND	ND
4,4'-DDT	0.003	ND	ND
Diesel	82	ND	ND

10W-01	QUARTERS		
ANALYTE	2Q-94	3Q-94	4Q-94
Arsenic	3.3	ND	12.8
Beryllium	2	2.2	ND
bis(2-Ethylhexyl)phthalate	0.7	ND	ND
Butylbenzylphthalate	0.9	ND	ND
Diethylphthalate	ND	0.5	ND

10B-07 DEPTH (feet)

LEGEND

10SP001 ○	SOIL PILE SAMPLE LOCATION
10B-04 H ■	SOIL BORING LOCATION (H INDICATES HAND-AUGER SAMPLE) AND/OR SURFACE SOIL SAMPLE
10W-02 ⊕	MONITORING WELL LOCATION
10BG-01 ●	BACKGROUND SURFACE SOIL SAMPLE
— — — ►	SURFACE-WATER FLOW DIRECTION
ND	NOT DETECTED

SOIL COMPOUND (mg/kg)	PRG	BACKGROUND	LUFT FIELD MANUAL GUIDANCE CRITERIA
ANTIMONY	31	8.38	NA
ARSENIC	0.38	4.25	NA
BERYLLIUM	0.14	1.42	NA
MANGANESE	3,200	655	NA
LEAD	130	21.7	NA
2,4-DINITROTOLUENE	0.65	NA	NA
DIESEL	NA	NA	100
N-NITROSO-DI-N-PROPYLAMINE	0.022	NA	NA
PENTACHLOROPHENOL	2.5	NA	NA
BENZO(a)PYRENE	0.061	NA	NA

GROUNDWATER COMPOUND (µg/l)	MCL	TAP-WATER PRG
ARSENIC	50	0.045
BERYLLIUM	4	0.016
BENZOIC ACID	–	150,000
BIS(2-ETHYLHEXYL)PHTHALATE	4	4.8
BUTYLBENZYLPHTHALATE	–	7,300
DIETHYLPHTHALATE	–	29,000

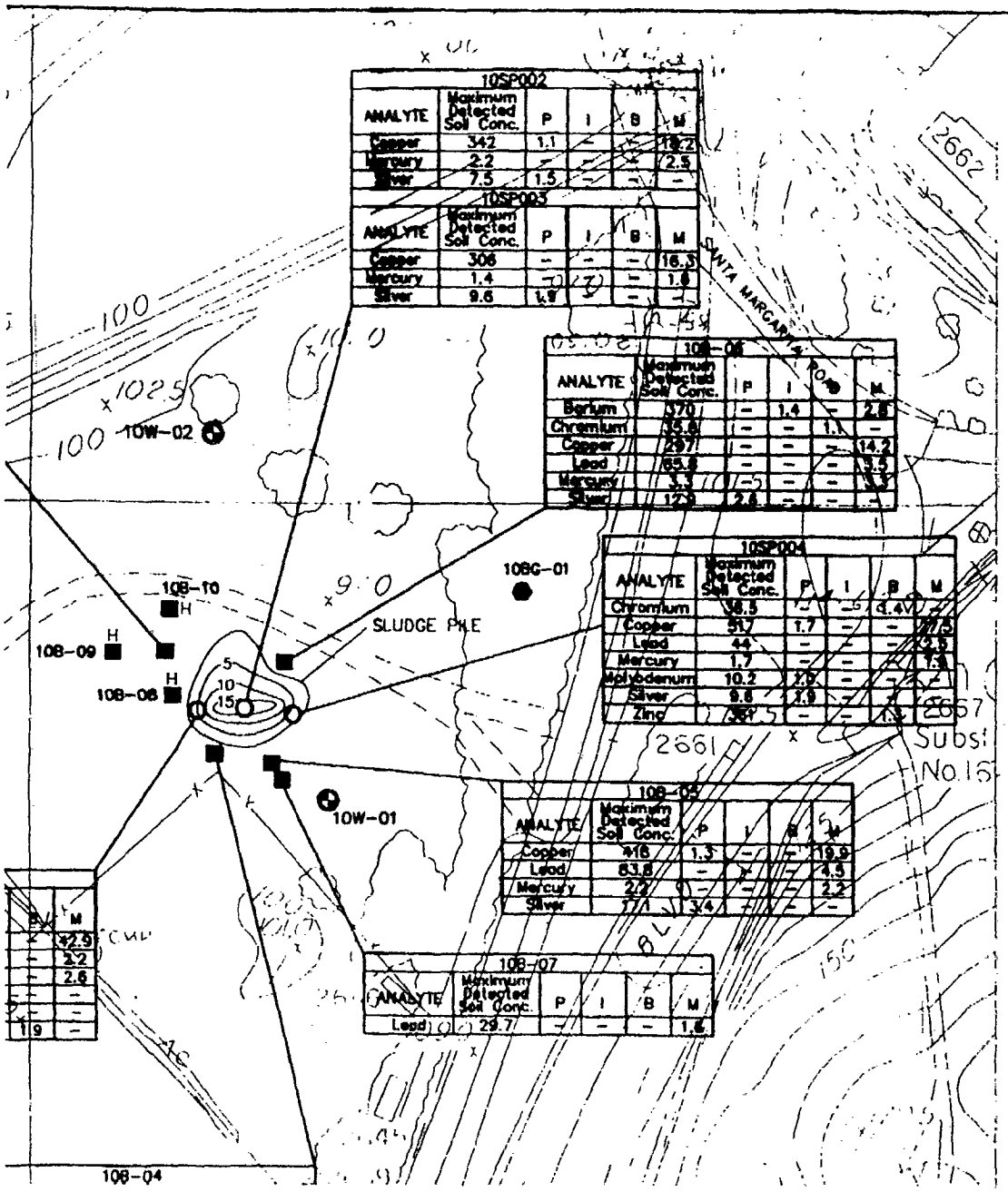
NOTES:

1. SOIL CONCENTRATIONS GIVEN IN MILLIGRAMS PER KILOGRAM. GROUNDWATER CONCENTRATIONS ARE GIVEN IN MICROGRAMS PER LITER.
2. CONCENTRATIONS EXCEEDING PRGs ARE SHADED; DIESEL CONCENTRATIONS EXCEEDING THE LUFT FIELD MANUAL GUIDANCE ARE ARE OUTLINED IN BOLD.
3. ALL DETECTED ORGANICS ARE SHOWN IN THE FIGURE; ONLY INORGANICS EXCEEDING PRGs ARE SHOWN.
4. DEPTH INTERVALS WITH NO DETECTS EXCEEDING PRGs ARE NOT SHOWN

TOPOGRAPHIC REFERENCES:
MARINE CORPS BASE CAMP PENDLETON GENERAL DEVELOPMENT MAPS 30B AND 23D DATE: DECEMBER 1987

FIGURE 2-20

SITE 10 - 26 AREA SEWAGE SLUDGE



LEGEND

10SP001	○	SOIL PILE SAMPLE LOCATION
10B-04	H ■	SOIL BORING LOCATION (H INDICATES HAND-AUGER SAMPLE)
10W-02	◐	MONITORING WELL LOCATION
10BG-01	⬢	BACKGROUND SURFACE SOIL SAMPLE
ND		NOT DETECTED
--		LESS THAN 1.0

NOTES:

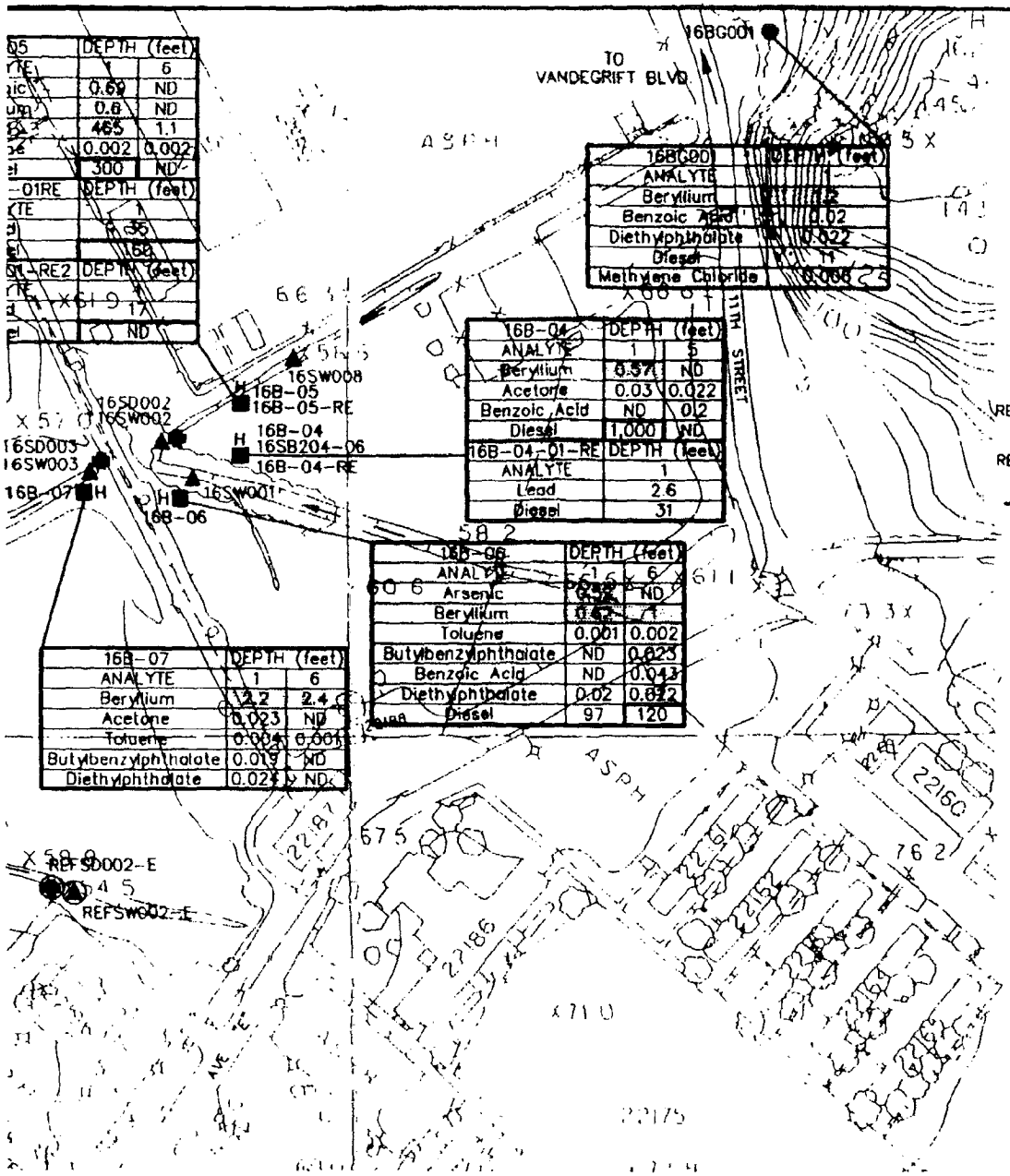
1. FOR EACH SAMPLE LOCATION, CONCENTRATIONS ARE GIVEN IN MILLIGRAMS PER KILOGRAM FOR INORGANIC ANALYTES AND IN MICROGRAMS PER KILOGRAM FOR ORGANIC ANALYTES.
2. HAZARD QUOTIENTS HQs ≥1.0 ARE GIVEN FOR PLANTS (P), TERRESTRIAL INVERTEBRATES (I), BIRDS (B), OR MAMMALS (M).

TOPOGRAPHIC REFERENCES:
MARINE CORPS BASE CAMP PENDLETON GENERAL DEVELOPMENT MAPS 30B AND 23D. DATE: DECEMBER 1987

SCALE
0 150 300 FEET

FIGURE 2-21

SITE 10 - 26 AREA SEWAGE SLUDGE COMPOSTING YARD



16BG001	DEPTH (feet)	
ANALYTE	1	6
Beryllium	0.69	ND
Benzoic Acid	0.6	ND
Diesel	465	1.1
Methylene Chloride	0.002	0.002
	300	ND

16B-01RE	DEPTH (feet)	
ANALYTE	1	6
	35	
	68	

16B-01RE2	DEPTH (feet)	
ANALYTE	1	6
	17	
	ND	

16BG001	DEPTH (feet)	
ANALYTE	1	6
Beryllium	0.12	ND
Benzoic Acid	0.02	ND
Diethylphthalate	0.022	ND
Diesel	11	ND
Methylene Chloride	0.008	0.0

16B-04	DEPTH (feet)	
ANALYTE	1	5
Beryllium	0.57	ND
Acetone	0.03	0.022
Benzoic Acid	ND	0.2
Diesel	1,000	ND

16B-04-01-RE	DEPTH (feet)
ANALYTE	1
Lead	2.6
Diesel	31

16B-06	DEPTH (feet)	
ANALYTE	1	6
Arsenic	[illegible]	ND
Beryllium	0.42	[illegible]
Toluene	0.001	0.002
Butylbenzylphthalate	ND	0.023
Benzoic Acid	ND	0.043
Diethylphthalate	0.02	0.022
Diesel	97	120

16B-07	DEPTH (feet)	
ANALYTE	1	6
Beryllium	2.2	2.4
Acetone	0.023	ND
Toluene	0.004	0.001
Butylbenzylphthalate	0.019	ND
Diethylphthalate	0.02	ND

LEGEND

- 16SW001 ▲ SURFACE-WATER SAMPLE LOCATION. SAMPLES COLLECTED DURING 3/94 AND 2/95. NO WATER PRESENT IN 11/94
- 16SW003 ▲ SURFACE-WATER SAMPLE LOCATION. SAMPLES COLLECTED DURING 3/94, 11/94, AND 2/95.
- 16SW005 ▲ SURFACE-WATER SAMPLE LOCATION. SAMPLES COLLECTED DURING 3/94 NO WATER PRESENT IN 11/94 AND 2/95.
- 16SD002 ● PHASE 2 SEDIMENT SAMPLE LOCATION
- 16B-04 ■H HAND-AUGER SOIL BORING LOCATION
- 16B-04-RE PHASE 2 SURFACE SOIL SAMPLE COLLECTED AT SPECIFIED SAMPLING LOCATION
- 16BG-01 ● BACKGROUND SURFACE SOIL SAMPLE
- REFSW002-E ECOLOGICAL RISK ASSESSMENT REFERENCE SURFACE-WATER SAMPLE
- REFSD002-E ECOLOGICAL RISK ASSESSMENT REFERENCE SEDIMENT SAMPLE
- → SURFACE-WATER FLOW DIRECTION
- ND NOT DETECTED

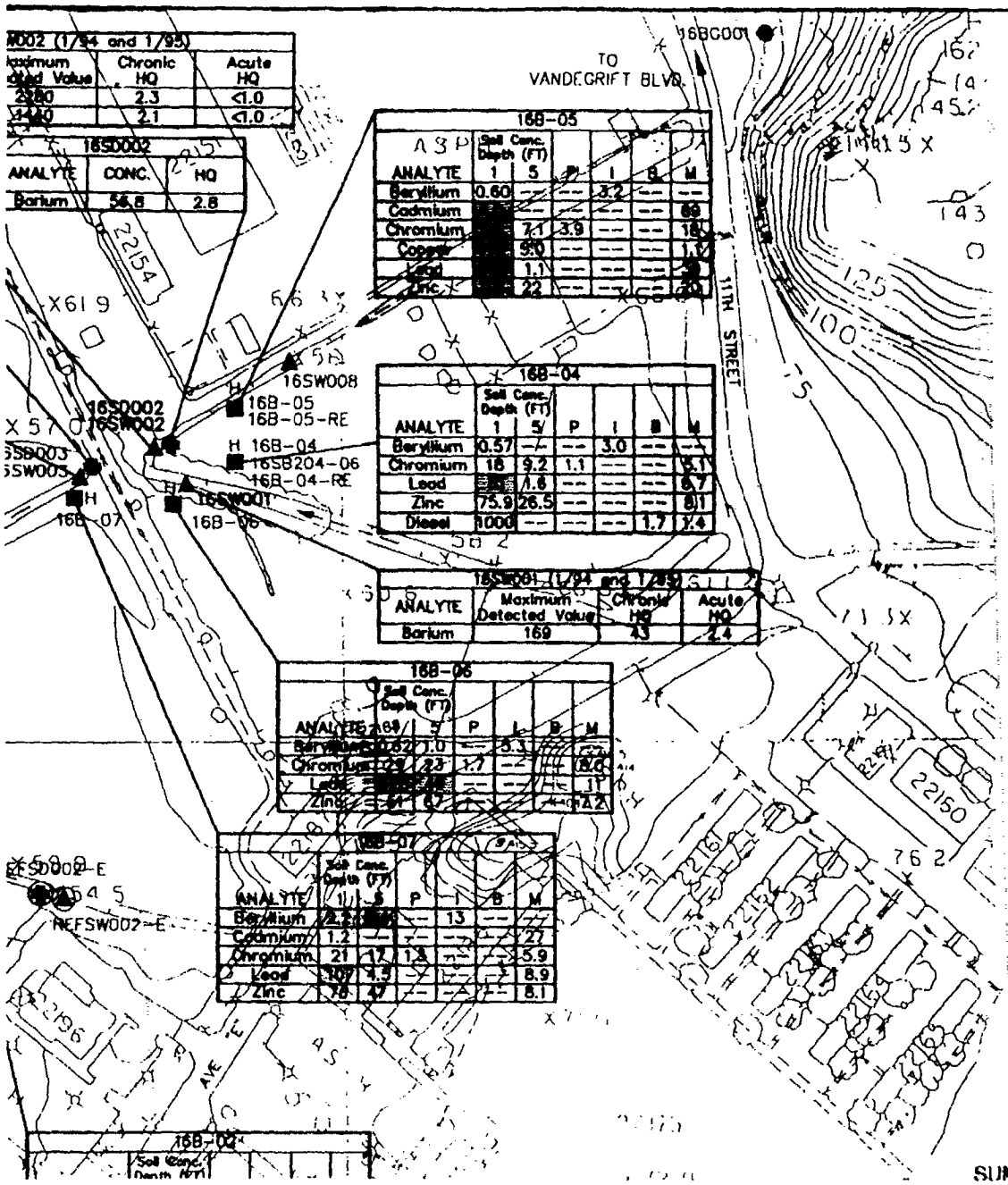
COMPOUND (mg/kg)	PRG	BACKGROUND	LUFT MANUAL GUIDANCE CRITERIA
ARSENIC	0.38	4.25	NA
BERYLLIUM	0.14	1.42	NA
DIESEL	NA	NA	100
LEAD	130	21.7	NA

NOTES:

1. CONCENTRATIONS GIVEN IN MILLIGRAMS PER KILOGRAM
2. CONCENTRATIONS EXCEEDING PRGs ARE SHADED; DIESEL CONCENTRATIONS EXCEEDING THE LUFT FIELD MANUAL GUIDANCE ARE OUTLINED IN BOLD.
3. ALL DETECTED ORGANICS ARE SHOWN IN THE FIGURE; ONLY INORGANICS EXCEEDING PRGs ARE SHOWN.
4. DEPTH INTERVALS WITH NO ORGANIC DETECTS OR NO INORGANIC CONCENTRATIONS EXCEEDING PRGs ARE NOT SHOWN.

FIGURE 2-22

SITE 16 - 22 AREA BUILDINGS 22151 AND 22187 DITCH CONFLUENCE AND DITCH



16SW002 (1/94 and 1/95)		
Maximum Detected Value	Chronic HQ	Acute HQ
2880	2.3	<1.0
2440	2.1	<1.0

16SD002		
ANALYTE	CONC.	HQ
Barium	56.8	2.8

16B-05						
	Soil Conc. Depth (FT)					
ANALYTE	1	5	P	I	B	M
Beryllium	0.60	--	--	3.2	--	--
Cadmium	[illegible]	--	--	--	--	69
Chromium	[illegible]	7.1	3.9	--	--	18
Copper	[illegible]	5.0	--	--	--	[illegible]
Lead	[illegible]	1.1	--	--	--	[illegible]
Zinc	[illegible]	22	--	--	--	[illegible]

16B-04						
	Soil Conc. Depth (FT)					
ANALYTE	1	5	P	I	B	M
Beryllium	0.57	--	--	3.0	--	--
Chromium	18	9.2	1.1	--	--	5.1
Lead	[illegible]	1.6	--	--	--	6.7
Zinc	75.9	26.5	--	--	--	8.1
Diesel	1000	--	--	--	1.7	1.4

16SW001 (1/94 and 1/95)			
ANALYTE	Maximum Detected Value	Chronic HQ	Acute HQ
Barium	169	4.3	2.4

16B-06						
	Soil Conc. Depth (FT)					
ANALYTE	1	5	P	I	B	M
Beryllium	0.62	1.0	--	3.3	--	--
Chromium	29	23	1.7	--	--	8.0
Lead	[illegible]	[illegible]	--	--	--	11
Zinc	[illegible]	67	--	--	--	7.2

16B-07						
	Soil Conc. Depth (FT)					
ANALYTE	1	5	P	I	B	M
Beryllium	[illegible]	[illegible]	--	13	--	--
Cadmium	1.2	--	--	--	--	27
Chromium	21	17	1.8	--	--	5.9
Lead	107	4.5	--	--	--	8.9
Zinc	78	47	--	--	--	8.1

16B-02
Soil Conc. Depth (FT)

LEGEND

16SW001 ▲	SURFACE-WATER SAMPLE LOCATION. SAMPLES COLLECTED DURING 3/94 AND 2/95. NO WATER PRESENT IN 11/94.
16SW003 ▲	SURFACE-WATER SAMPLE LOCATION. SAMPLES COLLECTED DURING 3/94, 11/94, AND 2/95.
16SW005 ▲	SURFACE-WATER SAMPLE LOCATION. SAMPLES COLLECTED DURING 3/94. NO WATER PRESENT IN 11/94 AND 2/95.
16SD002 ●	SEDIMENT SAMPLE LOCATION
H 16B-04 ■	HAND-AUGER SOIL BORING LOCATION
16SB204-06	QUALITY CONTROL (DUPLICATE) SOIL SAMPLE COLLECTED AT SPECIFIED SAMPLING LOCATION
16B-04-RE	PHASE 2 SOIL SAMPLE COLLECTED AT SPECIFIED SAMPLING LOCATION
16BG-01 ●	BACKGROUND SURFACE SOIL SAMPLE
REFSW002-E ▲	ECOLOGICAL RISK ASSESSMENT REFERENCE SURFACE-WATER SAMPLE
REFSD002-E ●	ECOLOGICAL RISK ASSESSMENT REFERENCE SEDIMENT SAMPLE
— — →	SURFACE-WATER FLOW DIRECTION

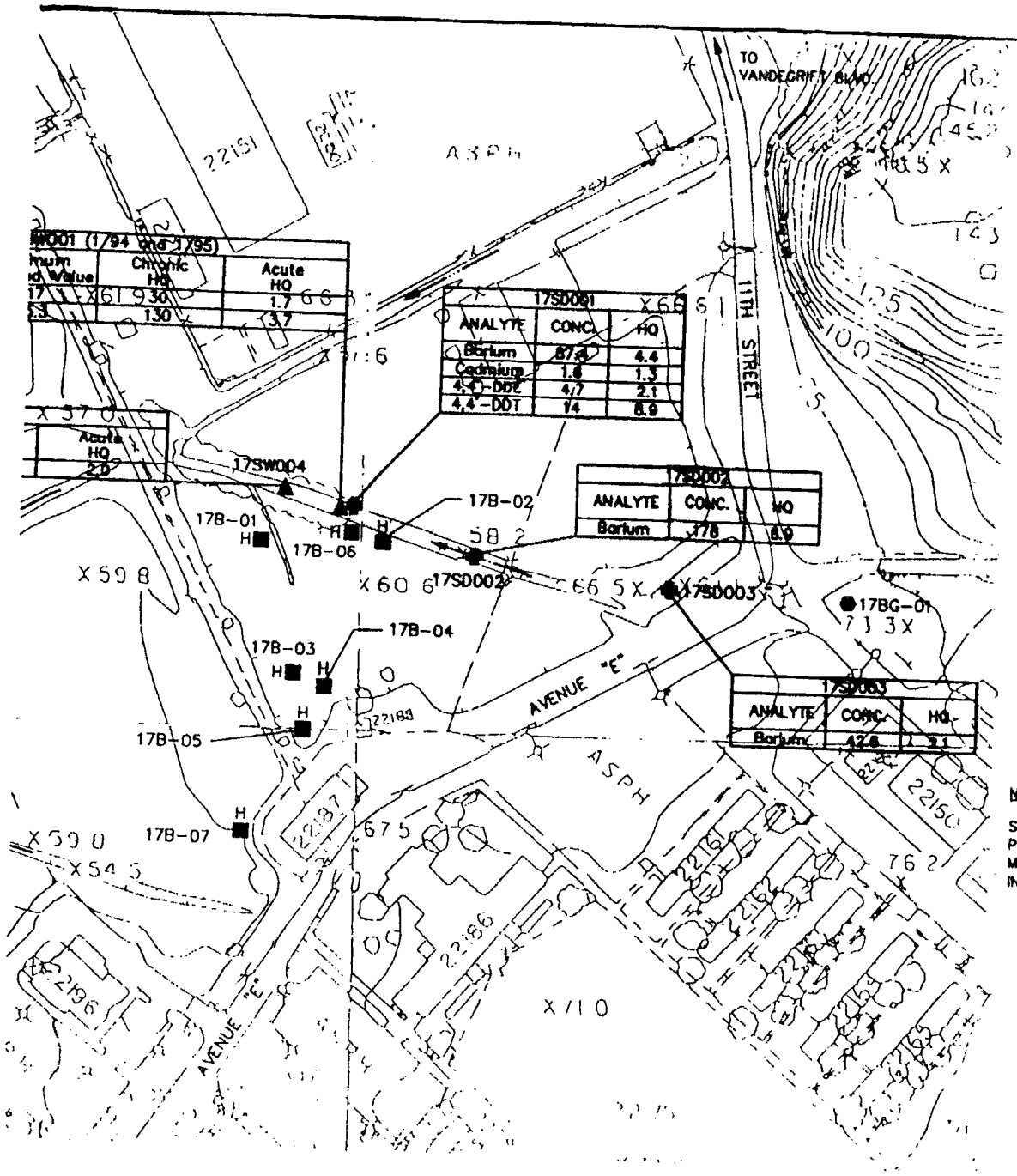
ANALYTE	SOIL BACKGROUND CONCENTRATION (mg/kg)
BARIUM	262
BERYLLIUM	1.52
CADMIUM	1.58
CHROMIUM	33
COPPER	26.8
IRON	26,459
LEAD	29.1
ZINC	111

NOTES:

1. FOR EACH SAMPLE LOCATION, ANALYTE CONCENTRATION GIVEN IN MILLIGRAMS PER KILOGRAM (mg/kg). HAZARD QUOTIENT ≥1.0 ARE GIVEN FOR PLANTS (P), TERRESTRIAL INVERTEBRATES (I), BIRDS (B), OR MAMMALS (M).
2. SHADING INDICATES THAT CONCENTRATIONS EXCEED BACKGROUND FOR THE SANTA MARGARITA BASIN.
3. SURFACE-WATER CONCENTRATIONS GIVEN IN MICROGRAMS PER LITER (µg/l); SEDIMENT CONCENTRATIONS GIVEN IN MILLIGRAMS PER KILOGRAM (mg/kg) FOR INORGANICS AND IN MICROGRAMS PER KILOGRAM (µg/kg) FOR ORGANICS

FIGURE 2-23

SITE 16 - 22 AREA BUILDINGS 22151 AND 22187 DITCH CONFLUENCE AND DITCH SUMMARY OF SOIL, SEDIMENT, AND SURFACE-



LEGEND

17SW001 ▲	SURFACE-WATER SAMPLE LOCATION SAMPLES COLLECTED DURING MARCH 1994 AND FEB. 1995.
17SW004 ⊗	SURFACE-WATER SAMPLE LOCATION SAMPLE COLLECTED DURING FEB. 1995. NO WATER PRESENT IN MARCH 1994.
17SD002 ●	PHASE 2 SEDIMENT SAMPLE LOCATION
17B-07 H ■	SOIL BORING LOCATION (H INDICATES HAND-AUGER SAMPLE)
17BG-01 ●	BACKGROUND SURFACE SOIL SAMPLE
——→	SURFACE-WATER FLOW DIRECTION
CONC.	CONCENTRATION
HQ	HAZARD QUOTIENT
ND	NOT DETECTED
NA	NOT AVAILABLE

SURFACE-WATER INORGANICS (µg/l)	PLE	BACKGROUND
BARIUM	3.9	NA
SILVER	0.12	NA
SEDIMENT INORGANICS (mg/kg)	**PLE**	**BACKGROUND**
BARIUM	2.0	262
CADMIUM	1.2	1.6
SEDIMENT ORGANICS (µg/kg)	**PLE**	**BACKGROUND**
4,4'-DDE	2.2	NA
4,4'-DDT	1.6	NA

NOTE:

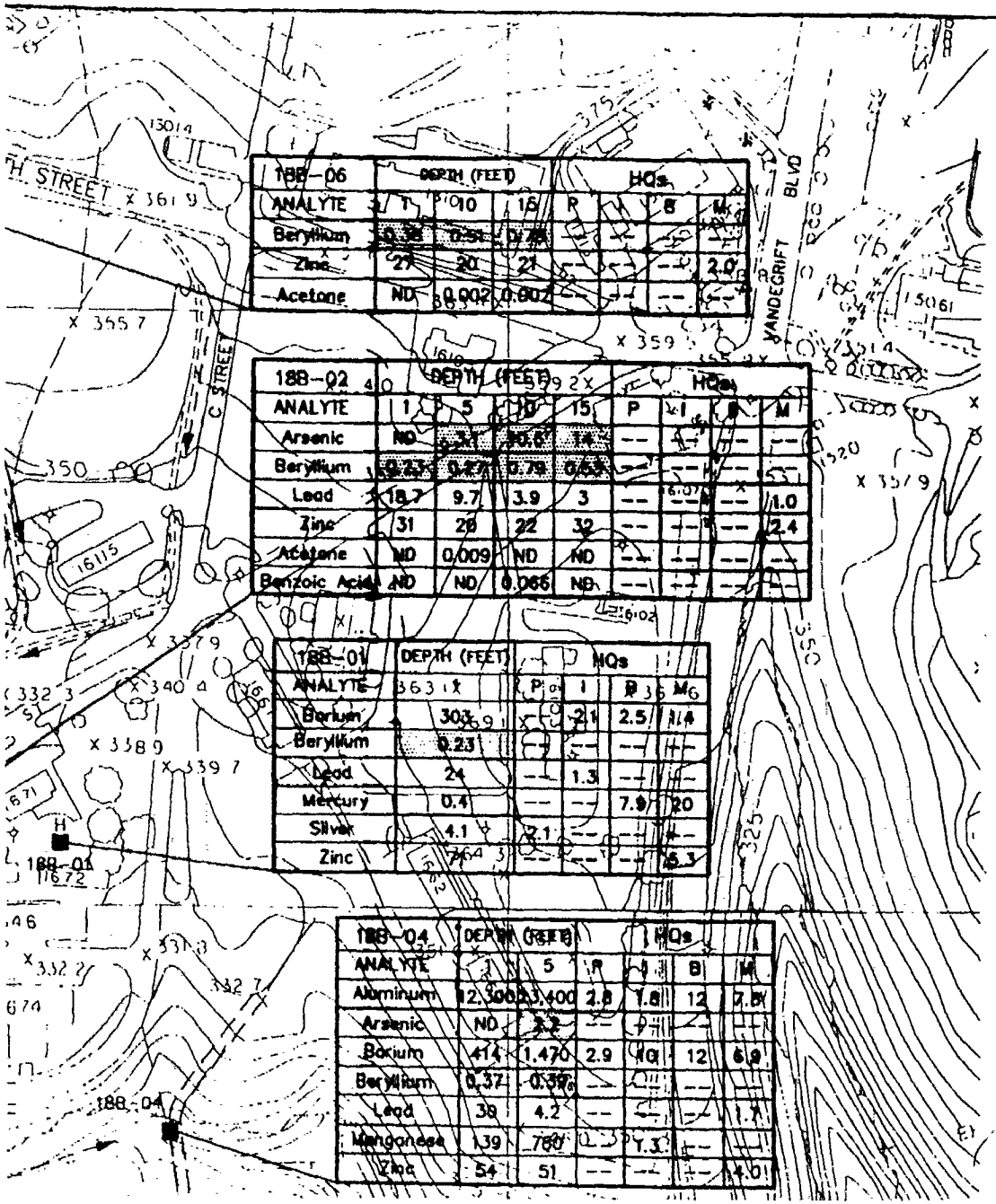
SURFACE-WATER CONCENTRATIONS GIVEN IN MICROGRAMS PER LITER (µg/l). SEDIMENT CONCENTRATIONS GIVEN IN MILLIGRAMS PER KILOGRAM (mg/kg) FOR INORGANICS AND IN MICROGRAMS PER KILOGRAM (µg/kg) FOR ORGANICS.

TOPOGRAPHIC REFERENCE:
MARINE CORPS BASE CAMP PENDLETON GENERAL DEVELOPMENT MAP 16C DATE: DECEMBER 1987

SCALE
0 200 400 FEET

FIGURE 2-24

SITE 17 - 22 AREA BUILDING 22187 MARSH AND DITCH SUMMARY OF SURFACE-WATER AND



18B-06	DEPTH (FEET)			HQs			
ANALYTE	1	10	15	P	I	B	M
Beryllium	0.38	0.54	0.78	--	--	--	--
Zinc	27	20	21	--	--	--	2.0
Acetone	ND	0.002	0.002	--	--	--	--

18B-02	DEPTH (FEET)				HQs			
ANALYTE	1	5	10	15	P	I	B	M
Arsenic	ND	3.1	10.6	14	--	--	--	--
Beryllium	0.23	0.27	0.79	0.63	--	--	--	--
Lead	18.7	9.7	3.9	3	--	--	--	1.0
Zinc	31	28	22	32	--	--	--	2.4
Acetone	ND	0.009	ND	ND	--	--	--	--
Benzoic Acid	ND	ND	0.066	ND	--	--	--	--

18B-01	DEPTH (FEET)	HQs			
ANALYTE	1	P	I	B	M
Barium	303	--	2.1	2.5	1.4
Beryllium	0.23	--	--	--	--
Lead	24	--	1.3	--	--
Mercury	0.4	--	--	7.9	20
Silver	4.1	2.1	--	--	--
Zinc	364	--	--	--	5.3

18B-04	DEPTH (FEET)		HQs			
ANALYTE	1	5	P	I	B	M
Aluminum	12,300	23,400	2.8	1.8	12	7.8
Arsenic	ND	3.2	--	--	--	--
Barium	414	1,470	2.9	10	12	6.9
Beryllium	0.37	0.59	--	--	--	--
Lead	39	4.2	--	--	--	1.7
Manganese	139	760	--	7.3	--	--
Zinc	54	51	--	--	--	4.0

LEGEND

18B-03 H — SOIL BORING LOCATION (H INDICATES HAND-AUGER SAMPLE)

18SB01 — SOIL BORING LOCATION SAMPLED DURING BECHTEL NATIONAL, INC., 1996 INVESTIGATION

18MW-01 — ATTEMPTED WELL BORING LOCATION DRILLED AND SAMPLED DURING BECHTEL NATIONAL, INC., 1996 INVESTIGATION (REFUSAL PREVENTED GROUNDWATER SAMPLING)

— — — → UNLINED DRAINAGE DITCH

——→ CONCRETE-LINED DITCH

ND NOT DETECTED

HQs HAZARD QUOTIENTS

COMPOUND (mg/kg)	PRG	BACKGROUND
ARSENIC	0.38	16
BERYLLIUM	0.14	1.42

NOTES:

1. CONCENTRATIONS GIVEN IN MILLIGRAMS PER KILOGRAM (mg/kg).
2. CONCENTRATIONS ABOVE PRGs ARE SHADED.
3. ALL DETECTED ORGANICS ARE SHOWN IN THE FIGURE; ONLY INORGANICS EXCEEDING PRGs OR HQs ≥1.0 ARE SHOWN.
4. DEPTH INTERVALS WITH NO ORGANIC DETECTIONS OR NO INORGANIC CONCENTRATIONS EXCEEDING PRGs OR WITH HAZARD QUOTIENTS ≥1.0 ARE NOT SHOWN.
5. FOR EACH SAMPLE LOCATION, HAZARD QUOTIENTS ≥1.0 ARE GIVEN FOR PLANTS(P), TERRESTRIAL INVERTEBRATES(I), BIRDS(B), OR MAMMALS(M)

TOPOGRAPHIC REFERENCE:

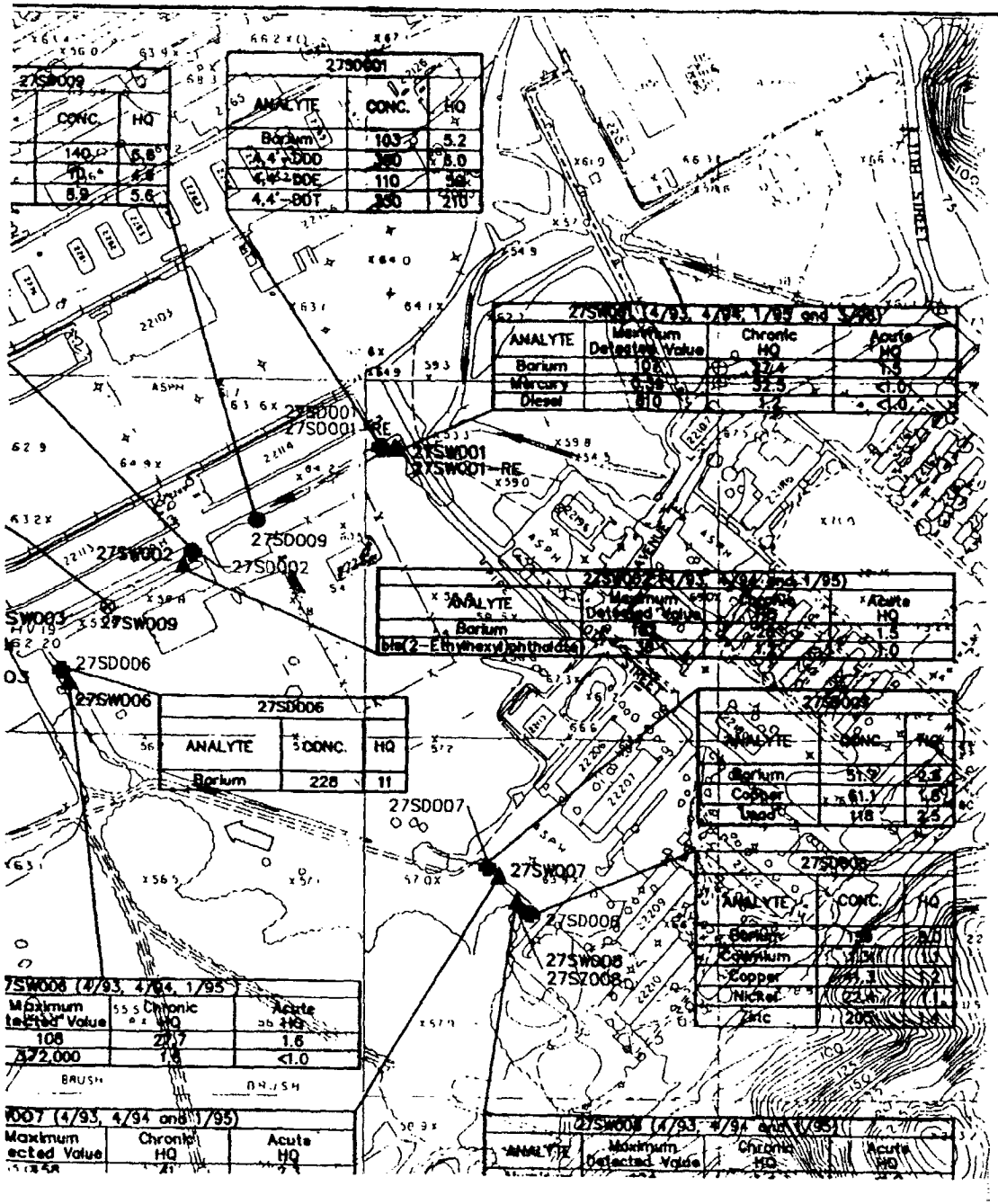
MARINE CORPS BASE CAMP PENDLETON GENERAL DEVELOPMENT MAPS 24A AND 17C. DATE: DECEMBER 1987

SCALE

0 250 500 FEET

FIGURE 2-25

SITE 18 — 13/18 AREA BUILDING



LEGEND

27SW004 ▲	PHASE 1 SURFACE-WATER SAMPLE LOCATIONS. SAMPLES COLLECTED DURING 12/93, 11/94, AND 2/95.
27SW001-RE	PHASE 2 SURFACE-WATER SAMPLE COLLECTED AT SPECIFIED SAMPLING LOCATION.
27SW009 ⊗	PHASE 2 SURFACE-WATER SAMPLE LOCATION. SAMPLE COLLECTED DURING 6/96.
27SD009 ●	PHASE 1 SEDIMENT SAMPLE LOCATION.
27SD001-RE	PHASE 2 SEDIMENT SAMPLE COLLECTED AT SPECIFIED SAMPLING LOCATION.
27SD009 ●	PHASE 2 SEDIMENT SAMPLE LOCATION.
—— →	SURFACE-WATER FLOW DIRECTION
⇦	APPROXIMATE GROUNDWATER FLOW DIRECTION

HQ HAZARD QUOTIENT

NA NOT APPLICABLE

ND NOT DETECTED

SEDIMENT INORGANICS (mg/kg)	PLE	BACKGROUND
BARIUM	20	262
CADMIUM	1.2	1.6
COPPER	34	26.8
LEAD	46.7	29.1
MANGANESE	460	688
NICKEL	20.9	22.5
ZINC	150	111

SEDIMENT ORGANICS (µg/kg)	PLE	BACKGROUND
AROCLOR-1260	5	NA
4,4'-DDD	63	NA
4,4'-DDE	2.2	NA
4,4'-DDT	1.58	NA

SURFACE-WATER INORGANICS (µg/l)	PLE
ALUMINUM	87
BARIUM	3.9
CHLORIDE	230,000
CYANIDE	5.2
IRON	1,000
MANGANESE	1,100
MERCURY	0.012
SILVER	0.12

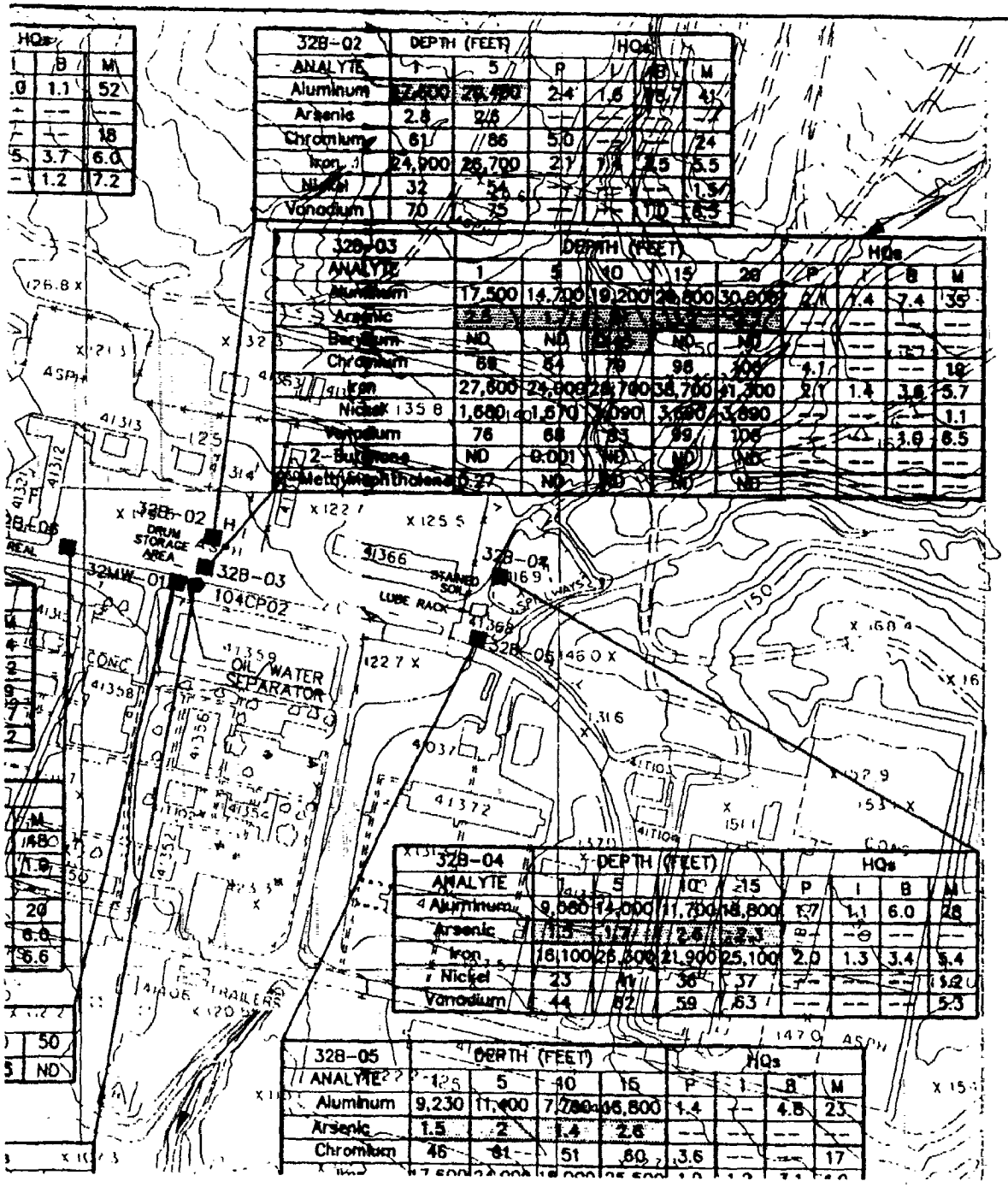
SURFACE-WATER ORGANICS (µg/l)	PLE
BENZOIC ACID	2.0
BIS(2-ETHYLHEXYL)PHTHALATE	32
DIESEL	690

NOTE:
SURFACE-WATER CONCENTRATIONS GIVEN IN MICROGRAMS PER LITER (µg/l); SEDIMENT CONCENTRATIONS GIVEN IN MILLIGRAMS PER KILOGRAM (mg/kg) FOR INORGANICS AND MICROGRAMS PER KILOGRAM (µg/kg) FOR ORGANICS.

FIGURE 2-26

SITE 27 - 22 AREA DITCHES

BELMAR PLUMBING 22210



32B-02	DEPTH (FEET) 1	5	HQs P	I	B	M
ANALYTE						
Aluminum	22,600	26,400	2.4	1.6	16.7	41
Arsenic	2.8	2.6	--	--	--	--
Chromium	61	86	5.0	--	--	24
Iron	24,900	26,700	2.1	1.4	2.5	5.5
Nickel	32	34	--	--	--	1.3
Vanadium	70	75	--	--	10	6.5

32B-03	DEPTH (FEET) 1	5	10	15	20	HQs P	I	B	M
ANALYTE									
Aluminum	17,500	14,700	19,200	26,800	30,800	2.1	1.4	7.4	35
Arsenic	2.6	1.7	[illegible]	[illegible]	[illegible]	--	--	--	--
Beryllium	ND	ND	[illegible]	ND	ND	--	--	--	--
Chromium	68	84	79	98	106	4.1	--	--	18
Iron	27,600	24,900	28,700	38,700	41,300	2.1	1.4	3.8	5.7
Nickel	1,680	1,670	1,090	3,690	3,890	--	--	--	1.1
Vanadium	76	68	83	99	106	--	--	3.0	6.5
2-Butanone	ND	0.001	ND	ND	ND	--	--	--	--
2-Methylnaphthalene	0.27	ND	ND	ND	ND	--	--	--	--

32B-04	DEPTH (FEET) 1	5	10	15	HQs P	I	B	M
ANALYTE								
Aluminum	9,660	14,000	11,700	18,800	1.7	1.1	6.0	28
Arsenic	1.5	1.7	2.6	2.3	--	--	--	--
Iron	16,100	26,300	21,900	25,100	2.0	1.3	3.4	5.4
Nickel	23	41	36	37	--	--	--	1.2
Vanadium	44	62	59	63	--	--	--	5.3

32B-05	DEPTH (FEET) 1	5	10	15	HQs P	I	B	M
ANALYTE								
Aluminum	9,230	11,400	7,780	16,800	1.4	--	4.8	23
Arsenic	1.5	2	1.4	2.6	--	--	--	--
Chromium	46	61	51	80	3.6	--	--	17

LEGEND

32B-01 ■ SOIL BORING LOCATION (H INDICATES HAND-AUGER SAMPLE)

32MW-01 ■ ATTEMPTED WELL BORING LOCATION DRILLED AND SAMPLED DURING BECHTEL NATIONAL, INC., 1996 INVESTIGATION

104CP61 ● HYDROPUNCH GROUNDWATER LOCATION SAMPLED DURING BECHTEL NATIONAL, INC., 1995 INVESTIGATION

104CP02 ● SURFACE SOIL LOCATION SAMPLED DURING BECHTEL NATIONAL, INC., 1995 INVESTIGATION

—— ——→ SURFACE-WATER FLOW DIRECTION

ND NOT DETECTED

COMPOUND (mg/kg)	PRG	BACKGROUND
ARSENIC	0.38	2.67
BERYLLIUM	0.14	1.52
CHROMIUM VI	0.2	NA

NOTES:

1. SOIL CONCENTRATIONS GIVEN IN MILLIGRAMS PER KILOGRAM (mg/kg). GROUNDWATER CONCENTRATIONS GIVEN IN MICROGRAMS PER LITER (µg/l).
2. CONCENTRATIONS EXCEEDING PRGs ARE SHADED
3. ALL DETECTED ORGANICS ARE SHOWN IN THE FIGURE; ONLY INORGANICS EXCEEDING PRGs OR HAVING HQs ≥ 1.0 ARE SHOWN.
4. SOIL DEPTH INTERVALS WITH NO ORGANIC DETECTIONS OR NO INORGANIC CONCENTRATIONS EXCEEDING PRGs ARE NOT SHOWN.
5. FOR EACH SAMPLE LOCATION, HAZARD QUOTIENTS ≥1.0 ARE GIVEN FOR PLANTS(P), TERRESTRIAL INVERTEBRATES(I), BIRDS(B), OR MAMMALS(M).

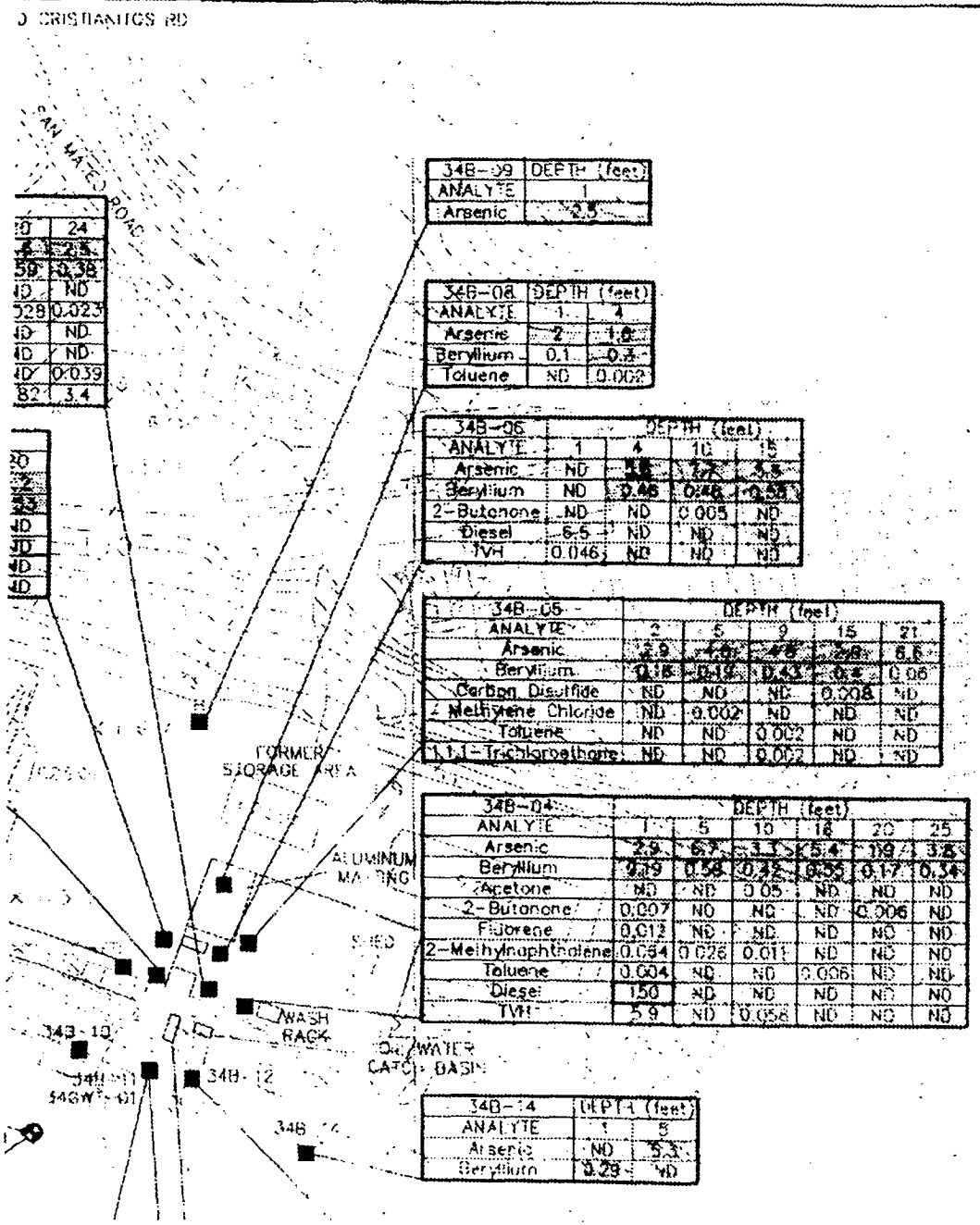
TOPOGRAPHIC REFERENCE:

MARINE CORPS BASE CAMP PENDLETON GENERAL DEVELOPMENT MAPS 13D AND 14C. DATE: DECEMBER 1987

SCALE

0 300 600 FEET

FIGURE 2-27



34B-09	DEPTH (feet)
ANALYTE	1
Arsenic	2.5

34B-08	DEPTH (feet)	
ANALYTE	1	4
Arsenic	2	1.6
Beryllium	0.1	0.3
Toluene	ND	0.002

34B-06	DEPTH (feet)			
ANALYTE	1	4	10	15
Arsenic	ND	4.6	7.7	3.5
Beryllium	ND	0.46	0.46	0.55
2-Butanone	ND	ND	0.005	ND
Diesel	6.5	ND	ND	ND
TVH	0.046	ND	ND	ND

34B-05	DEPTH (feet)				
ANALYTE	2	5	9	15	21
Arsenic	2.9	4.6	4.8	2.8	6.6
Beryllium	0.18	0.19	0.43	0.4	0.06
Carbon Disulfide	ND	ND	ND	0.008	ND
Methylene Chloride	ND	0.002	ND	ND	ND
Toluene	ND	ND	0.002	ND	ND
1,1,1-Trichloroethane	ND	ND	0.002	ND	ND

34B-04	DEPTH (feet)					
ANALYTE	1	5	10	15	20	25
Arsenic	2.9	6.7	3.3	5.4	10.4	3.8
Beryllium	0.19	0.58	0.42	0.55	0.17	0.34
Acetone	ND	ND	0.05	ND	ND	ND
2-Butanone	0.007	ND	ND	ND	0.006	ND
Fluorene	0.012	ND	ND	ND	ND	ND
2-Methylnaphthalene	0.064	0.026	0.011	ND	ND	ND
Toluene	0.004	ND	ND	0.006	ND	ND
Diesel	150	ND	ND	ND	ND	ND
TVH	5.9	ND	0.058	ND	ND	ND

34B-14	DEPTH (feet)	
ANALYTE	1	8
Arsenic	ND	5.3
Beryllium	0.29	ND

LEGEND

34B-09 ■	SOIL BORING LOCATION (H INDICATES HAND-AUGER SAMPLE)
34MW-01 ■	TEMPORARY WELL GROUNDWATER SAMPLE LOCATION
34MW-01 ⊕	MONITORING WELL LOCATION DRILLED AND SAMPLED DURING BECHTEL NATIONAL, INC., 1995 INVESTIGATION
——→	SURFACE-WATER FLOW DIRECTION
ND	NOT DETECTED
TVH	TOTAL VOLATILE HYDROCARBONS

SOIL COMPOUND (mg/kg)	PRG	LUFT MANUAL GUIDANCE CRITERIA	BACKGROUND
ARSENIC	0.38	–	4.25
BERYLLIUM	0.14	–	1.42
DIESEL	NA	100	NA

GROUNDWATER COMPOUND (µg/l)	MCL	TAP-WATER PRG
ARSENIC	50	0.045
BERYLLIUM	4	0.016
MANGANESE	–	1,700

NOTES:

1. SOIL CONCENTRATIONS GIVEN IN MILLIGRAMS PER KILOGRAM (mg/kg). GROUNDWATER CONCENTRATIONS GIVEN IN MICROGRAMS PER LITER (µg/l).
2. CONCENTRATIONS EXCEEDING PRGs ARE SHADED; DIESEL CONCENTRATIONS EXCEEDING THE LUFT FIELD MANUAL GUIDANCE CRITERIA ARE OUTLINED IN BOLD.
3. ALL DETECTED ORGANICS ARE SHOWN IN THE FIGURE; ONLY INORGANICS EXCEEDING PRGs ARE SHOWN.
4. DEPTH INTERVALS WITH NO ORGANIC DETECTIONS OR NO INORGANIC CONCENTRATIONS EXCEEDING PRGs ARE NOT SHOWN.

TOPOGRAPHIC REFERENCE:

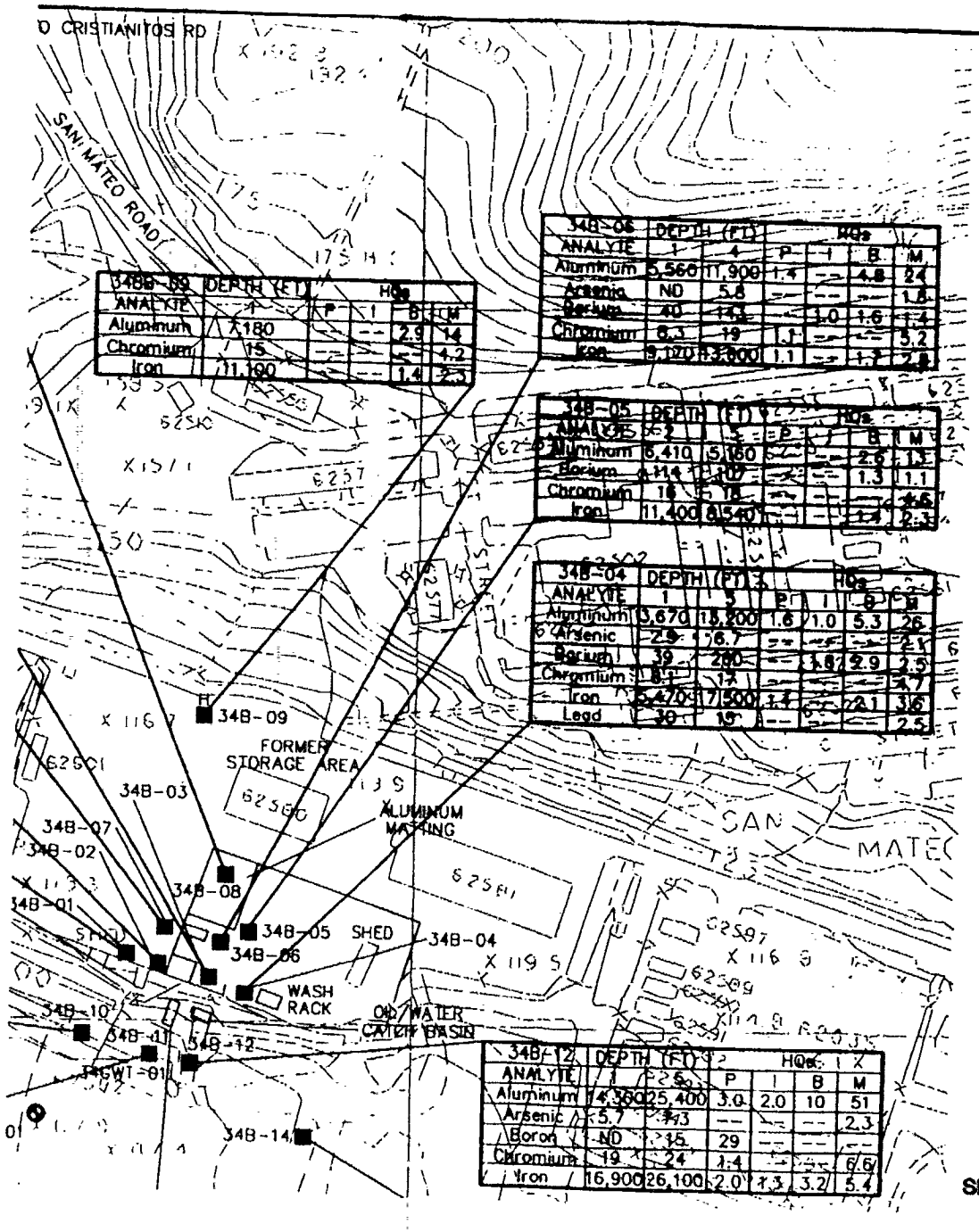
MARINE CORPS BASE CAMP PENDLETON
GENERAL DEVELOPMENT MAP 57D
DATE: DECEMBER 1987

SCALE

0 200 400 FEET

FIGURE 2-28

SITE 34 - COMBAT ENGINEERS MAINTENANCE FACILITY, BUILDINGS 62580-62583



34B-09	DEPTH (FT) 1		HQs P	I	B	M
Aluminum	7,180		--		2.9	14
Chromium	15		--		--	4.2
Iron	11,100		--	--	1.4	2.3

34B-06	DEPTH (FT) 1	4	HQs P	I	B	M
Aluminum	5,560	11,900	1.4	--	4.8	24
Arsenic	ND	5.8	--	--	--	1.8
Barium	40	143	--	1.0	1.6	1.4
Chromium	6.3	19	1.1	--	--	5.2
Iron	9,100	13,900	1.1	--	1.3	2.8

34B-05	DEPTH (FT) 1	4	HQs P	I	B	M
Aluminum	6,410	5,160	--	--	2.6	13
Barium	114	107	--	--	1.3	1.1
Chromium	16	18	--	--	--	4.6
Iron	11,400	8,540	--	--	1.4	2.3

34B-04	DEPTH (FT) 1	3	HQs P	I	B	M
Aluminum	3,670	18,200	1.6	1.0	5.3	26
Arsenic	2.9	16.7	--	--	--	2.1
Barium	39	280	--	1.0	2.9	2.5
Chromium	8.1	17	--	--	--	4.7
Iron	5,470	17,500	1.4	--	2.1	3.6
Lead	30	15	--	--	--	2.5

34B-12	DEPTH (FT) 1	2.5	HQs P	I	B	M
Aluminum	14,300	25,400	3.0	2.0	10	51
Arsenic	5.7	4.3	--	--	--	2.3
Boron	ND	15	29	--	--	--
Chromium	19	24	1.4	--	--	6.6
Iron	16,900	26,100	2.0	1.3	3.2	5.4

LEGEND

34B-09 ■ SOIL BORING LOCATION (H INDICATES HAND-AUGER SAMPLE)

34GWT-01 ■ TEMPORARY WELL GROUNDWATER SAMPLE LOCATION

34MW-01 ⊙ MONITORING WELL LOCATION

→ SURFACE-WATER FLOW DIRECTION

COMPOUND (mg/kg)	BACKGROUND
ALUMINUM	20,999
ARSENIC	4.6
BARIUM	262
BORON	--
CHROMIUM	33.0
IRON	26,459
MOLYBDENUM	7.4
NICKEL	22.5

NOTE:

1. FOR EACH SAMPLE LOCATION, HAZARD QUOTIENTS (HQs) ≥1.0 ARE GIVEN FOR PLANTS (P), TERRESTRIAL INVERTEBRATES (I), BIRDS (B), OR MAMMALS (M).

TOPOGRAPHIC REFERENCE:

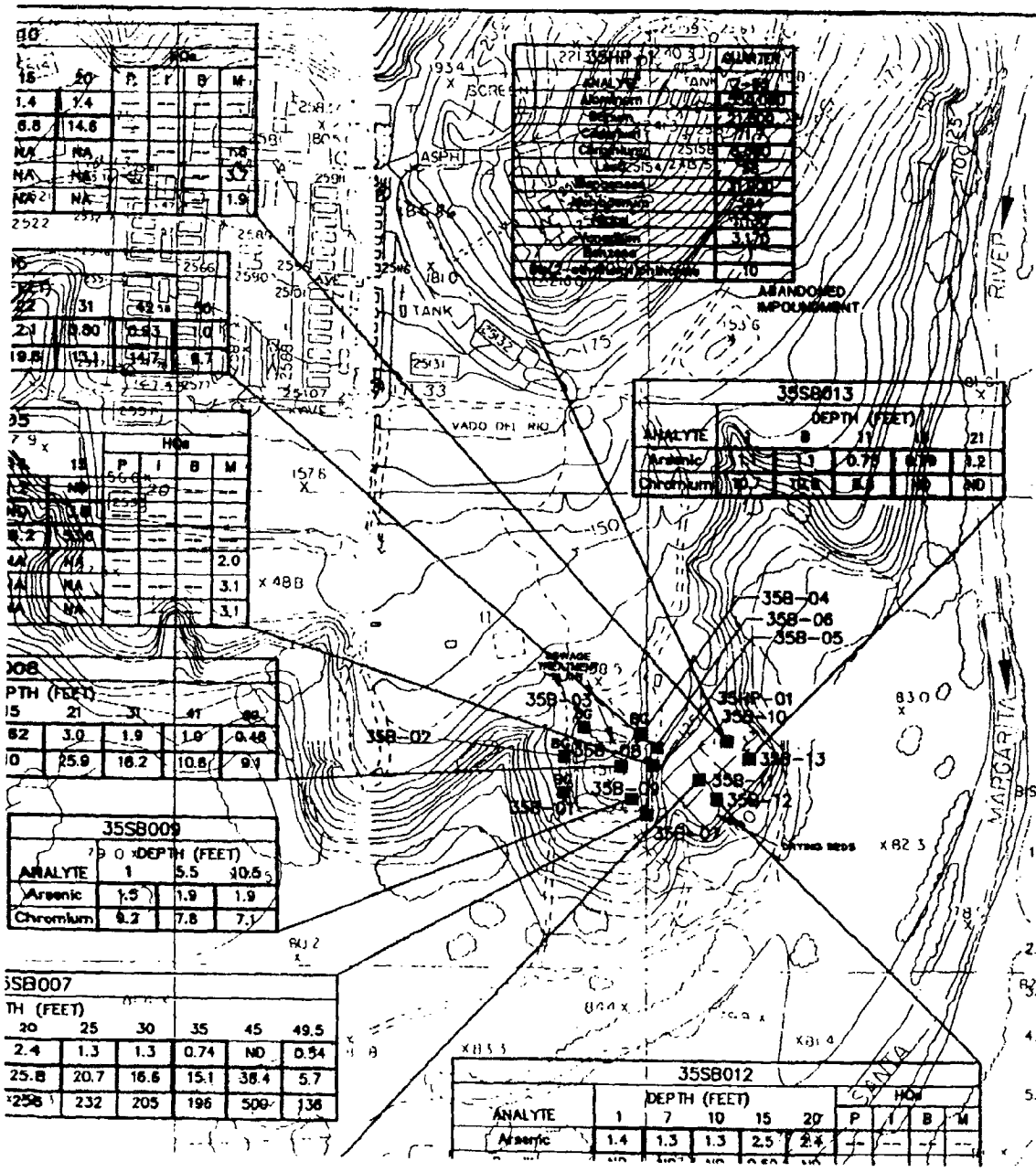
MARINE CORPS BASE CAMP PENDLETON GENERAL DEVELOPMENT MAP 57D. DATE: DECEMBER 1987

SCALE

0 200 400 FEET

FIGURE 2-29

SITE 34 - COMBAT ENGINEERS MAINTENANCE FACILITY BUILDINGS 62580 - 62583



LEGEND

35B-05	BOREHOLE LOCATION
35B-02 BG	BACKGROUND BOREHOLE LOCATION
35HP-01	HYDROPUNCH GROUNDWATER SAMPLE LOCATION
--	HQ LESS THAN 1.0
→	SURFACE-WATER FLOW DIRECTION
- - →	SURFACE-WATER FLOW DIRECTION (EPHEMERAL)
NA	NOT APPLICABLE
ND	NOT DETECTED

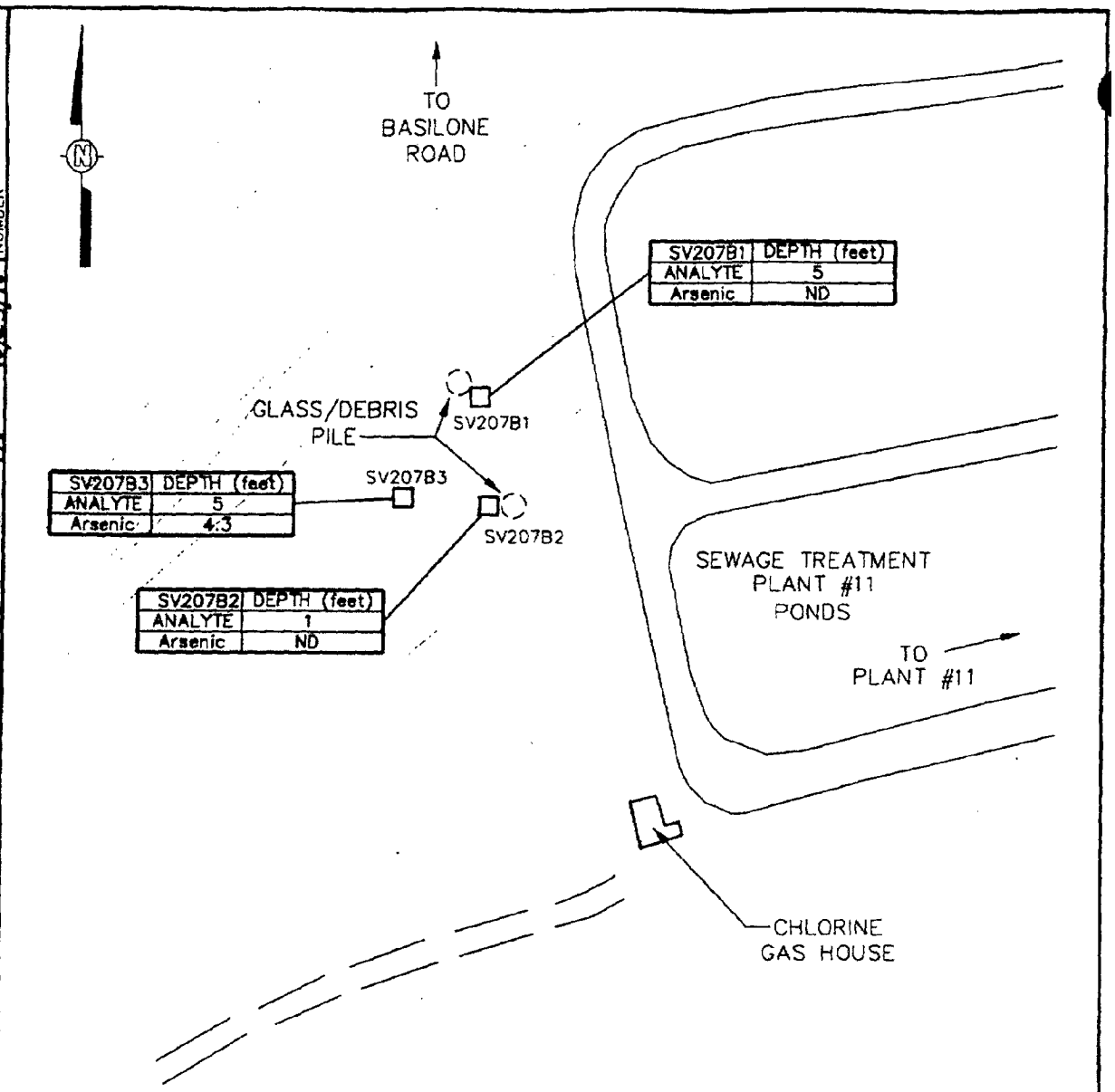
SOIL INORGANICS (mg/kg)	PRG	BACKGROUND
ARSENIC	0.38	0.68
BERYLLIUM	0.14	1.6
CHROMIUM	0.2	16.9
MANGANESE	380	276
SOIL ORGANICS (µg/kg)	**PRG**	**BACKGROUND**
BENZO(a)PYRENE	61	NA

GROUNDWATER COMPOUNDS (µg/l)	PRG	MCL	BACKGROUND
ALUMINUM	37,000	1,000	NA
BARIUM	2,600	1,000	NA
CADMIUM	18	5	NA
CHROMIUM	0.16	50	NA
LEAD	4	50	NA
MANGANESE	180	NA	NA
MOLYBDENUM	180	NA	NA
NICKEL	730	100	NA
VANADIUM	260	NA	NA
BENZENE	0.39	1	NA
BIS(2-ETHYLHEXYL)PHTHALATE	4.8	4	NA

NOTES:

1. INORGANIC CONCENTRATIONS IN SOIL GIVEN IN MILLIGRAMS PER KILOGRAM (mg/kg). ORGANIC CONCENTRATIONS IN SOIL GIVEN IN MICROGRAMS PER KILOGRAMS (µg/kg). CONCENTRATIONS IN GROUNDWATER GIVEN IN (µg/l).
2. CONCENTRATIONS OUTLINED IN BOLD EXCEED PRGs.
3. SOIL DEPTH INTERVALS WITH NO DETECTS EXCEEDING PRGs OR NO HAZARD QUOTIENTS ≥1.0 ARE NOT SHOWN
4. GROUNDWATER ANALYTES WITH CONCENTRATIONS EXCEEDING PRGs ARE SHOWN
5. HAZARD QUOTENTS ≥1.0 ARE GIVEN FOR PLANTS (P), TERRESTRIAL INVERTEBRATES (I), BIRDS (B), OR MAMMALS (M).

FIGURE 2-30



SV207B1	DEPTH (feet)
ANALYTE	5
Arsenic	ND

SV207B3	DEPTH (feet)
ANALYTE	5
Arsenic	4.3

SV207B2	DEPTH (feet)
ANALYTE	1
Arsenic	ND

LEGEND

□ PREVIOUS SOIL SAMPLE LOCATION

SV207B2 DRILLED AND SAMPLED DURING RCRA FACILITY ASSESSMENT; SITE 207, BORING 2

◌ GLASS/DEBRIS PILE

SCALE

0 75 100 FEET

REFERENCE:
GENERAL DEVELOPMENT MAP 49D (4B)

FIGURE 2-31

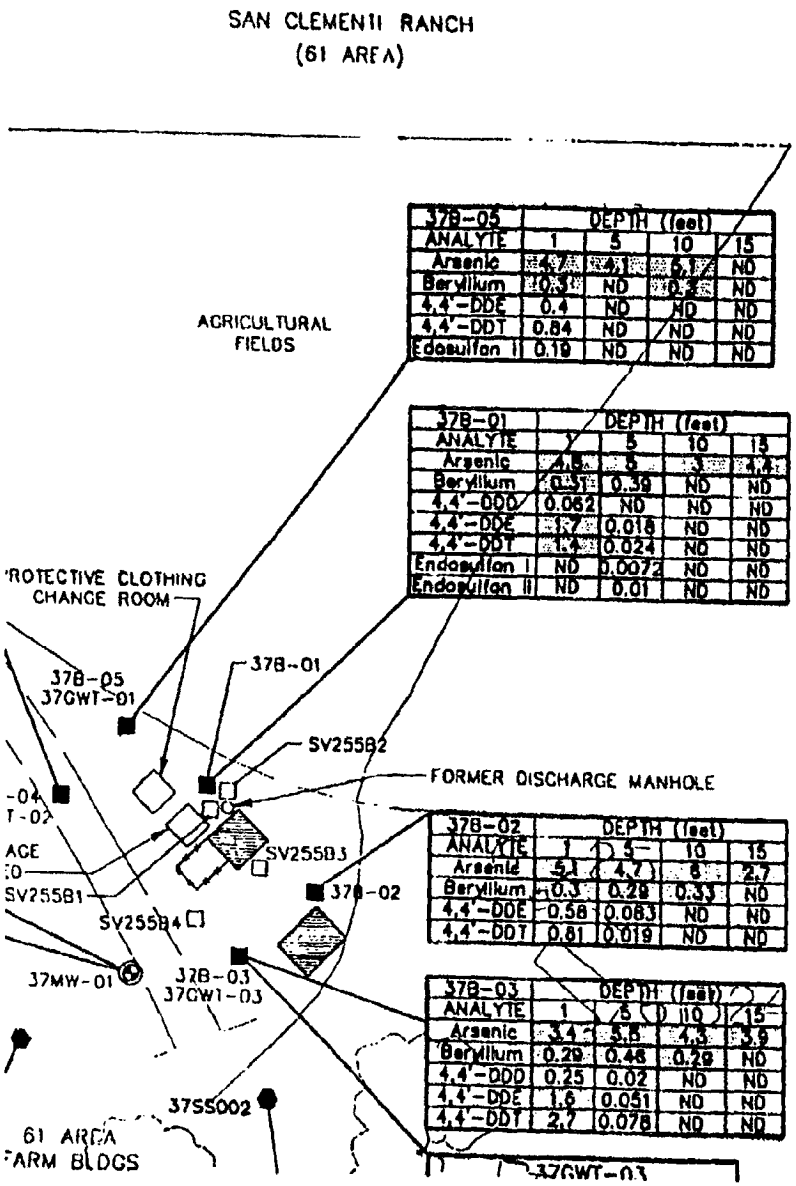
SITE 36
DEBRIS PILE AREA BEHIND PONDS AT SEWAGE TREATMENT PLANT 11
SUMMARY OF SOIL ANALYTICAL RESULTS
MCB CAMP PENDLETON, CALIFORNIA

PREPARED FOR

NAVAL FACILITIES ENGINEERING SERVICE CENTER
CONTRACT NO. N47408-92-D-30546

INTERNATIONAL TECHNOLOGY CORPORATION

DRAWN BY JJC 3-25-98 | CHECKED BY | APPROVED BY | 4/30/98 | DRAWING NUMBER 771529-A6



37B-05	DEPTH (feet)			
ANALYTE	1	5	10	15
Arsenic	4.7	4.1	6.1	ND
Beryllium	0.3	ND	0.2	ND
4,4'-DDE	0.4	ND	ND	ND
4,4'-DDT	0.84	ND	ND	ND
Endosulfan II	0.19	ND	ND	ND

37B-01	DEPTH (feet)			
ANALYTE	1	5	10	15
Arsenic	4.8	5	3	4.4
Beryllium	0.37	0.39	ND	ND
4,4'-DDD	0.062	ND	ND	ND
4,4'-DDE	1.7	0.018	ND	ND
4,4'-DDT	1.4	0.024	ND	ND
Endosulfan I	ND	0.0072	ND	ND
Endosulfan II	ND	0.01	ND	ND

37B-02	DEPTH (feet)			
ANALYTE	1	5	10	15
Arsenic	5.1	4.7	8	2.7
Beryllium	0.3	0.29	0.33	ND
4,4'-DDE	0.58	0.083	ND	ND
4,4'-DDT	0.81	0.019	ND	ND

37B-03	DEPTH (feet)			
ANALYTE	1	5	10	15
Arsenic	3.4	5.6	4.3	3.9
Beryllium	0.29	0.46	0.29	ND
4,4'-DDD	0.25	0.02	ND	ND
4,4'-DDE	1.6	0.051	ND	ND
4,4'-DDT	2.7	0.078	ND	ND

LEGEND

37SS001 ●	SURFACE SOIL SAMPLE LOCATION
SV255B2 □	PREVIOUS SOIL BORING LOCATION DRILLED AND SAMPLED DURING RCRA FACILITY ASSESSMENT; SITE 255, BORING 2
37B-01 ■	SOIL BORING LOCATION
37GWT-01	TEMPORARY WELL GROUNDWATER SAMPLE LOCATION
37MW-01 ⊕	MONITORING WELL LOCATION DRILLED AND SAMPLED DURING BECHTEL NATIONAL, INC., 1996 INVESTIGATION
▭	CONCRETE SLAB
—o—o—	FENCE
POL	PETROLEUM, OIL, AND LUBRICANT
ND	NOT DETECTED

SOIL COMPOUND (mg/kg)	PRG	BACKGROUND
ARSENIC	0.38	4.25
BERYLLIUM	0.14	1.42
4,4'-DDE	1.3	NA
4,4'-DDT	1.3	NA
TOXAPHENE	0.4	NA

GROUNDWATER COMPOUND (µg/l)	MCL	TAP-WATER PRG
4,4'-DDD	NA	0.28
4,4'-DDE	NA	0.2
4,4'-DDT	NA	0.2
DIELDRIN	NA	0.0042
ENDOSULFAN I	NA	220
ENDOSULFAN II	NA	220
ENDOSULFAN SULFATE	NA	NA

NOTES:

1. SOIL CONCENTRATIONS GIVEN IN MILLIGRAMS PER KILOGRAM (mg/kg). GROUNDWATER CONCENTRATIONS GIVEN IN MICROGRAMS PER LITER (µg/l).
2. CONCENTRATIONS EXCEEDING PRGs ARE SHADED.
3. ALL DETECTED ORGANICS ARE SHOWN IN THE FIGURE; ONLY INORGANICS EXCEEDING PRGs ARE SHOWN.
4. SOIL DEPTH INTERVALS WITH NO ORGANIC DETECTIONS OR NO INORGANIC CONCENTRATIONS EXCEEDING PRGs ARE NOT SHOWN.

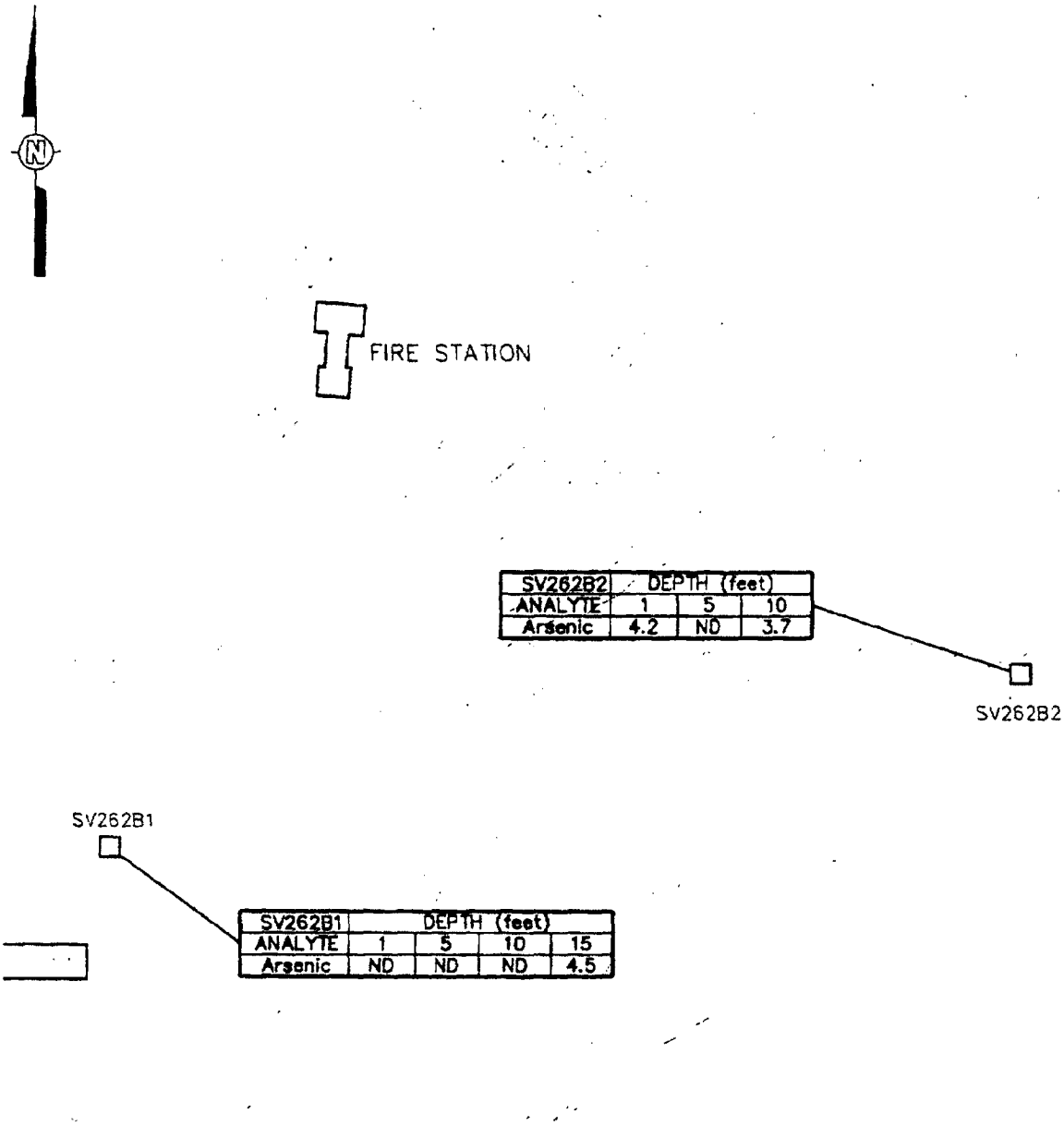
TOPOGRAPHIC REFERENCE:
MARINE CORPS BASE CAMP PENDLETON GENERAL DEVELOPMENT MAP 48C DATE: DECEMBER 1987

SCALE
0 75 150 FEET

FIGURE 2-32

SITE 37 - PESTICIDE- AND POL-

DRAWN BY	CHECKED BY	DRAWING NUMBER
JJC 3-28-98	APPROVED BY	771529-A7



SV262B2	DEPTH (feet)		
ANALYTE	1	5	10
Arsenic	4.2	ND	3.7

SV262B1	DEPTH (feet)			
ANALYTE	1	5	10	15
Arsenic	ND	ND	ND	4.5

LEGEND

□ PREVIOUS RFA SOIL BORING

SV262B2 DRILLED AND SAMPLED DURING RCRA FACILITY ASSESSMENT; SITE 262, BORING 2

SCALE

0 150 300 FEET

REFERENCE:
GENERAL DEVELOPMENT MAP 49D (4D,E)

FIGURE 2-33

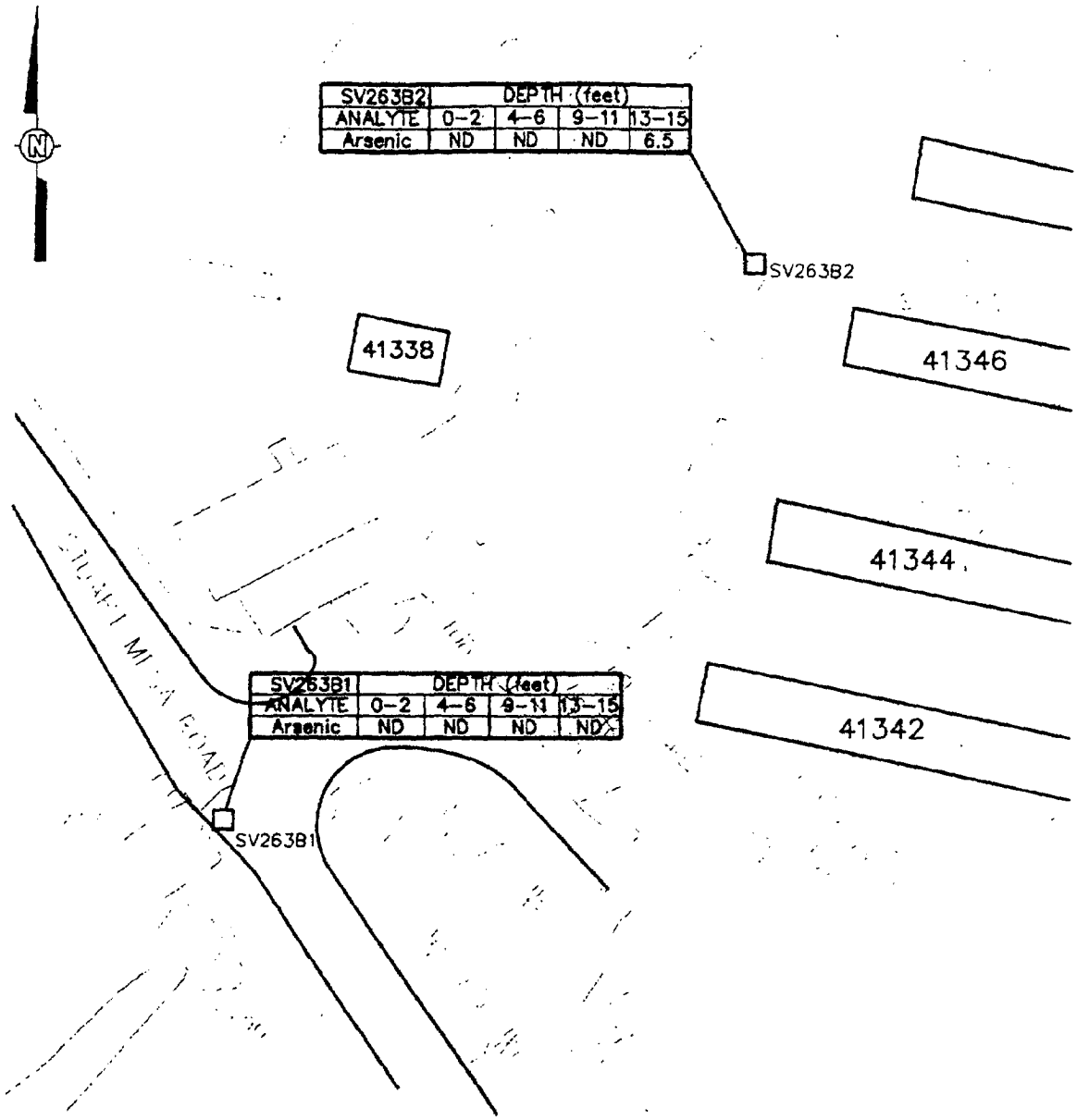
SITE 38
52 AREA SEWER LINE, BUILDING 52188
SUMMARY OF SOIL ANALYTICAL RESULTS
MCB CAMP PENDLETON, CALIFORNIA

PREPARED FOR

NAVAL FACILITIES
ENGINEERING SERVICE CENTER
CONTRACT NO. N47408-92-D-3056

INTERNATIONAL TECHNOLOGY CORPORATION

DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
JJC 3-28-98	KJD 7/30/98	RJT 8/25/98	7/1529-A8



SV263B2	DEPTH (feet)			
ANALYTE	0-2	4-6	9-11	13-15
Arsenic	ND	ND	ND	6.5

SV263B1	DEPTH (feet)			
ANALYTE	0-2	4-6	9-11	13-15
Arsenic	ND	ND	ND	ND

NOTE: SOIL CONCENTRATIONS GIVEN IN MILLIGRAMS PER KILOGRAMS.

LEGEND

□ RFA SOIL BORING

SV263B1 DRILLED AND SAMPLED DURING RCRA FACILITY ASSESSMENT; SITE 263, BORING 2

SCALE

0 100 200 FEET

REFERENCE:
GENERAL DEVELOPMENT MAP 14C (3A)

FIGURE 2-34

SITE 39
41 AREA SEWER LINE,
BUILDINGS 41300 AND 41346
SUMMARY OF SOIL ANALYTICAL RESULTS
MCB CAMP PENDLETON, CALIFORNIA

PREPARED FOR

NAVAL FACILITIES
ENGINEERING SERVICE CENTER
CONTRACT NO. N47408-92-D-3056

INTERNATIONAL TECHNOLOGY CORPORATION

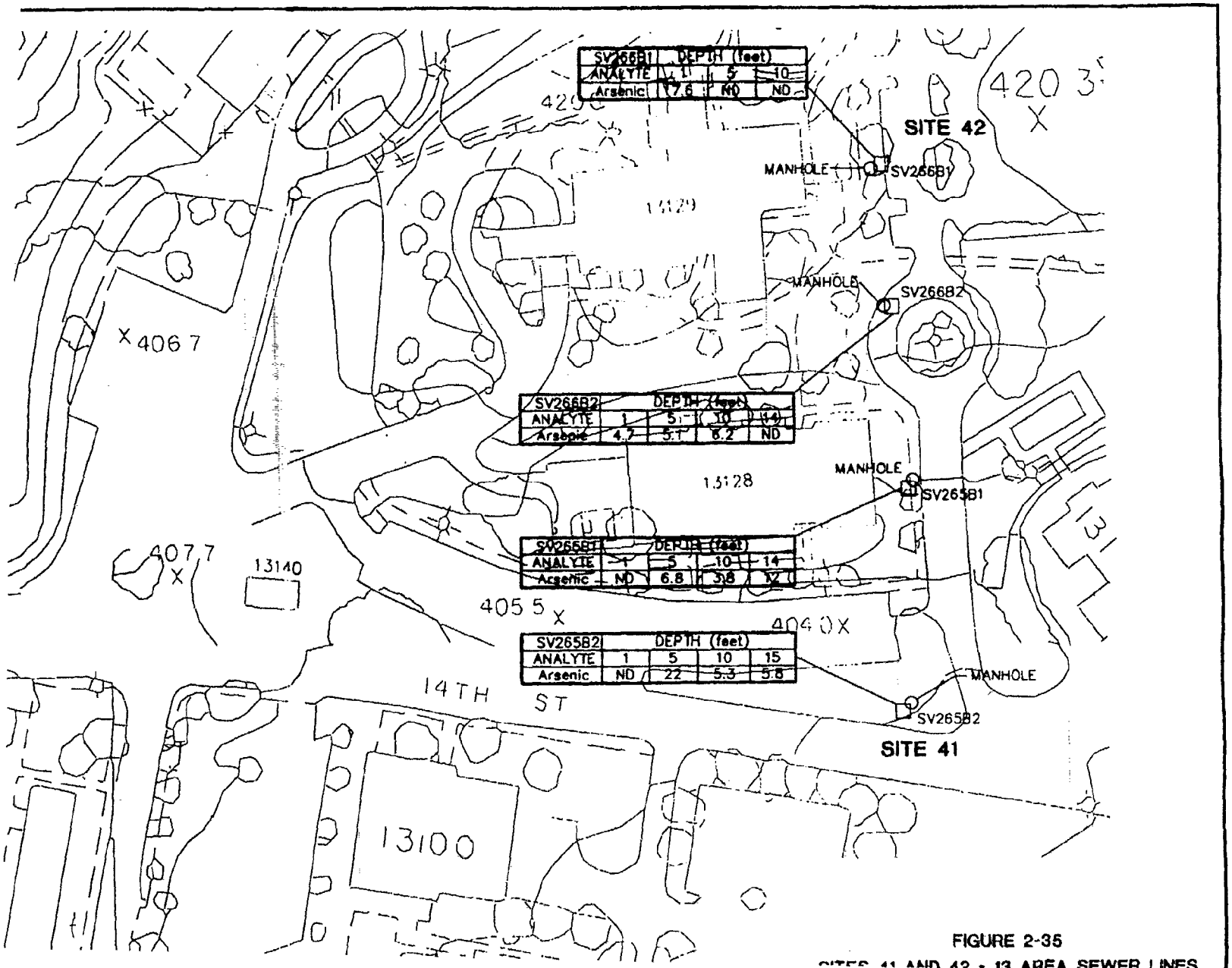
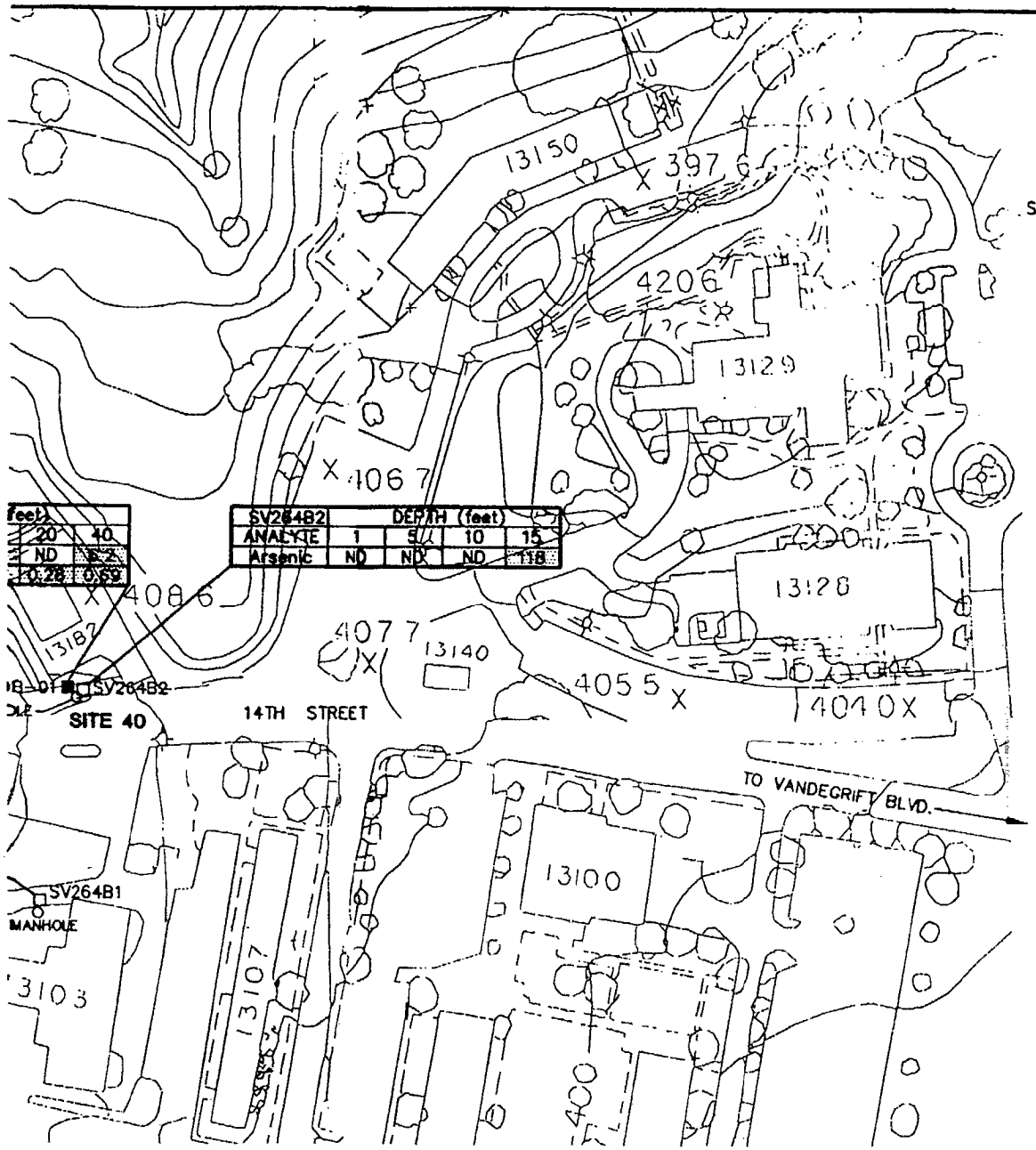


FIGURE 2-35

SITES 41 AND 42 - 13 AREA SEWER LINES



LEGEND

40B-01 ■ SOIL BORING LOCATION

SV264B2 □ PREVIOUS RFA SOIL BORING LOCATION DRILLED AND SAMPLED DURING RCRA FACILITY ASSESSMENT; SITE 264, BORING 2

ND NOT DETECTED

COMPOUND (mg/kg)	PRG	BACKGROUND
ARSENIC	0.38	16
BERYLLIUM	0.14	1.42

NOTES:

1. CONCENTRATIONS GIVEN IN MILLIGRAMS PER KILOGRAM (mg/kg).
2. CONCENTRATIONS EXCEEDING PRGs ARE SHADED.
3. ONLY INORGANICS EXCEEDING PRGs ARE SHOWN IN THE FIGURE.
4. DEPTH INTERVALS WITH NO ORGANIC DETECTIONS OR NO INORGANIC CONCENTRATIONS EXCEEDING PRGs ARE NOT SHOWN, WITH THE EXCEPTION OF ARSENIC

TOPOGRAPHIC REFERENCE:

MARINE CORPS BASE CAMP PENDLETON GENERAL DEVELOPMENT MAPS 24A AND 24C. DATE: DECMBER 1987

SCALE

0 150 300 FEET

3.0 Responsiveness Summary

As previously discussed in Section 2.2, documents leading to the decisions presented in this ROD have been released to the public and are included in the Administrative Record available for public review. The main documents were made available to the public in the information repositories maintained at the base and at the Oceanside Public Library. The public was informed of the availability of the complete Administrative Record, which is maintained at the AC/S,ES offices at MCB Camp Pendleton and at the SWDIV offices in San Diego. Notices of availability were published in local newspapers, as were notices of public meetings and public review and comment periods. No questions or comments were received from any source during the public comment periods. Therefore, a responsiveness summary is not required and is not part of the Administrative Record. This decision document presents the selected remedies for MCB Camp Pendleton OU3 sites, chosen in accordance with CERCLA, as amended by SARA, and to the extent practicable, the NCP. The decisions for these sites are based on the Administrative Record.

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APPENDIX A
TRANSCRIPT OF THE PUBLIC MEETING

A public meeting was held at the Oceanside Senior Citizens Center in Oceanside, California on 14 May 1998 at 7:00 p.m. for the Operable Unit 3 sites. A display session was held prior to the meeting at the Senior Citizens Center from 5:00 p.m. to 7:00 p.m. Displays included photographs and information relating to the Operable Unit 3 sites, as well as general information regarding the environmental program at MCB Camp Pendleton. Personnel from the base, Southwest Division Navy, U.S. Environmental Protection Agency, California Environmental Protection Agency Department of Toxic Substances Control and San Diego Regional Water Quality Control Board, and the Navy's environmental contractor were present to provide information to the public and to answer any questions or concerns. No members of the public attended the display session or the public meeting. The base did not receive any telephone calls or written comments during the 30-day public comment period.

The meeting was publicized in four local newspapers, the *North County Times*, both *Inland* and *Coastal Editions*, the *Sun Post*, and the *Scout*, on 1 May 1998.

The transcripts of the meeting are provided in this appendix. Because no members of the public attended the meeting, it lasted only several minutes, however, base, Navy, and agency representatives remained at the Senior Citizens Center for an additional ½ hour to ensure that no late arrivals from the public were missed.

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PUBLIC MEETING

Commencing : 7:00 p.m.
Location : 455 Country Club Lane
Oceanside, California 92054
Day, Date : Thursday, May 14, 1998
Reported By : LESLIE R. JOHNSON, CSR No. 11451

MS. TROST: Welcome to the public meeting for Operable Unit Three of the Installation Restoration Program for Camp Pendleton, California. My name is Teresa Trost, and I represent the Marine Corps on the Federal Facilities Team.

For the record, will the other members of the Federal Facilities Team state their name and affiliation.

MR. MANGOLD: Davis Mangold, the Remedial Project Manager for Southwest Division.

MS. LAUTH: Sheryl Lauth, L-a-u-t-h, Remedial Project Manager from EPA.

MR. ODERMATT. John Odermiatt, 0-d-e-r-m-a-t-t, Remedial Project Manager from the Regional Water Quality Control Board.

MS. TROST: Okay. Let the record show that there is no member of the public in the audience and that we have fulfilled the requirement under CERCL for a public meeting. And I would propose that the meeting is now closed.

Do I have a second?

MR. MANGOLD: Second.

MS. TROST: The meeting is now closed.

(The public meeting concluded at 7:03 p.m.)

REPORTER'S CERTIFICATE

I, LESLIE R. JOHNSON, Certified Shorthand Reporter for the State of California, do hereby certify:

That said public meeting was taken before me at the time and place therein stated and was thereafter transcribed into print under my direction and supervision, and I hereby certify the foregoing public meeting is a full, true and correct transcript of my shorthand notes so taken.

In witness whereof I have subscribed my name this 25th day of May, 1998.

Leslie R. Johnson

LESLIE R. JOHNSON
Certified Shorthand Reporter No. 11451
for the State of California

APPENDIX B

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR OU3 SITES 1A, 1D, 1E, A2 AND 7

Table of Contents

List of Tables . . . . . .B-iii

Abbreviations/Acronyms . . . . . .B-v

1.0 Introduction B-1

2.0 ARARs for the Selected Remedies for OU3 Sites 1A, 1D, 1E, 1F, 2A, AND 7 . . . . . B-3

2.1 ARARs for Sites 1A, 1D, 1E, 1F, and 2A. B-4

2.2 ARARs for Site 7 . . . . . .B-8

3.0 References B-13

List of Tables

Table B-1 Applicable or Relevant and Appropriate Requirements for OU3 Sites 1A, 1D,
1E, 1F, and 2A

Table B-2 Applicable or Relevant and Appropriate Requirements for Site 7

Abbreviations/Acronyms

APCD	Air Pollution Control District
ARAR	Applicable or Relevant and Appropriate Requirement
CAA	Clean Air Act
CAMU	Corrective Action Management Unit
CCC	California Coastal Commission
CCR	California Code of Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIWMB	California Integrated Waste Management Board
DLM	Designated Level Methodology
DON	Department of the Navy
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U.S. Environmental Protection
FR	Federal Register
MCB	Marine Corps Base
MSWLF	Municipal Solid Waste Landfill
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
OU	Operable Unit
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RWQCB	California Regional Water Quality Control Board
SIP	State Implementation Plan
SWDIV	Southwest Division Naval Facilities Engineering Command
SVRCB	California State Water Resources Control Board
TBC	To Be Considered
USC	United States Code

1.0 Introduction

Section 121 (d) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) states that remedial actions at CERCLA sites must attain (or the decision document justify the waiver of) any Federal or more stringent State environmental standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate.

Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requiremnts, criteria, or limitations promulgated under Federal or State law that specifically address the situation at a CERCLA site. The requirement is applicable if the jurisdictional prerequisites of the standard show a direct correspondence when objectively compared with conditions at the site. If the requirement is not legally applicable, the requirement is evaluated to determine whether it is relevant and appropriate. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that, although not applicable, address problems or situations sufficiently similar to the circumstances of the proposed response action and are well-suited to the conditions of the site (U.S. Environmental Protection Agency [EPA], 1988). The criteria for determining relevance and appropriateness are listed in Title 40, Code of Federal Regulations (CFR), Section 300.400(g)(2).

To qualify as a State applicable or relevant and appropriate requirement (ARAR) under CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), a State requirement must be all of the following:

- A State law
- An environmental or facility siting law
- Promulgated (of general applicability and legally enforceable)
- Substantive (not procedural or administrative)
- More stringent than the Federal requirement
- Identified in a timely manner
- Consistently applied.

In order to constitute an ARAR, a requirement must be substantive. Therefore, only substantive provisions of requirements identified are considered ARARs. The ARARs identified for the selected remedial action alternative for Operable Unit (OU) 3 Sites 1A, 1D, 1E, 1F, and 2A at Marine Corps Base (MCB) Camp Pendleton are summarized in the following sections, Table B-1 and Table B-2. Table B-1 provides ARARs for Sites 1A, 1D, 1E, 1F, and 2A. Table B-2 provides ARARs for Site 7 and includes landfill cap ARARs originally presented in the Site 7 engineering evaluation/cost analysis (EE/CA) for installation of a landfill cap (SWDIV, 1995), in addition to groundwater monitoring and postclosure maintenance ARARs not previously included in the EE/CA ARARs.

Although, the cap ARARs were identified for a removal action, they are considered complete due to the Department of the Navy's (DON's) policy to comply with EPA's promulgated requirement that removal actions ". . . shall, to the extent practicable considering the exigencies of the situation, attain applicable or relevant and appropriate requirements under federal environmental or state environmental or facility siting laws" (40 CFR 300.415[i]). Groundwater ARARs were not addressed in the EE/CA because the groundwater remedial investigation (RI) was not complete. Subsequent to completion of the EE/CA, the RI recommended no remedial action for Site 7 groundwater based on the results of the risk assessment (SWDIV, 1996a). Groundwater monitoring ARARs for the presumptive remedy cap and postclosure maintenance of the landfill are however, included in Table B-2. Subsequent to the time that Site 7 ARARs were presented in the EE/CA, State Water Quality Control Board (SWQCB) landfill requirements of Title 23 California Code of Regulations (CCR) and California Integrated Waste Management Board (CIWMB) landfill requirements of Title 14 have since been replaced by the combined SWRCB/CIWMB Regulations in Title 27 CCR. Updated citations are provided in Table B-2 in addition to the former citations.

2.0 ARARs for the Selected Remedies for OU3 Sites 1A, 1D, IE, 1F, 2A, and 7

Remedial action for soil was selected for the following OU 3 sites at MCB Camp Pendleton:

- 1A - Refuse Burning Ground in 14 Area
- 1D - Refuse Burning Ground in 20 Area
- 1E - Refuse Burning Ground in 32 Area
- 1F - Refuse Burning Ground in 43 Area
- 2A - Grease Disposal Pit in 14 Area
- 7 - Box Canyon Landfill

The same action was selected for Sites 1A, 1D, 1E, 1F, and 2A: soil excavation and on-base disposal; no further action for groundwater. No further action was recommended for groundwater at these sites during the RI (SWDIV, 1996b and 1997). The risk assessment identified no unacceptable risks from groundwater. The selected remedy involves no treatment because the RI results indicate that contaminated soils at Sites 1A, 1D, 1E, 1F, and 2A would not leach to groundwater, and meet the requirements for fill at Site 7 - Box Canyon Landfill. Based on the Designated Level Methodology (DLM) (California Regional Water Quality Control Board [RWQCB], 1986), excavated soil from Sites 1A, 1D, 1E, and 1F would not impact groundwater at Site 7 (SWDIV, 1998a). Soil from Site 2A exceeded the designated levels, although only slightly; therefore, the soil from Site 2A was tested for leachability using DI WET analysis. The DI WET results were compared against a soluble designated level predicted by the DLM. DI WET results were less than the soluble designated levels, indicating that Site 2A soils would not pose a threat to groundwater (SWDIV, 1998b). 'The identified ARARs for Sites 1A, 1D, 1E, 1F, and 2A are listed in Table B-1.

The action selected for Site 7 includes installation of an evapotranspiration cap and associated long-term monitoring. Groundwater monitoring will be conducted to measure the effectiveness of the landfill cap, as part of the presumptive remedy, and to comply with postclosure maintenance requirements identified in the EE/CA. ARARs for Site 7 are identified in this appendix and are listed in Table B-2.

2.1 ARARs for Sites 1A, 1D, 1E, 1F, and 2A

The Department of the Navy (DON) has determined that 22 CCR 66264.94 is a "relevant and appropriate" Federal ARAR for the selected remedies for the OU3 sites. The DON considers 22 CCR 66264.94 a federal ARAR because it was approved by the EPA in its 23 July 1992 authorization of the State of California Resource Conservation and Recovery Act (RCRA) program and is federally enforceable (see 57 Federal Register [FR] 32727, 23 July 1992, and 55 FR 8742, 8 March 1990; see also Wyckoff v. EPA 796 F.2d 1197, [9th Cir. 1986]). The State of California disagrees that 22 CCR 66264.94 is a "Federal" ARAR. This regulation is a part of the State's authorized hazardous waste control program. It is the State's position that it is a "State" ARAR and are a "Federal" ARAR. See 55 FR 8765, 8 March 1990, and U.S. v. State of Colorado, 990 F.2d 1565, (1993).

For the same reasons stated above for 22 CCR 66264.94, the DON has determined that other specifically identified substantive requirements of Title 22 CCR approved under the authorized State RCRA program are Federal ARARs for the selected remedies for the OU3 sites. The State of California disagrees with finding the other substantive requirements under the authorized State RCRA program "Federal" ARARs for the reasons set forth above. It is the State's position that these requirements are "State" ARARs not "Federal" ARARs.

The DON has determined that the SWRCB Resolution No. 92-49 and 27 CCR 20400 (formerly 23 CCR 2550.4) do not constitute ARARs for the selected remedies for OU3 because they are State requirements and we are not more stringent than the Federal ARAR provisions of 22 CCR 66264.94. The NCP, as set forth in 40 CFR 300.400(g), provides that only state standards more stringent than Federal standards may be ARARs (see also Section 121[d][2][A][ii] of CERCLA).

The provisions of 22 CCR 66264.94 and 27 CCR 20400 (formerly 23 CCR 2550.4) that address soil concentration limits are identical. Therefore, 27 CCR 20400 is not more stringent than 22 CCR 66264.94 and its provisions we not ARARs. SWRCB Resolution No. 92-49 was promulgated by the SWRCB as policies and procedures to be followed by Regional Water Boards for oversight of investigations and cleanup and abatement orders. It is, therefore, not of general applicability and is not an "applicable" ARAR. However, it was evaluated as a potential "relevant and appropriate" State ARAR, Section III.G of

SWRCB Resolution 92-49 provides in relevant part that regional boards, shall "...in approving any alternative cleanup levels less stringent than background, apply Section 2550.4... [now 27 CCR 20400]." Because this resolution incorporates and relies upon the provisions of 23 CCR 2550.4 (now 27 CCR 20400), which are not more stringent than 22 CCR 66264.94, SWRCB Resolution No. 92-49 is also not more stringent and, hence, its provisions are not State ARARs.

The State of California disagrees with the DON's assertion that SWRCB Resolution No. 92-49 is not an ARAR and believes the resolution is an applicable requirement for the OU3 remedial actions. It requires compliance with more than 66264.94. Resolution No. 92-49 requires compliance with 23 CCR 2550.4, but Sections III.F and III.G also have additional requirements that must be met. To the extent that Resolution No. 92-49 includes provisions that are the same as 22 CCR 66264.94, the State believes it is appropriate for the DON to defer to the State's interpretation of 22 CCR 66264.94.

Despite the disagreement on whether identified ARARs are "federal" or "state," the State has decided to exercise its discretion not to invoke dispute resolution for this Record of Decision for the following reasons:

- The State believes excavation of soil from the OU3 sites and placement under the landfill cover at the Site 7 CAMU is the best remedy and complies with all substantive State requirements

- The soil from OU3 Sites 1A, 1D, 1E, 1F, and 2A are contaminated with metals that, when placed under the landfill cover already approved by the State for the Site 7 CAMU, will be protective of groundwater

- The cleanup levels for the soil at Sites 1A, 1D, 1E, 1F, and 2A will be protective of groundwater and comply with all substantive requirements.

The excavation, transportation, and handling of soil at the OU3 remedial action sites could result in fugitive emissions of particulate matter. San Diego County Air Pollution Control District (APCD) Rule 50(d)(1) has been identified as an applicable Federal ARAR for such emissions (Table B-1). This rule is considered a Federal ARAR because it is included in the approved State Implementation Plan (SIP) under Section 110 of the Clean Air Act (CAA).

The DON has determined that substantive provisions of 22 CCR 66262.10(a) and 66262.11 are ARARs for determination of hazardous waste. The soils at Sites 1A, 1D, 1E, 1F, and 2A have been identified as hazardous waste by applying knowledge of the hazard characteristic of the waste in light of the materials or processes used to generate the wastes.

The substantive provisions of 22 CCR 66264.13(a) and (b) are also determined to be ARARs. The substantive provisions at 22 CCR 66264.13(a) require analysis of hazardous waste "before an owner or operator transfers, treats, stores, or disposes of any hazardous waste." Representative samples of the soil from the OU3 sites have been analyzed during the RI and in a recent field sampling effort in May 1998 to ftirther delineate the sites. This analysis included the information necessary for acceptance into the CAMU designated at Site 7. The requirements at 22 CCR 66264.13(b) require an analysis plan. Work plans for the RI and the additional sampling for further delineation were written to satisfy the substantive provisions for analysis plans in 22 CCR 66264.13(b) and concurrence was received from DTSC, RWQCB, and EPA. The sampling and analysis provided adequate information for placing the waste at the Site 7 CAMU even if it was assumed to be hazardous waste and therefore, no additional sampling and analysis to determine whether the waste is hazardous was necessary.

The Department of the Navy has determined that substantive provisions of 27 CCR 20230(a) and (b) are the controlling ARARs for soil discharge levels for the Site 7 - Box Canyon Landfill (Table B-1). To assess if the soils at Sites 1A, 1D, 1E, 1F, and 2A meet these requirements, a two-phased screening process was conducted. The first phase included using the designated level methodology (DLM) (California Regional Water Quality Control Board [RWQCB], 1986). Acceptable soil concentrations are calculated through the use of DLM equation and compared to actual soil concentrations. Soil concentrations at Sites 1A, 1D, 1E, and 1F met the requirements. The soil at Site 2A did not meet DLM criteria. Because of the conservative nature of the DLM, the second phase of screening was applied for Site 2A and leachability analysis using DI WET, was conducted for Site 2A soils. The DI WET results were compared against a soluble designated level predicted by the DLM. DI WET results were less than the soluble designated levels, indicating that Site 2A soils also meet State discharge requirements (SWDIV, 1998b).

The Department of the Navy has determined that the DLM is a method for determining acceptable contaminant concentrations in soil to meet State discharge requirements, specifically 27 CCR 20230. However, failure of site soil to meet DLM does not indicate noncompliance. Further testing and/or evaluation may indicate compliance.

Federal- and State-listed threatened and endangered species are present at or near remedial action Sites 1A, 1D, 1E, 1F, and 2A. The California gnatcatcher (Federal-listed endangered species) was observed on Sites 1A, 1D, and 1E and is suspected at Sites 1F and 2A, where habitat had burned prior to field surveys (SWDIV, 1998a). The least Bell's vireo (State-listed endangered species) was observed near Sites 1A and 1D. The Federal and State endangered species requirements are identified as ARARs as indicated in Table B-1. The Migratory Bird Act set forth in 16 USC 703 is a Federal ARAR for the remedial actions at Sites 1A, 1D, and 1E and may also be an ARAR for Sites 2A and 1F after the habitat recovers from the 1997 brushfire.

The substantive provisions of 36 CFR 800.4 for historical property identification are considered applicable Federal ARARs for the OU3 remedial action sites. An archaeologist will monitor excavation activities. If previously unidentified archaeological resources are identified during the remedial actions, substantive provisions of 32 CFR 229.1 et seq. will be applicable Federal ARARs. These sections require protection of archaeological resources on Federal lands by consultation with the State Historic Preservation Officer.

Sites 1D and 1E are located within the designated boundary of the coastal zone, as indicated on California Coastal Commission (CCC) maps that delineate the extent of the coastal zone (CCC, 1993). The Federal and State requirements are applicable for controlling direct significant impacts on coastal waters and for protecting State and national interests in California coastal resources. The coastal zone requirements are ARARs.

Site 1D is located within the 100-year floodplain and is subject to Federal ARARs identified at 22 CCR 66264.18(b) and 40 CFR Part 6.

2.2 ARARs for Site 7

The ARAR evaluation for Site 7 focused on the action-specific closure and postclosure cam requirements of the Resource Conservation and Recovery Act (RCRA) and the State municipal solid waste landfill (MSWLF) requirements. Air, vadose zone, and groundwater action-specific requirements are discussed as appropriate. Limited location-specific ARARs are discussed because the location of the landfill is fixed and only those requirements that pertain to the selected removal action alternative are identified.

RCRA closure and postclosure requirements are set forth in Subtitle D for MSWLFs and in Subtitle C for hazardous waste landfill. State requirements other than RCRA requirements for closure and postclosure care of landfills are set forth in Title 27 CCR Division 2, Subdivision 1. California implemented portions of RCRA Subtitle D requirements in Title 27 CCR, Division 2, Subdivision 1, and in SWRCB Resolution No. 93-62. These requirements are discussed further in the following paragraphs.

RCRA Subtitle C requirements are applicable if the waste is a listed or characteristic waste under RCRA and was treated, stored, or disposed of after the effective date of the RCRA requirements or the activity at the CERCLA site constitutes treatment, storage, or disposal as defined by RCRA (EPA, 1988). The wastes disposed of at Site 7 are not considered listed wastes because their source cannot be identified. Because of the heterogeneous nature of the landfilled wastes and because a representative sample could not be obtained from the landfill, the hazardous characteristics of the waste were not tested. The landfill stopped accepting municipal waste in 1984, after the effective date (1980) of the RCRA requirements for hazardous waste. However, the hazardous wastes reportedly disposed of at the site (Naval Energy and Environmental Support Activity, 1984) likely were deposited before the effective date of RCRA. The capping of waste in place does not constitute RCRA placement or disposal (EPA, 1988). Therefore, RCRA Subtitle C requirements are not applicable for the Site 7 cap.

Although RCRA requirements are not applicable for Site 7, because of the similarity of the landfill waste to a RCRA hazardous waste, the similarity of the site to a hazardous waste landfill, and the similarity of the selected action to RCRA closure, those RCRA closure and postclosure care requirements for landfills set forth in 22 CCR 66264.310 that are pertinent and substantive are considered relevant and appropriate requirements and are

considered Federal ARARs (Table B-2). Section 66264.310(a) requires the owner or operator of a landfill to cover the landfill during final closure. The design and construction requirements are detailed in Table B-2.

Significant provisions of RCRA Subtitle D requirements are set forth in 40 CFR 258 - Criteria for Municipal Solid Waste Landfills. The purpose of the Subtitle D requirements is to establish minimum national criteria under RCRA for all MSWLF units to ensure the protection of human health and the environment. The criteria apply to owners and operators of new MSWLF units and existing MSLWF units that received waste after 9 October 1991. The requirements do not apply to Site 7 because waste receipts at the Box Canyon landfill stopped in 1984. However, most of the closure and postclosure care requirements set forth in 40 CFR 258.60 and 258.61 are relevant and appropriate substantive requirements. Section 258.60(a) requires owners or operators to install a final cover system. Detailed substantive RCRA Subtitle D requirements that are Federal ARARs for Site 7 are listed in Table B-2.

In October 1991, the EPA promulgated revised Federal laws and regulations on solid waste disposal under RCRA Subtitle D (56 *Federal Register* 50978, 9 October 1991). On 7 October 1993, the EPA issued a final determination of the adequacy for California's MSWLF permit program, in compliance with 40 CFR 258 (58 *Federal Register* 52300, 7 October 1993). The EPA expects any owner or operator complying with the provisions of a State program approved by the EPA to be in compliance with the Federal criteria (56 *Federal Register* 50978 and 50995, 9 October 1991).

CIWMB and SWRCB have combined their regulations for solid waste into Title 27 CCR which became effective on July 18, 1997. Regulations for closure and postclosure of solid waste disposal sites for both agencies are listed in Table B-2. These regulations include landfill cover design specifications, maintenance and monitoring requirements, and other requirements pertinent to landfill capping.

SWRCB requirements for discharges of waste to land went into effect on 27 November 1984. Because operations at the Box Canyon landfill ended in May 1984, the site is considered an inactive unit. Therefore, these closure and postclosure care requirements are not applicable but may be relevant and appropriate if they are more stringent than Federal

ARARs. The substantive provisions of 27 CCR that are more stringent than Federal ARARs are listed in Table B-2 as State ARARs for Site 7.

Air emission requirements are identified in the SIP as Federal ARARs that affect the design of landfill covers and implementation of construction activities. San Diego County APCD requirements not included in the SIP have been identified as State ARARs that may affect the design and construction of the proposed removal action. Pertinent and substantive air requirements are listed in Table B-2, along with their ARAR status.

The Department of the Navy has determined that substantive provisions of 22 CCR 66264.98 are controlling ARARs for groundwater monitoring to measure the landfill cap effectiveness and for postclosure landfill maintenance (Table B-2). Title 22 CCR 66264.98 is considered "relevant and appropriate" and is a Federal ARAR because it was approved by the EPA in its 23 July 1992 authorization of the State of California's RCRA program Title 22 CCR 66264.98 requires that a detection monitoring program be implemented and is essentially the same as 27 CCR 20420 (formerly 23 CCR 2550.8). The Federal ARAR (22 CCR 66264.98) is controlling because the State monitoring requirements (27 CCR 20420) are not more stringent and are, therefore, not potential ARARs. The NCP (40 CFR 300.400[g]) provides that only State standards more stringent than Federal standards may be ARARs (see also Section 121[d][2][A][ii] of CERCLA).

The corrective action management unit (CAMU) requirements are Federal ARARs for Site 7, where the excavated soil from the OU3 remedial action sites will be placed. These requirements are set forth in 40 CFR 264.552(c) and (e); they allow for consolidation of wastes in a more cost-effective approach while still protecting human health and the environment. Placement of remediation wastes into or within a CAMU does not constitute land disposal of hazardous waste or creation of a unit subject to minimum technology requirements and, as such, are not subject to land disposal requirements. The Department of the Navy has designated Site 7 as a CAMU for the consolidation of excavated soil from OU3 Sites 1A, 1D, 1E, 1F, and 2A by applying the substantive CAMU regulations but not the procedural requirements. The following seven criteria of 40 CFR 264.552(c) were evaluated based on the Site 7 rationale provided after each:

1. The CAMU shall facilitate the implementation of reliable, effective, protective, and cost-effective corrective action measures.

   The use of Site 7 as a CAMU for the disposal of excavated soil from OU3 sites is a reliable, effective, and protective remedy. A landffil cap will be placed over the excavated soil to limit mobilization of contaminants and minimize potential exposure. The use of Site 7 as a CAMU is more cost-effective than other alternatives evaluated such as off-site disposal.

2. Waste management activities associated with the CAMU shall not create unacceptable risks to humans or to the environment resulting from exposure to hazardous wastes, hazardous substances, or hazardous constituents.

   The excavated soils from OU3 sites are not expected to result in any unacceptable risks at Site 7. In addition, site data has been evaluated to assess if soils from Sites 1A, 1D, 1E, 1F, and 2A would impact groundwater beneath Site 7. Results of the DLM using RI data and leachability testing of site soils show that placement of the wastes at Site 7 from these five sites would not have a detrimental impact on groundwater. Further evaluation of existing soil and groundwater data, soil pH, landfill gas generation, features of the planned cap at Site 7, and local rainfall data was performed to assess the leaching potential from the site soils. Each of the factors evaluated indicate that metals present in the soils to be placed at Site 7 will not adversely impact groundwater. Details of this evaluation are presented in the Technical Memorandum for Leaching Potential of Sites 1A, 1D, 1E, 1F, and 2A dated 2 October 1998 (SWDIV, 1998c). Review of this evaluation by the EPA's Office of Research and Development found the evaluation to be technically acceptable and found little risk of metals mobilization from the consolidated/capped contaminated soils (EPA, 1998).

3. The CAMU shall include uncontaminated areas of the facility, only if including such areas of the purpose of managing remediation waste is more protective than management of such wastes at contaminated areas of the facility.

   Excavated soil from OU3 sites will only be located within the existing footprint of the Site 7 landfill and will not include uncontaminated areas.

4. Areas within the CAMU, where wastes remain in place after closure of the CAMU, shall be managed and contained so as to minimize future releases, to the extent practicable.

   The Site 7 landfill will be capped to contain the excavated soil and minimize the potential for future releases from the soil to groundwater.

5. The CAMU shall expedite the timing of corrective action activity implementation, when appropriate and practicable.

Using Site 7 for disposal of excavated soil from OU3 sites will expedite the remedial action because it will take less time than off-site disposal.

6. The CAMU shall enable the use, when appropriate, of technologies (including innovative technologies) to enhance the long-term effectiveness of corrective actions by reducing the toxicity, mobility, or volume of wastes that will remain in place after closure of the CAMU.

   The mobility of contaminants in the soil excavated from the OU3 sites will be reduced when placed at Site 7 because the depth to groundwater at Site 7 is greater than the OU3 remedial action sites and the landfill cap will be placed over the excavated soil.

7. The CAMU shall, to the extent practicable, minimize the land area of the facility upon which wastes will remain in place after closure of the CAMU.

   The consolidation of soil wastes from OU3 sites at Site 7 will aid in minimizing the land area of MCB Camp Pendleton upon which wastes will remain in place.

The substantive provisions of 40 CFR 264.552(e) require the following to be specified:

- The areal configuration of the CAMU
- Remediation waste management including applicable design. operation, and closure requirements
- Requirements for groundwater monitoring
- Closure and post-closure requirements

The areal configuration of the Site 7 CAMU is shown in Figure 2-11 of the main text. The design, operation, and closure and post-closure requirements for the CAMU are identified in Table B-2 and Appendix A of the Site 7 EE/CA. The requirements for groundwater monitoring at Site 7 have been identified in this appendix and are included in Table B-2. As identified in Table B-2, the substantive detection monitoring requirements at 22 CCR 66264.98 and the concentration limits at 22 CCR 66264.94 have been determined to be relevant and appropriate Federal ARARs for groundwater monitoring at the Site 7 CAMU.

The substantive requirements set forth in 22 CCR 66264.111 (a) and (b) are Federal ARARs for closing the OU3 remedial action sites after excavation of the contaminated soil and replacement of clean fill. These provisions require elimination of the need for further

maintenance and control of the sites and elimination of the postclosure escape of hazardous waste. The excavation of the contaminated soil will comply with these requirements.

3.0 References

California Coastal Commission, 1993, Maps indicating coastal zone designations for County of San Diego, June.

California Regional Water Quality Control Board, 1986, *The Designated Level Methodology for Waste Classification and Cleanup Level Determination*, updated June 1989.

CCC, see California Coastal Commission.

EPA, see U.S. Environmental Protection Agency.

RWQCB, see California Regional Water Quality Control Board, Central Valley Region.

Naval Energy and Environmental Support Activity, 1984, "Initial Assessment Study of Marine Corps Base, Camp Pendleton, California,"NEESA, 13-057, prepared by SCS Engineers, Inc., September.

Southwest Division Naval Facilities Engineering Command, 1995, "Marine Corps Base Camp Pendleton, California, Engineering Evaluation/Cost Analysis (EE/CA) for Installation of a Cap at Site 7 - Box Canyon Landfill," Draft Final, 25 September.

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Southwest Division Naval Facilities Engineering Command, 1996b, "Marine Corps Base Camp Pendleton, California, Remedial Investigation/Feasibility Study, RI Report for Group C Sites," Draft Final, prepared by Jacobs Engineering Group Inc., 12 November.

Southwest Division Naval Facilities Engineering Command, 1997, "Marine Corps Base Camp Pendleton, California, Remedial Investigation/Feasibility Study, Remedial Investigation for Group D Sites," Draft Final, 16 July.

Southwest Division Naval Facilities Engineering Command, 1998a, "Marine Corps Base Camp Pendleton, California, Remedial Investigation and Feasibility Study for Operable Unit 3," Draft Final, 1 May.

Southwest Division Naval Facilities Engineering Command, 1998b, "Final Minutes o the Forty-Third FFA Project Managers' Meeting for MCB Camp Pendleton," prepared by IT Corporation, 20 August.

Southwest Division Naval Facilities Engineering Command, 1998c, "Technical Memorandum, MCB Camp Pendleton, Leaching Potential of Sites 1A, 1D, 1E, 1F, and 2A," prepared by IT Corporation, 2 October 1998.

SWDIV, see Southwest Division Naval Facilities Engineering Command.

SWRCB, see California State Water Resources Control Board.

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U.S. Environmental Protection Agency, 1998, memorandum regarding MCB Camp Pendleton Consolidation and Capping of Metal Contaminated Soils, Office of Research and Development, 21 October.

TABLE B-1
Applicable or Relevant and Appropriate Requirements for
OU3 Sites 1A, 1D, 1E, 1F, and 2A
MCB Camp Pendleton
(Sheet 1 of 4)

Federal or State ARAR or TBC	Citation	Requirement	Comments
Federal[a]	22CCR 66264,94(a)(1) and (3), (c), (d), and (e)	Groundwater protection standards: Owners/operators of RCRA treatment, storage, or disposal facilities must comply with conditions in this section that are designed to ensure that hazardous constituents entering the groundwater from a regulated unit do not exceed the concentration limits for contaminants of concern (set forth under Section 66264.94) in the uppermost aquifer underlying the waste management area beyond the point of compliance.	Relevant and appropriate for soil excavation cleanup levels at Sites 1A, 1D, 1E, 1F, and 2A as specified in Table 2-1.
State	California Regional Water Quality Control Board, Central Valley Region	Designated Level Methodology for Waste Classification and Cleanup Level Determination	DLM is a method for demonstating acceptable contaminant concentrations in soil to meet State discharge requirements in 27 CCR 20230.
Federal*	22 CCR 66264.18(b)	Facility must be designed, constructed, operated,and maintained to avoid washout.	Relevant and appropriate for Site 1D, which is located within a 100- year floodplain.
Federal	40 CFR 6, Appendix A; (excluding 6[a][2], [4], and [6]); 40 CFR 6.302(b)	Actions taken should avoid adverse effects, minimize potential harm, and restore and preserve natural and beneficial values.	Applicable for Site 1D; site 1D is located within a floodplain.
Federal	36 CFR 800.4 (a),(b),(c), and (e)	Identify potentially affected historic properties or cultural resources.	Applicable for excavation activities at OU3 sites, which constitute a Federal undertaking.
Federal	16 USC 1536(a)	Action to conserve endangered species or threatened species, including consultation with the Department of the interior	Applicable for Sites 1A, 1D, and 1E where endangered or threatened species have been observed on or near the sites. Potentially applicable for Sites 1F and 2A after habitat recovers from wild fire in 1997

TABLE B -1
Applicable or Relevant and Appropriate Requirements for
OU3 Sites 1A, 1D, 1E,1F, AND 2A
MCB Camp Pendleton
(Sheet 2 of 4)

Federal or State ARAR or TBC	Citation	Requirement	Comments
Federal	Section 1456(c); 15 CFR 930 and 923.45	Conduct activities in a manner consistent with approved State management programs.	Applicable for Sites 1D and 1E; Sites 1D and 1E are located within the coastal zone.
Federal	16 USC 703	Protects almost all species of native birds in the United States from unregulated "take," which can include poisoning at hazardous waste sites.	Applicable; Migratory birds have been observed in the vicinity of Sites 1A, 1D, and 1E. Not ARARs for Sites 1F and 2A because wildfires destroyed potential habitats.
State	Fish and Game Code Section 2080	No person shall import, export, take, possess, or sell any endangered or threatened species or part or product thereof.	Applicable for Sites 1A, 1D, and 1E; An endangered species (California gnatcatcher) has been identified at Sites 1A, 1D, and 1E.
State	Public Resources Code § 300000 - 30900; 14 CCR 13001 - 13666.4	Regulates activities associated with development to control direct significant impacts on coastal waters and to protect State and national interests in California Coastal Resources.	Applicable for Sites 1D and 1E; Sites 1D and 1E are located within the designated boundary of the coastal zone on California Coastal Commission maps (CCC, 19930).
Federal*	22 CCR 66264.111 (a) and (b), excluding references to procedural require-ments such as plans and notifications.	General performances standard requires elimination of need for further maintenance and control; elimination of postclosure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products.	Relevant and appropriate for the excavation of contaminated soil to remedial action standards for soil specified in Table 2 - 1.
Federal*	22 CCR 66262.10 (a) and 66262.11	Person who generates waste shall determine if that waste is a hazardous waste.	Applicable; Excavation of contaminated soil is considered generation of waste. Not an ARAR for no action.
Federal*	22CCR 66264. 13 (a) and (b)	Before an owner or operator transfers, treats, stores, or disposes of any hazardous waste, a detailed chemical and physical analysis of a representative sample shall be obtained. The owner or operator shall develop and follow a written analysis plan, which describes the analysis procedures.	Applicable for the soil excavation and placement at Site 7.

TABLE B-1
Applicable or Relevant and Appropriate Requirements for
OU3 Sites 1A, 1D, 1E, 1F, and 2A
MCB Camp Pendleton
(Sheet 3 of 4)

Federal or State ARAR or TBC	Citation	Requirement	Comments
Federal*	22 CCR 66262.34	Generator may accumulate waste on-site for 90 days or less or must comply with requirements for operating a storage facility.	Potential applicable for on-site storage of contaminated soil. All excavated soil is proposed to be removed from site daily.
Federal*	22 CCR 66264.552(c) and (e) also: (40 CFR 264.552[c]and [e])	An area at a RCRA facility may be designated as a CAMU. Placement of remediation wastes into or within a CAMU does not constitute land disposal of hazardous wastes or creation of a unit subject to minimum technology requirements.	Applicable for on-base placement of excavated soil.
Federal	40 USC 7410; portions of 40 CFR 52.220 applicable to San Diego County Air Pollution Control District (APCD)	Provisions of State Implementation plan (SIP) approved by the U.S. Environmental Protection Agency (EPA)under Section 110 of CAA.	Specific pertinent rules are listed below.
Federal	APCD Rule 50(d)(1)	No person shall discharge into the atmosphere from any single source of emissions, for more than 3 minutes in any 60-minute period, any air contaminant that is darker than number 1 on the Ringelmann chart.	Fugitive dust emissions of particulate matter are expected for excavation and transportation of soil.
State	Title 27 CCR, Division 2, Subdivision 1, Discharges of Waste to Land, Sections 20200-20230	Regulates siting, design, construction, operation, closure, and monitoring of waste discharges to land for treatment, storage, or disposal, including landfills, surface impoundments, waste piles, and land treatment facilities. Wastes regulated include hazardous, designated, nonhazardous, and inert wastes.	Applicable for the placement of excavated soil on base. Relevant and appropriate for soil left in place.

TABLE B-1
Applicable or Relevant and Appropriate Requirements for
OU3 Sites 1A, 1D, 1E, 1F, and 2A
MCB Camp Pendleton
(Sheet 4 of 4)

Federal or State ARAR or TBC	Citation	Requirement	Comments
State	Comprehensive Water Quality Control Plan for the San Diego Basin Water Code Section 13240	Establishes beneficial uses of groundwater; establishes water quality objectives.	Applicable for soil excavation at Sites 1A, 1D, 1E, 1F, and 2A.
State	Fish and Game Code, Section 3005	Prohibits taking animals with nets, poison, cage, etc.	Soil contaminants could be poisonous to animals.

*The provisions of the California Hazardous Waste Control Act that have been approved by the EPA as part of the State RCRA program are federally enforceable and are, therefore, Federal ARARs. It is the State of California's position that the requirements under the approved RCRA program are State ARARs. See Section 2.0 for a more detailed discussion.

APCD - Air pollution Control District
ARARs - Applicable or relevant and appropriate requirements.
CAA - Clean Air Act.
CAMU - Corrective Action Management Unit.
CCR - California Code of Regulations.
CFR - Code of Federal Regulations.
EPA - U.S. Environmental Protection Agency.
OU - Operable unit.
RCRA - Resource Conservation and Recovery Act.
SIP - State Implementation Plan.
TBC - To be considered.
USC - United States Code.

References:
California Coastal Commission, 1993, Maps indicating coastal zone designations for County of San Diego, June.

TABLE B-2
Applicable or Relevant and Appropriate Requirements
Site 7 - Box Canyon Landfill
MCB Camp Pendleton
(Sheet 1 of 7)

Federal or State ARAR or TBC	Citation	Requirement	Comments
Federal	Title 40, Code of Federal Regulations (CFR), 258.61 (a)(4)	A gas monitoring system must be maintained and monitored in accordance with 40 CFR 258.23.	Relevant and appropriate. See also Title 27, California Code of Regulations (CCR), Section 20921 (a); formerly 14 CCR Section 17783(a).
Federal	40 CFR 258.60(a)(2) and (3)	The final cover must have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present or a permeability no greater than $1x10^{-5}$ centimeters per second (cm/s), whichever is less. The infiltration layer must contain a minimum of 18 inches of earthen material.	Relevant and appropriate for Site 7 cover.
Federal	40 CFR 258.60(a)(3)	An erosion layer must be provided, must contain a minimum of 6 inches of earthen material, and must be capable of sustaining native plant growth.	Relevant and appropriate for Site 7 cover.
Federal	40 CFR 258.61 (a) and (b)	Postclosure care must be conducted for 30 years. Based on protectiveness of human health and the environment, the postclosure care period may be shortened or lengthened.	Only relevant and appropriate as related to capping requirements.
State	27 CCR 21135(a)(b)(f) and (g) and 27 CCR 21180(a)(i) [formerly 14 CCR 17767(c), (d), and (e) and 17788(a)(3)]	Sign(s) shall be posted at all points of access at the site and for a period of not less than one hundred eighty (180) days after the facility has received the final shipment of waste stating the intended date of last receipt of waste at the site and the location of alternative permitted solid waste management facilities. Sites which do not allow public disposal shall be exempt from the provisions of this section. The operator shall ensure that all points of access to the site are restricted to protect public health and safety. Once closure activities are complete, site access by the public may be allowed.	Applicable.
State	27 CCR 21142(a) [formerly 14 CCR 17776(e)]	Final grades must be designed to reduce impacts to health and safety and take into consideration any postclosure land use. Final grading requirements concerning water quality protection are in Section 21090(b).	Applicable.

TABLE B-2
Applicable or Relevant and Appropriate Requirements
Site 7 - Box Canyon Landfill
MCB Camp Pendleton
(Sheet 2 of 7)

Federal or State ARAR or TBC	Citation	Requirement	Comments
State	27 CCR 21142(b) [formerly 14 CCR 17776(f)]	Requires owner/operator to produce five yearly iso settlement maps subsequent to the creation and submittal of the initial postclosure topographic map.	Applicable.
State	27 CCR 21550(a), (b), and (c) [formerly 14 CCR 17778(a) and (c) to (j)]	The drainage and erosion control system shall be designed and maintained to ensure integrity of postclosure land uses; to prevent public contact with wastes; to ensure integrity of gas monitoring systems; to prevent safety hazards; and to prevent exposure of waste.	Applicable.
State	14 CCR 17783(a)(1), (2), and (3)	The operator shall ensure that landfill gases generated at a facility are controlled during the periods of closure and postclosure maintenance. Methane must not exceed 1.25 percent by volume in air within on-site structures. Concentrations of methane gas migrating from the landfill must not exceed 5 percent by volume in air at the facility property boundary. Trace gases shall be controlled to prevent adverse acute and chronic exposure to toxic and/or carcinogenic compounds.	Applicable.
State	27 CCR 21180(a) (formerly 14 CCR 17788(a) and (b))	The landfill must be maintained and monitored for no less than 30 years following closure of the entire landfill.	Applicable.
Federal*	22 CCR 66264.94(a)(1) and (3), (c), (d), and (e)	Groundwater protection standards: Owners/operators of RCRA treatment, storage, or disposal facilities must comply with conditions in this section that are designed to ensure that hazardous constituents entering the groundwater from a regulated unit do not exceed the concentration limits for contaminants of concern (set forth under Section 66264.94) in the uppermost aquifer underlying the waste management area beyond the point of compliance.	Relevant and appropriate for the groundwater monitoring at Site 7.

TABLE B-2
Applicable or Relevant and Appropriate Requirements
Site 7 - Box Canyon Landfill
MCS Camp Pendleton
(Sheet 3 of 7)

Federal or State ARAR or TBC	Citation	Requirement	Comments
Federal*	22 CCR 66264.98	Groundwater detection monitoring program.	Relevant and approprite for measuring the effectiveness of the landfill cap at Site 7 and for postclosure maintenance.
Federal*	22CR 66264.25	Cover and drainage control systems shall be designed to function without failure when subjected to capacity, hydrostatic, and hydrodynamic loads resulting from a 24- hour maximum precipitation storm. Covers and cover systems and all containment and control features shall be designed, constructed, and maintained to withstand the maximum credible earthquake without decrease to the level of protection of public health and the environment.	Relevant and approprite for Site 7 landfill.
Federal*	22 CCR 66264.117(b)(1) and (2)	Postclosure care shall begin after completion of closure and continue for 30 years. Based on protectiveness to human health and the environment, the postclosure period maybe care shortened or lengthened.	Only relevant and appropriate as related to the capping requirements.
Federal*	22 CCR 66264.310(c)	A control system must be provided to prevent migration of gas.	Relevant and appropriate.
Federal*	22 CCR 66264.228(e)(1)	If waste is to remain in a unit, the unit shall be compacted before any portion of the final cover is installed.	Relevant and appropriate. Waste is to be left in place for the Site 7 remedial action.
Federal*	22 CCR 66264.228(e)(4)	A foundation layer shall be provided for the compacted barrier.	Relevant and appropriate.
Federal*	22 CCR 66264.228(e)(5) and (7)	A compacted barrier layer of clean earth shall be provided above the foundation layer. A nonearthen layer may be used as the barrier layer if it will equally impede fluid movement and be as durable.	Relevant and appropriate.
Federal*	22 CCR 66264.228(e)(10)	A water drainage layer, blanket, or channel must be provided above the compacted barrier layer.	Relevant and appropriate.
Federal*	22 CCR 66264.228(e)(11)	A filter layer must be provided above the water drainage layer.	Relevant and appropriate.

TABLE B-2
Applicable or Relevant and Appropriate Requirements
Site 7 - Box Canyon Landfill
MCS Camp Pendleton
(Sheet 4 of 7)

Federal or State ARAR or TBC	Citation	Requirement	Comments
Federal*	22 CCR 66264.229(e)(12)	A layer of topsoil must be provided that is thick enough to support vegetation for erosion control and deep enough to prevent root penetration into the filter layer.	Relevant and appropriate.
Federal*	22 CCR 66264.228(e)(13)	Permanent disposal areas shall be graded at closure so that, with allowance for setting and subsidence, the slope of the land surface above all portions of the cover shall be sufficient to prevent ponding of water and soil erosion.	Relevant and appropriate.
Federal*	22 CCR 66264.228(f)	Before installing the compacted barrier layer of the final cover, the correlation between the desired permeability and the density at which that permeability is achieved must be established.	Relevant and appropriate.
Federal*	22 CCR 66264.309(a)	A map must be prepared showing the exact location and dimensions, including depth, of each cell with respect to surveyed permanent benchmarks with horizontal and vertical controls.	Relevant and appropriate.
Federal*	22 CCR 66264.310(a)(1) and (5)	The final cover must be designed and constructed to prevent downward entry of water into the closed landfill throughout a period of at least 100 years and to accommodate lateral and vertical shear forces generated by the maximum credible earthquake so that the integrity of the cover is maintained.	Relevant and appropriate.
State	27 CCR 20320(c) and (d) [formerly 23 CCR Section 2541 (c) and (d)]	Hydraulic conductivities determined through laboratory methods shall be confirmed by appropriate field testing. Earthen materials used in containment structures shall consist of a mixture of clay and other suitable fine-grained soils that have specified characteristics and that, in combination, can be compacted to attain the required permeability when installed.	Relevant and appropriate. Applies to the construction of engineered caps at solid waste disposal sites. Incorporated by reference in 27 CCR 21090 (formerly 23 CCR 2581).

TABLE B-2
Applicable or Relevant and Appropriate Requirements
Site 7 - Box Canyon Landfill
MCB Camp Pendleton
(Sheet 5 of 7)

Federal or State ARAR or TBC	Citation	Requirement	Comments
State	27 CCR 20365(c) and (d) [formely 23 CCR 2546(c) and (d)]	Diversion and drainage facilities shall be designed, constructed and maintained to accommodate the anticipated volume of precipitation and peak flows. Collection and holding facilities associated with drainage control shall be emptied immediately or otherwise managed to maintain the design capacity.	Relevant and appropriate.
State	27CCR 20950(d) [formerly 23 CCR 2580(d)]	Closed waste management units shall be provided with two permanent monuments, installed by a licensed land surveyor or a registered civil engineer, from which the location and elevation of wastes, containment structures, and monitoring facilities can be determined throughout the postclosure period.	Relevant and appropriate.
State	27 CCR 21090(a)(1) [formerly 23 CCR 2581(a)(1)]	Closed landfills shall be provided with not less than 2 feet of appropriate materials as a foundation layer for the final cover.	Relevant and appropriate.
State	27 CCR 21090(a)(2) [formerly 23 CCR 2581(a)(2)]	Not less than 1 foot of soil containing no waste or leachate shall be placed on top of the foundation layer and be compacted to a permeability of $1x10^{-6}$ cm/s or less or equal to the permeability of underlying geology or liner, whichever is less.	Relevant and appropriate.
State	27 CCR 21090(a)(3) [formerly 23 CCR 2581 (a)(3)]	Not less than 1 foot of topsoil containing no waste or leachate shall be placed on top of (a)(2) layer and vegetation rooting depth must not exceed the depth to the (a)(2) layer.	Relevant and appropriate.
State	27CCR 21090(b)(1) (formerly 23 CCR 2581(b)(1))	Closed landfills shall be graded and maintained to prevent ponding and to provide slopes of at least 3 percent.	Applicable.
State	APCD Rule 50(d)(1)	No person shall discharge into the atmosphere from any single source of emissions for more than 3 minutes in any 60-minute period any air contaminant, other than uncombined water vapor, that is darker than No. 1 on the Ringelmann chart.	Applicable. Remedial action activities will include engineering controls to limit emissions of fugitive dust.

TABLE B-2
Applicable or Relevant and Appropriate Requirements
Site 7 - Box Canyon Landfill
MCS Camp Pendleton
(Sheet 6 of 7)

Federal or State ARAR or TBC	Citation	Requirement	Comments
State	APCD Rule 52	Particulate matter from any source may not be discharged to the atmosphere in excess of 0.1 grain per dry standard cubic foot (0.231 gram per dry standard cubic meter) of gas.	Applicable. Minor fugitive dust emissions are expected from excavation and storage of soil.
State	APCD Rule 59(a) and (b)(2)	Rule 59 is applicable to waste disposal sites with the potential to emit gaseous reactive organic compounds, odors, and/or toxic air contaminants unless they comply with provisions of Section 59(e) and can demonstrate that concentration limits of Section 59 (d)(1)(ii) are never exceeded in the absence of a gas control system.	Applicable. Substantive provisions only (State rule not included in SIP).
State	Rule 59(d)(1)(ii)	No person owning or operating a landfill shall allow emissions of any odors, toxic air contaminants, and/or reactive organic compounds to any point immediately above the surface of the landfill unless it is demonstrated that, at all times, concentrations of organic compounds do not exceed 500 parts per million volumetric expressed as methane, toxic air contaminant concentrations do not exceed threshold levels established by the California Air Resources Board (CARB) or threshold limit values established by the American Conference of Governmental Industrial Hygienists (ACGIH) or any concentration that poses unacceptable health risk to human beings, and there are no detectable emissions of toxics for which no level is known below which adverse health effects are anticipated. The most stringent limit will apply. If these concentrations are not maintained, the owner/operator shall install best available control technology (BACT).	Applicable. Substantive provisions only (State rule not included in SIP).
State	APCD Rule 59(e)(1)	Every landfill owner/operator shall analyze the concentrations of total organic compounds and toxic air contaminants found in the body and immediately above the surface of the landfill.	Applicable. Substantive provisions only (State rule not included in SIP).

TABLE B-2
Applicable or Relevant and Appropriate Requirements
Site 7 - Box Canyon Landfill
MCB Camp Pendleton
(Sheet 7 of 7)

Federal or State ARAR or TBC	Citation	Requirement	Comments
State	Comprehensive Water Quality Control Plan for the San Diego Basin (Basin Plan) Water Code Section 13240	Establishes beneficial uses of groundwater; established water quality objectives.	Applicable for groundwater monitoring at Site 7.
State	Fish and Game Code Sections 5650 and 5652	It is unlawful to deposit in, permit to pass into, or place where it can pass into the waters of this State any material listed in Fish and Game Code Sections 5650 and 5652.	Applicable. Site 7 may leach if not capped under the presumptive remedy.

*The provisions of the California Hazardous Waste Control Act that have been approved by the EPA as part of the State RCRA program are federally enforceable and are, therefore, Federal ARARs. It is the State of California's position that the requirements under the approved RCRA program are State ARARs. See Section 2.0 for a more detailed discussion.

ACGIH - American Conference of Governmental Industrial Hygienists.
APCD - Air Pollution Control District.
ARAR - Applicable or relevant and appropriate requirement.
BACT - Best available control technology.
CARB - California Air Resources Board.
CCR - California Code of Regulations.
CFR - Code of Federal Regulations.
cm/s - Centimeters per second.
MCB - Marine Corps Base.
RCRA - Resource Conservation and Recovery Act.
SIP - State implementation plan.
TBC - To be considered.

APPENDIX C
ADMINISTRATIVE RECORD INDEX

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO. . . / APPROX. # . OF . PAGES	DOC. NO . . .	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE / TO . . . . . / TO . SIGNATURE . . .	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. . . . . Site	. . . . . Location . . . . .
M00681 DATA 0004	001923	06/28/94 04.3	MCB CAMP PENDLETON MCB CAMP PENDLETON	PROPOSED REMEDIAL ACTION OBJECTIVES FOR SOIL GROUP A SITES. ECOLOGICAL RISK ASSESSMENT FOR MCB CAMP PENDLE-TON.	ADMIN RECORD	RA RISK	GROUP A	
M00681 DATA 0004	002036	06/29/94 02.1	MCB CAMP PENDLETON MCB CAMP PENDLETON	SUMMARY OF ANALYTICAL DATA FOR SURFACE IMPOOUNDMENT CONSTITUENTS.	ADMIN RECORD	SAP SLUDGE		
M00681 DATA 0003	002037	06/29/94 02.2	DAMES & MOORE MCB CAMP PENDLETON	SITE VISIT COLLECTING SAMPLES AND TIMES SAMPLES WERE COLLECTED.	ADMIN RECORD	SV SLUDGE		
M00681 DATA 000000000000000 0004	001504	06/21/94 09/18/80 00000 02.2	ENVIRONMENTAL ENG. MCB CAMP PENDLETON	LOS FLORES B-41614 MCB CAMP PENDLETON DATA	ADMIN RECORD	DATA	BA GROUP B OU2	SOUTHWEST DIVISION
M00681 DATA 000000000000000 0003	001371	06/20/94 04/19/82 00000 03.2	ENVIRON ENG LAB. R. CHAMBERS SOUTHWEST DIVISION	ANALYTICAL DATA MCB CAMP PENDLETON #1	ADMIN RECORD	DATA		SOUTHWEST DIVISION
M00681 DATA 0003	002054	06/29/94 12/08/89 01.1	MCB CAMP PENDLETON MCB CAMP PENDLETON	MCB CAMP PENDLETON INSTALLATION RESTORATION PROGRAM BACKGROUND.	ADMIN RECORD	IAS FS RI REMOVAL (3) REMOVAL (6)	3 4 5 6 8 41 GROUP A GROUP B OU1, OU2	SOUTHWEST DIVISION
M00681 DATA 0004	001780	06/27/94 08/07/91 03.2	SOUTHWEST DIVISION A.E. THOMPSON MCB CAMP PENDLETON	CONTAMINATED SOIL TREATMENT. PROJECT ACTIVATION GUIDELINES.	ADMIN RECORD	TSDF		
M00681 DATA 000000000000000 0009	000802	05/17/94 03/03/92 00166 02.2		DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: ORGANOCHLORINE PESTICIDES PCBs SDG# S0525	ADMIN RECORD	PESTICIDES PCB	GROUP A	SOUTHWEST DIVISION
M00681 DATA 0007	000805	05/17/94 03/03/92 00166 02.2		DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: VOLATILES SDG# S0525	ADMIN RECORD	VOLATILES		

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO. . . / APPROX. # . OF . PAGES	DOC. NO . . .	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE / TO . . . . . / TO . SIGNATURE . . .	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. . . . . Site . . . . . Location . . . . .
M00681 DATA 0008	000806	05/17/94 03/03/92 00166 02.2		DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: SEMIVOLATILES SDG# S0525	ADMIN RECORD	SEMIVOLATILES	
M00681 DATA 0009	000807	05/17/94 03/03/92 00166 02.2		DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: ORGANOCHLORINE PESTICIDES\PCBs SDG# S0525	ADMIN RECORD	PESTICIDES PCB	
M00681 DATA 0008	000808	05/17/94 03/03/92 00166 02.2		DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: SEMIVOLATILES SDG# S0525	ADMIN RECORD	SEMIVOLATILES	
M00681 DATA 0007	000809	05/17/94 03/03/92 00166 02.2		DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: VOLATILES SDG# S0525	ADMIN RECORD	VOLATILES	
M00681 DATA 000000000000000 0003	002314	07/20/94 03/03/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: SOIL PARAMETERS: TPH GASOLINE AND TPH DIESEL SDG: S0525	ADMIN RECORD	FUEL	SOUTHWEST DIVISION
M00681 DATA 000000000000000 0007	002310	07/20/94 03/04/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: SOIL PARAMETERS: TAL METALS AND MOLYBDENUM SDG: S0525	ADMIN RECORD	METALS	SOUTHWEST DIVISION
M00681 DATA 35073 0256	000611	05/13/94 03/09/92 00166 02.2	CH2M HILL PEGGY A. NORTON CH2M HILL EARL BYRON	ANALYTICAL DATA MCB CAMP PENDLETON BIO ACCUMULATION PESTICIDES, PCB, TFH, HERBICIDES, METALS	ADMIN RECORD	PESTICIDES PCB TPH HERBICIDES METALS	
M00681 DATA 35128 0297	000612	05/13/94 03/09/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA MCB CAMP PENDLETON PESTICIDES, PCB, TFH, HERBICIDES, METALS	ADMIN RECORD	PESTICIDES PCB TPH HERBICIDE METALS	
M00681 DATA 0007	000794	05/17/94 03/09/92 00166 02.2		DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL AND WATER PARAMETER: ORGANOCHLORINE PESTICIDES\PCBs SDG# S0598	ADMIN RECORD	WATER PESTICIDES PCB	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO. . . / APPROX. # . OF . PAGES	DOC. NO . . .	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE / TO . . . . . / TO . SIGNATURE . . .	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. . . . . Site . . . . . Location . . . . .
M00681 DATA 0007	000816	05/17/94 03/09/92 00166 02.2		DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL & WATER PARAMETER: ORGANOCHLORINE PESTICIDES\PCBs SDG# S0598	ADMIN RECORD	WATER PESTICIDES PCB	
M00681 DATA 35121 0390	000610	05/13/94 03/10/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARKLY	ANALYTICAL DATA MCB CAMP PENDLETON PESTICIDES, PCB, TFH, HERBICIDES, METALS	ADMIN RECORD	PESTICIDES PCB TPH HERBICIDE METALS	
M00681 DATA 35078 0201	000613	05/13/94 03/10/92 00166 02.2	CH2M HILL PEGGY A. NORTON CH2M HILL EARL BYRON	ANALYTICAL DATA MCB CAMP PENDLETON BIO ACCUMULATION PESTICIDES, PCB, TFH, HERBICIDES, METALS	ADMIN RECORD	PESTICIDES PCB TPH HERBICIDE METALS	
M00681 DATA 0009	000795	05/17/94 03/10/92 00166 02.2		DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: ORGANOCHLORINE PESTICDES\PCBs SDG# S0636	ADMIN RECORD	PESTICIDES PCB	
M00681 DATA 0006	000796	05/17/94 03/10/92 00166 02.2		DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL &WATER PARAMETER: ORGANOCHLORINE PESTICDES\PCBs SDG# S0617	ADMIN RECORD	WATER PESTICIDES PCB	
M00681 DATA 0006	000812	05/17/94 03/10/92 00166 02.2		DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER & SOIL PARAMETER: ORGANOCHLORINE PESTICDES\PCBs SDG# S0617	ADMIN RECORD	WATER PESTICIDES PCB	
M00681 DATA 0009	000817	05/17/94 03/10/92 00166 02.2		DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: ORGANOCHLORINE PESTICDES\PCBs SDG# S0636	ADMIN RECORD	PESTICIDES PCB	
M00681 DATA 0039	001332	05/31/94 03/10/92 02.2	 MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: PCDD & PCDFs LAB: ENSECO-CAL SDG# S0598	ADMIN RECORD	DATA	
M00681 DATA 000000000000000 0005	002312	07/20/94 03/10/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: SOIL PARAMETERS: TAL METALS AND MOLYBENUM SDG: S0636	ADMIN RECORD	METALS	SOUTHWEST DIVISION

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO . . . / DOCUMENT . TYPE . . . / CONTR/GUID . . NO. . . / APPROX. # . OF . PAGES	PRC . DATE FROM . . . . . / DOC . DATE FROM . SIGNATURE / CTO . NO . . TO . . . . . / EPA . CAT# TO . SIGNATURE . . .	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. . . . . Site	. . . . . Location . . . . .
M00681 002324 DATA 000000000000000 0005	07/21/94 03/10/92 00000 02.2 ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER AND SOIL PARAMETERS: TAL METALS AND MOLYBDENUM SDG: S0617	ADMIN RECORD	WATER METALS		SOUTHWEST DIVISION
M00681 000789 DATA 000000000000000 0532	05/17/94 03/12/92 00166 02.2 WESTON MANAGERS IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON DIXIONS RFW# 9203S268	ADMIN RECORD	DATA	6	SOUTHWEST DIVISION
M00681 002358 DATA 000000000000000 0020	07/21/94 03/12/92 00166 02.2 ESE MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: CARBAMATE/UREA PESTICIDES SDG: G26823, G26961, G28402, G28403, G28541, G29186	ADMIN RECORD	WATER PESTICIDES	23	SOUTHWEST DIVISION
M00681 000797 DATA 0007	05/17/94 03/13/92 00166 02.2	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: ORGANOCHLORINE PESTICDES\PCBs SDG# S0657	ADMIN RECORD	PESTICIDES PCB		
M00681 000813 DATA 0007	05/17/94 03/13/92 00166 02.2	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: ORGANOCHLORINE PESTICDES\PCBs SDG# S0657	ADMIN RECORD	PESTICIDES PCB		
M00681 002307 DATA 000000000000000 0003	07/20/94 03/13/92 00000 02.2 ROY F. WESTON MCB CAMP PENDLETON	MATRIX: SOIL PARAMETERS: TPH GASOLINE AND TPH DISEL SDG: S0657	ADMIN RECORD	FUEL		SOUTHWEST DIVISION
M00681 002311 DATA 000000000000000 0007	07/20/94 03/13/92 00000 02.2 ROY F. WESTON MCB CAMP PENDLETON	MATRIX: SOIL PARAMETERS: TAL METALS AND MOLYBDENUM SDG: S0657	ADMIN RECORD	METALS		SOUTHWEST DIVISION
M00681 000734 DATA 01F166S920066 0241	05/16/94 03/16/92 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: TRIAZINE, PESTICIDES LAB: ESE SDG#G26951, G27060, G28670, G28964, G29112, G29391	ADMIN RECORD	PESTICIDES		
M00681 002351 DATA 000000000000000 0050	07/21/94 03/16/92 00166 02.2 ESE MCB CAMP PENDLETON	MATRIX: SOIL PARAMETERS: CHLORINATED HERBICIDES CASE: NACPS1 SDG: G27017, G29493, G28842, AND G28712	ADMIN RECORD	HERBICIDE		SOUTHWEST DIVISION
M00681 000776 DATA 0271	05/17/94 03/19/92 00166 02.2 WESTION MANGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON DIXIONS RFW# 9203S352	ADMIN RECORD	HPCCD		

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO. . . / APPROX. # . OF . PAGES	DOC. NO . . .	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE / TO . . . . . / TO . SIGNATURE . . .	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS . . . . . Site . . . . . Location . . . . .
M00681 DATA 0351	000780	05/17/94 03/19/92 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON DIXIONS RFW# 9203S351	ADMIN RECORD	HPCCD
M00681 DATA 0419	000781	05/17/94 03/19/92 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON DIXIONS RFW# 9203S347	ADMIN RECORD	HPCCD
M00681 DATA 0329	000791	05/17/94 03/19/92 00166 02.2	WESTON MANAGERS IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON DIXIONS RFW# 9203S317	ADMIN RECORD	HPCCD
M00681 DATA 0339	000790	05/17/94 03/20/92 00166 02.2	WESTON MANAGERS IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON DIXIONS RFW# 9203S379	ADMIN RECORD	HPCCD
M00681 DATA 0037	000784	05/17/94 03/26/92 00166 02.2	WESTON MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL PURGEABLE HYDROCARBONS ANALYSIS SDG# S0598 RFW# 9203S317, 9203S332, 9203S347	ADMIN RECORD	TPH
M00681 DATA 0038	000785	05/17/94 03/26/92 00166 02.2	WESTON MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL PURGEABLE HYDROCARBONS ANALYSIS SDG# S0525 RFW# 9203S230, 9203S268, 9203S316	ADMIN RECORD	TPH
M00681 DATA 0053	000786	05/17/94 03/27/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GCMS\SEMIVOLATILES ANALYSIS SDG# S0525 RFW# 9203S230, 9203S268, 9203S316	ADMIN RECORD	SEMIVOLATILES
M00681 DATA 0045	000798	5/17/94 03/27/92 00166 02.2	WESTON MANGER IT CORPORATION	DATA SUMMARY PACKAGE FOR MCB CAMP PENDLETON GCMS\VOLATILES ANALYSIS SDG# S0525 RFW# 9203S230, 9203S268, 9203S316	ADMIN RECORD	VOLATILES
M00681 DATA 0005	000803	05/17/94 03/27/92 00166 02.2		DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: ORGANOCHLORINE PESTICIDES PCBs SDG# S0848	ADMIN RECORD	WATER PESTICIDES PCB
M00681 DATA 0004	000804	05/17/94 03/27/92 00166 02.2		DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: SEMIVOLATILES SDG# S0848	ADMIN RECORD	WATER SEMIVOLATILES

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO. . . / APPROX. # . OF . PAGES	DOC. NO . . .	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE / TO . . . . . / TO . SIGNATURE . . .	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. . . . . Site . . . . . Location . . . . .
M00681 DATA 0005	000810	05/17/94 03/27/92 00166 02.2		DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: ORGANOCHLORINE PESTICIDES\PCB SDG# S0848	ADMIN RECORD	WATER PESTICIDES PCB	
M00681 DATA 0004	000811	05/17/94 03/27/92 00166 02.2		DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: SEMIVOLATILES SDG# S0848	ADMIN RECORD	WATER SEMIVOLATILES	
M00681 DATA 000000000000000 0003	002308	07/20/94 03/27/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: SOIL PARAMETERS: TPH GASOLINE AND TPH DIESEL SDG: S0872	ADMIN RECORD	FUEL	SOUTHWEST DIVISION
M00681 DATA 000000000000000 0005	002325	07/21/94 03/27/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: SOIL PARAMETERS: TAL METALS AND MOLYBDENUM SDG: S0848	ADMIN RECORD	WATER METALS	SOUTHWEST DIVISION
M00681 DATA 0270	000783	05/17/94 03/28/92 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON DIXIONS RFW# 9203S438	ADMIN RECORD	HPCCD	
M00681 DATA 0028	000799	05/17/94 03/30/92 00166 02.2	WESTON MANAGER IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON PURGEABLE PETROLEUM HYDROCARBONS ANALYSIS SDG# S0636 RFW# 9203S350, 9203S351	ADMIN RECORD	TPH	
M00681 DATA 0005	000800	05/17/94 03/30/92 00166 02.2		DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER & SOIL PARAMETER: SEMIVOLATILES SDG# S0909	ADMIN RECORD	WATER SEMIVOLATILES	
M00681 DATA 0005	000801	05/17/94 03/30/92 00166 02.2		DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER & SOIL PARAMETER: ORGANOCHLORINE PESTICIDES PCBs SDG# S0909	ADMIN RECORD	WATER PESTICIDES PCB	
M00681 DATA 0005	000814	05/17/94 03/30/92 00166 02.2		DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL & WATER PARAMETER: SEMIVOLATILES SDG# S0909	ADMIN RECORD	WATER SEMIVOLATILES	
M00681 DATA 0005	000815	05/17/94 03/30/92 00166 02.2		DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL & WATER PARAMETER: ORGANOCHLORINE PESTICIDES\PCBs SDG# S0909	ADMIN RECORD	WATER PESTICIDES PCB	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO. . . / APPROX. # . OF . PAGES	DOC. NO . . .	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE / TO . . . . . / TO . SIGNATURE . . .	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. . . . . Site . . . . . Location . . . . .
M00681 DATA 000000000000000 0008	002321	07/21/94 03/30/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER AND SOIL PARAMETERS: TAL METALS AND MOLYBDENUM SDG: S0909	ADMIN RECORD	WATER METALS	SOUTHWEST DIVISION
M00681 DATA 0478	000782	05/17/94 03/31/92 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON DIXIONS RFW# 9203S447	ADMIN RECORD	HPCCD	
M00681 DATA 0034	000792	05/17/94 03/31/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE HYDROCARBONS ANALYSIS SDG# S0525 RFW# 9203S230, 9203S268, 9203S316	ADMIN RECORD	TEH	
M00681 DATA 0070	000793	05/17/94 03/31/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANICS ANALYSIS SDG# S0525 RFW# 9203S230, 9203S268, 9203S316	ADMIN RECORD	IOG	
M00681 DATA 0028	000766	05/17/94 04/01/92 00166 02.2	WESTION MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE HYDROCARBONS ANALYSIS SDG# S0636 RFW# 9203S350, 9203S351	ADMIN RECORD	TPH	
M00681 DATA 0033	000767	05/17/94 04/01/92 00166 02.2	WESTION MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE PETROLEUM HYDROCARBONS ANALYSIS SDG# S0598 RFW# 9203S317, 9203S332, 9203S347	ADMIN RECORD	TPH	
M00681 DATA 0310	000769	05/17/94 04/01/92 00166 02.2	WESTION MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON PESTICIDES\PCB RFW# 9203S471	ADMIN RECORD	PESTICIDES PCB	
M00681 DATA 0005	000779	05/17/94 04/01/92 00166 02.2		DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL AND WATER PARAMETER: ORGANOCHLORINE PESTICIDES/PCBs SDG# S0952	ADMIN RECORD	WATER PESTICIDES PCB	
M00681 DATA 0278	000787	05/17/94 04/01/92 00166 02.2	WESTON MANAGERS IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON VOLATILES RFW# 92035471	ADMIN RECORD	VOLATILES	
M00681 DATA 0362	000788	05/17/94 04/01/92 00166 02.2	WESTON MANAGERS IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON DIXIONS RFW# 9203S350	ADMIN RECORD	HPCCD	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO. . . / APPROX. # . OF . PAGES	DOC. NO . . .	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE / TO . . . . . / TO . SIGNATURE . . .	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. . . . . Site . . . . . Location . . . . .
M00681 DATA 000000000000000 0008	002326	07/21/94 04/01/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: SOIL AND WATER PARAMETERS: TAL METALS AND MOLYBDENUM SDG: S0952	ADMIN RECORD	WATER METALS	SOUTHWEST DIVISION
M00681 DATA 0027	000762	05/17/94 04/02/92 00166 02.2	WESTION MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL PETROELUM HYDROCARBONS ANALYSIS SDG# S0657 RFW# 9203S352, 92035374	ADMIN RECORD	TPH	
M00681 DATA 0041	000763	05/17/94 04/02/92 00166 02.2	WESTION MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL PURGEABLE PETROELUM HYDROCARBONS ANALYSIS SDG# S0617 RFW# 9203S362, 9203S363, 9203S364, 9203S399	ADMIN RECORD	TPH	
M00681 DATA 0043	000764	05/17/94 04/02/92 00166 02.2	WESTION MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON GC\MS VOLATILES ANALYSIS SDG# S0636 RFW# 9203S350, 9203S351	ADMIN RECORD	VOLATILES	
M00681 DATA 0037	000765	05/17/94 04/02/92 00166 02.2	WESTION MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON ORGANOPHOSPHOROUS PESTICIDES SDG# S0525 RFW# 9203S361	ADMIN RECORD	PESTICIDES	
M00681 DATA 0328	000768	05/17/94 04/02/92 00166 02.2	WESTION MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON DIOXINS\FURANS RFW# 9203S483	ADMIN RECORD	HPCCD	
M00681 DATA 0243	000771	05/17/94 04/02/92 00166 02.2	WESTION MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON DIXIONS RFW# 9203S485	ADMIN RECORD	HPCCD	
M00681 DATA 0027	000772	05/17/94 04/02/92 00166 02.2	WESTION MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE PETROLEUM HYDROCARBONS ANALYSIS SDG# S0657 RFW# 9203S352, 9203S374	ADMIN RECORD	TPH	
M00681 DATA 0050	000773	05/17/94 04/02/92 00166 02.2	WESTION MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON ORGANOPHOSPHOROUS PESTICIDES SDG# S0598, RFW# 9203S317, 9203S332, 9203S347	ADMIN RECORD	PESTICIDES	
M00681 DATA 0487	000775	05/17/94 04/02/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON SEMIVOLATILES RFW# 9203S483	ADMIN RECORD	SEMIVOLATILES	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE / CONTR/GUID . . NO. / APPROX. # . OF . PAGES	DOC. NO	PRC . DATE / DOC . DATE / CTO . NO / EPA . CAT#	FROM / FROM . SIGNATURE / TO / TO . SIGNATURE	SUBJECT	CLASSIFICATION	KEY WORDS	Site / Location
M00681 DATA 0268	000777	05/17/94 04/02/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON PESTICIDES PCB RFW# 9203S483	ADMIN RECORD	PESTICIDES PCB	
M00681 DATA 0219	000778	05/17/94 04/02/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON VOA RFW# 9203S483	ADMIN RECORD	VOA	
M00681 DATA 00019	000761	05/17/94 04/03/92 00166 02.2	WESTION MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL PURGEABLE PETROELUM HALOCARBONS ANALYSIS SDG# S0848 RFW# 9203S463	ADMIN RECORD	TPH	
M00681 DATA 0217	000774	05/17/94 04/03/92 00166 02.2	WESTION MANAGERS IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANICS RFW# 9203S483	ADMIN RECORD	IOG	
M00681 DATA 0525	000900	05/18/94 04/03/52 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON DIXIONS RFW# 9204S501	ADMIN RECORD	HPCCD	
M00681 DATA 32461 0022	000640	05/13/94 04/06/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON ORGANICS	ADMIN RECORD	DATA	
M0681 DATA 32364 0091	000641	05/13/94 04/06/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON ORGANICS VOLATILES	ADMIN RECORD	VOC	
M00681 DATA 32461 0104	000642	05/13/94 04/06/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON INORGANICS	ADMIN RECORD	IOG	
M00681 DATA 32364461 0226	000643	05/13/94 04/06/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON INORGANICS	ADMIN RECORD	IOG	
M00681 DATA 0540	000685	05/13/94 04/06/92 00166 02.2	ROY F. WESTION INC IT CORPORATION	ANALYTICAL DATA PACKAGE FOR MCB CAMP PENDLETON ANALYSIS RFW# 9204S506	ADMIN RECORD	DATA	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE / CONTR/GUID . . NO. / APPROX. # . OF . PAGES	DOC. NO	PRC . DATE / DOC . DATE / CTO . NO / EPA . CAT#	FROM / FROM . SIGNATURE / TO / TO . SIGNATURE	SUBJECT	CLASSIFICATION	KEY WORDS	Site	Location
M00681 DATA 0049	000652	05/13/94 04/07/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON ORGANOCHLORINE PESTICIDES & PCBs ANALYSIS SDG# S0525 RFW# 9203S230, 9203S268, 9203S316	ADMIN RECORD	PESTICIDES PCB		
M00681 DATA 0040	000653	05/13/94 04/07/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON HERBICIDES ANALYSIS SDG# S0598 RFW# 9203S332, 9203S347	ADMIN RECORD	HERBICIDE		
M00681 DATA 0063	000654	05/13/94 04/07/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANICS ANALYSIS SDG# S0598 RFW# 9203S317, 9203S332, 9203S347	ADMIN RECORD	IOG		
M00681 DATA 0036	000648	05/13/94 04/10/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACABLE PETROLEUM HYDROCARBONS ANALYSIS SDG# S0617 RFW# 9203S363, 9203S364, 9203S399	ADMIN RECORD	TPH		
M00681 DATA 0025	000649	05/13/94 04/10/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL PURGEABLE PETROLEUM HYDROCARBONS ANALYSIS SDG# S0872 RFW# 9203S471, 9203S483	ADMIN RECORD	TPH		
M00681 DATA 0043	000650	05/13/94 04/10/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GC\MS SEMIVOLATILES ANALYSIS SDG# S0617 RFW# 9203S362, 9203S363, 9203S364	ADMIN RECORD	SOLVENTS		
M00681 DATA 0025	000651	05/13/94 04/10/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL PURGEABLE PETROLEUM HYDROCARBONS ANALYSIS SDG# S0872 RFW# 9203S471, 9203S483	ADMIN RECORD	TPH		
M00681 DATA 0037	000655	05/13/94 04/10/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON HERBICIDES ANALYSIS SDG# S0636 RFW# 9203S350, 9203S351	ADMIN RECORD	HERBICIDE		
M00681 DATA 0071	000656	05/13/94 04/10/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANICS ANALYSIS SDG# S0636 RFW# 9204S488	ADMIN RECORD	IOG		
M00681 DATA 0036	000669	05/13/94 04/10/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GC\MS VOLATILE ANALYSIS SDG# S0657 RFW# 9203S352, 9203S374	ADMIN RECORD	VOC		

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO. . . / APPROX. # . OF . PAGES	DOC. NO . . .	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . / TO . . . . . / TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. . . . . Site . . . . . .Location . . . . .
M00681 DATA 32699 0212	000639	05/13/94 04/11/92 00166 02.2	CH2M HILL MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON VOLATILES	ADMIN RECORD	HERBICIDE WATER PESTICIDES	
M00681 DATA 0035	000672	05/13/94 04/13/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GC\MS SEMIVOLATILES ANALYSIS SDG# S0636 RFW# 9203S350, 9203S351	ADMIN RECORD	SOLVENTS	
M00681 DATA 0093	000679	05/13/94 04/13/92 00166 02.2	ESE	LABORATROY REPORT FOR MCB CAMP PENDLETON METALS	ADMIN RECORD	METALS	
M00681 DATA 0049	000657	05/13/94 04/14/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON ORGANOCHLORINE PESTICIDES AND PCBs ANALYSIS SDG# S0598 RFW# 9203S317, 9203S332, 9203S347	ADMIN RECORD	PESTICIDES PCB	
M00681 DATA 0069	000670	05/13/94 04/14/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANICS ANALYSIS 9203S399 SDG# S0617 RFW# 9203S362, 9203S363, 9203S364, 9203S379	ADMIN RECORD	IOG	
M00681 DATA 0021	000671	05/13/94 04/14/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GC\MS VOLATILES ANALYSIS SDG# S0848 RFW# 9203S463	ADMIN RECORD	VOC	
M00681 DATA 0435	000683	05/13/94 04/14/92 00166 02.2	ROY F. WESTION INC IT CORPORATION	ANALYTICAL DATA PACKAGE FOR MCB CAMP PENDLETON ANALYSIS RFW# 9204S580	ADMIN RECORD	DATA	
M00681 DATA 0410	000684	05/13/94 04/14/92 00166 02.2	ROY F. WESTION INC IT CORPORATION	ANALYTICAL DATA PACKAGE FOR MCB CAMP PENDLETON ANALYSIS RFW# 9204S571	ADMIN RECORD	DATA	
M00681 DATA 32717 0215	000638	05/13/94 04/15/92 00166 02.2	CH2M HILL MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON VOLATILES	ADMIN RECORD	VOC	
M00681 DATA 32717 1379	000644	05/13/94 04/15/92 00166 02.2	CH2M HILL PEGGY A. MORTON IT CORPORATION DAVE MARK	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON SEMIVOLATILES (missing pages 00001-000278)	ADMIN RECORD	SOLVENTS	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO. . . / APPROX. # . OF . PAGES	DOC. NO . . .	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . / TO . . . . . / TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. . . . . Site . . . . . .Location . . . . .
M00681 DATA 0053	000658	05/13/94 04/16/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GC\MS SEMIVOLATILES ANALYSIS SDG# S0598 RFW# 9203S317, 9203S332, 9203S347	ADMIN RECORD	SOLVENTS	
M00681 DATA 0065	000659	05/13/94 04/16/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GC\MS VOLATILES ANALYSIS SDG# S0598 RFW# 9203S317, 9203S332, 9203S347	ADMIN RECORD	VOC	
M00681 DATA 0047	000662	05/13/94 04/16/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON ORGANOPHOSPHOROUS PESTICIDES ANALYSIS SDG# S0617 RFW# 9203S362, 9203S363, 9203S364	ADMIN RECORD	PESTICIDES	
M00681 DATA 0021	000665	05/13/94 04/17/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GC\MS SEMIVOLATILES ANALYSIS SDG# S0848 RFW# 9203S463	ADMIN RECORD	SOLVENTS	
M00681 DATA 0629	000681	05/13/94 04/17/92 00166 02.2	ROY F. WESTION INC IT CORPORATION	ANALYTICAL DATA PACKAGE FOR MCB CAMP PENDLETON ANALYSIS RFW# 9204S607	ADMIN RECORD	DATA	
M00681 DATA 0516	000682	05/13/94 04/18/92 00166 02.2	ROY F. WESTION INC IT CORPORATION	ANALYTICAL DATA PACKAGE FOR MCB CAMP PENDLETON ANALYSIS RFW# 9204S616	ADMIN RECORD	DATA	
M00681 DATA 0000000000000000 0005	002323	07/21/94 04/19/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER AND SOIL PARAMETERS: TAL METALS AND MOLYBDENUM SDG: S0598	ADMIN RECORD	WATER METALS	SOUTHWEST DIVISION
M00681 DATA 0018	000645	05/13/94 04/20/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL PURGEABLE PETROLEUM HYDROCARBONS SDG# S0952 RFW# 9204S506	ADMIN RECORD	TPH	
M00681 DATA 0022	000646	05/13/94 04/20/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL PURGEABLE PETROLEUM HYDROCARBONS SDG# S0848 RFW# 9203S463	ADMIN RECORD	TPH	
M00681 DATA 0026	000647	05/13/94 04/20/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL PURGEABLE PETROLEUM HYDROCARBONS SDG# S0909 RFW# 9204S485, 9204S501	ADMIN RECORD	TPH	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE / CONTR/GUID . . NO. / APPROX. # . OF . PAGES	DOC. NO	PRC . DATE / DOC . DATE / CTO . NO / EPA . CAT#	FROM / FROM . SIGNATURE / TO / TO . SIGNATURE	SUBJECT	CLASSIFICATION	KEY WORDS	Site	Location
M00681 DATA 0065	000660	05/13/94 04/20/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON ORGANOPHOSPHOROUS PESTICIDES ANALYSIS SDG# S0636 RFW# 9203S350, 9203S351	ADMIN RECORD	PESTICIDES		
M00681 DATA 0107	000661	05/13/94 04/20/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON ORGANOPHOSPHOROUS PESTICIDES ANALYSIS SDG# S0657 RFW# 9203S352, 9203S374	ADMIN RECORD	PESTICIDES		
M00681 DATA 0007	000674	05/13/94 04/20/92 00166 02.2	WESTON MANAGERS IT CORPORATION	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL & WATER PARAMETER: VOLATILES LAB: ROY F. WESTON SDG# S1126	ADMIN RECORD	WATER		
M00681 DATA 0006	000675	05/13/94 04/20/92 00166 02.2	WESTON MANAGERS IT CORPORATION	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL & WATER PARAMETER: SEMIVOLATILES LAB: ROY F. WESTON SDG# S1126	ADMIN RECORD	SOLVENTS WATER		
M00681 DATA 0006	000676	05/13/94 04/20/92 00166 02.2	WESTON MANAGERS IT CORPORATION	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL & WATER PARAMERTER: ORGANOCHLORINE PFSTICIDES\PCBs LAB: ROY F. WESTON SDG# S1126	ADMIN RECORD	PESTICIDES PCB WATER		
M00681 DATA 000000000000000 0007	002320	07/21/94 04/20/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER AND SOIL PARAMETERS: TAL METALS AND MOLYBDENUM SDG: S1126	ADMIN RECORD	WATER METALS	SOUTHWEST DIVISION	
M00681 DATA 0052	000678	05/13/94 04/21/92 00166 02.2	ESE	LABORATROY REPORT FOR MCB CAMP PENDLET0M ANALYSIS	ADMIN RECORD	DATA		
M00681 DATA 0054	000663	05/13/94 04/22/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON ORGANOPHOSPHOROUS PESTICIDES & PCBs ANALYSIS SDG# S0636 RFW# 9203S350, 9203S351	ADMIN RECORD	PESTICIDES PCB		
M00681 DATA 0042	000664	05/13/94 04/22/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GC\MS VOLATILES ANALYSIS SDG# S0617 RFW# 9203S362, 9203S363, 9203S364, 92O3S399	ADMIN RECORD	VOC		
M00681 DATA 0042	000677	05/13/94 04/22/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATROY REPORT FOR MCB CAMP PENDLETON CHLORINATED HERBICIDES ANALYSIS SDG# S0657 RFW# 9203S352, 9203S374	ADMIN RECORD	HERBICIDE		

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE / CONTR/GUID . . NO. / APPROX. # . OF . PAGES	DOC. NO	PRC . DATE / DOC . DATE / CTO . NO / EPA . CAT#	FROM / FROM . SIGNATURE / TO / TO . SIGNATURE	SUBJECT	CLASSIFICATION	KEY WORDS	Site	Location
M00681 DATA 0060	000680	05/13/94 04/22/92 00166 02.2	ESE	LABORATROY REPORT FOR MCD CAMP PENDLETON CHLORINATED HERBICIDES ANALYSIS SDG# S0617 RFW# 9203S363, 9203S364,9203S399	ADMIN RECORD	HERBICIDES		
M00681 DATA 0007	001330	05/31/94 04/22/92 02.2	MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER, SOIL PARAMETERS: SEMIVOALTILES LAB: ROY F. WESTON SDG# S1166	ADMIN RECORD	WATER SEMIVOLATILES		
M00681 DATA 000000000000000 0006	002284	07/20/94 04/22/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER AND SOIL PARAMETERS: CLP METALS AND MOLYBDENUM SDG: S1166	ADMIN RECORD	WATER METALS		SOUTHWEST DIVISION
M00681 DATA 0056	000666	05/13/94 04/23/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LADORATORY REPORT FOR MCB CAMP PENDLETON INORGANICS ANALYSIS SDG# S0657 RFW# 9203S352, 9203S374	ADMIN RECORD	IOG		
M00681 DATA 0026	000667	05/13/94 04/23/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANICS NONCLP ANALYSIS SDG# S0848 RFW# 9203S463, 9203S447	ADMIN RECORD	IOG		
M00681 DATA 0031	000668	05/13/94 04/23/92 00166 02.2	WESTION MANAGERS IT CORPORATION	1ABORATORY REPORT FOR MCB CAMP PENDLETON GC\MS SEMIVOIATILE ANALYSIS SDG# S0657 RFW# 9203S352, 9203S374	ADMIN RECORD	SOLVENTS		
M00681 DATA 0042	000673	05/13/94 04/23/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GC\MS VOLATILES ANALYSIS SDG# S0909 RFW# 9204S485, 9204S501	ADMIN RECORD	VOC		
M00681 DATA 32459 0468	000576	05/12/94 04/28/92 00166 02.2	CH2M HILL PEGGA. NORTON IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. VOLATILES, HERBICIDES	ADMIN RECORD	VOC HERBICIDES		
M00681 DATA 0026	000588	05/12/94 04/28/92 00166 02.2	WESTION MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. GC\MS VOLATILES ANLYSIS SDG# S0952 RFW# 9204S506	ADMIN RECORD	VOC		
M00681 DATA 0028	000589	05/12/94 04/28/92 00166 02.2	WESTION MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. TOTAL EXTRACTABLE PETROLEUM HYDROCARBONS ANALYSIS SDG# S204S483 RFW# 9203S471, 9204S483	ADMIN RECORD	TPH		

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE / CONTR/GUID . . NO / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO / EPA . CAT#	FROM / FROM . SIGNATURE / TO / TO . SIGNATURE	SUBJECT	CLASSIFICATION	KEY WORDS	Site / Location
M00481 DATA 0011	000601	05/13/94 04/28/92 00166 02.2	WESTION MANAGERS MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLET0N MATRIX: SOIL & WATER PARAMETER: SEMIVOLATILES LAB: ROY F. WESTON SDG# S1166	ADMIN RECORD	WATER SOLVENTS	
M00681 DATA 000000000000000 0006	002313	07/20/54 04/28/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: SOIL, WATER PARAMETERS: VOLATILES SDG: S1188	ADMIN RECORD	WATER VOLATILES	SOUTHWEST DIVISION
M00681 DATA 0073	000587	05/12/94 04/29/92 00166 02.2	WESTION MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. INORGANICS ANALYSIS SDC# S0909 RFW# 9204S485, 9204S501	ADMIN RECORD	IOG	
M00681 DATA 000000000000000 0006	002283	07/20/94 04/29/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER AND SOIL PARAMETERS: CLP METALS AND MOLYBDENUM SDG: S1188	ADMIN RECORD	WATER METALS	SOUTHWEST DIVISION
M00681 DATA 0052	000591	05/12194 04/30/92 00166 02.2	WESTION MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. ORGANOPHOSPHOROUS PESTICIDES ANALYSIS SDG# S0657 RFW# 9203S352, 9203S374	ADMIN RECORD	PWSTICIDES	
M00681 DATA 0007	000602	05/13/94 04/30/92 00166 02.2	WESTION MANAGERS MCB CAMP PENDLETON	DATA VALAIDATION REPORT FOR MCB CAMP PENDLET0N MATRIX: SOIL & WATER PARAMETER: ORGANOCHLORINE PESTICIDES\PCBs LAB: ROY F. WESTON SDG# S1197	ADMIN RECORD	WATER PESTICIDES PCB	
M00681 DATA 0006	000603	05/13/94 04/30/92 00166 02.2	WESTION MANAGERS MCB CAMP PENDLETON	DATA VALAIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL & WATER PARAMETER: VOLATILES LAB: ROY F. WESTON SDG# S1197	ADMIN RECORD	WATER VOC	
M00681 DATA 0004	000604	05/13/94 04/30/92 00166 02.2	WESTION MANAGERS MCB CAMP PENDLETON	DATA VALAIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL & WATER PARAMETER: SEMIVOLATILES LAB: ROY F. WESTON SDG# S1197	ADMIN RECORD	WATER SOLVENTS	
M00681 DATA 0006	001327	05/31/94 04/30/92 02.2	 MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER, SOIL PARAMETERS: VOLATILES LAB: ROY F. WESTON SDG# S1197	ADMIN RECORD	WATER VOLATILES	
M00681 DATA 0007	001328	05/31/94 04/30/92 02.2	 MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER, SOIL PARAMETERS: ORGANOCHLORINE PESTICIDES PCBs LAB: ROY F. WESTON SDG# S1197	ADMIN RECORD	WATER PESTICIDES PCB	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . . . Site . . . . . Location . . . . .
M00681 DATA 0004	001329	05/31/94 04/30/92 02.2	 MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER, SOIL PARAMETERS: SEMIVOLATILES LAB: ROY F. WESTON SDG# S1197	ADMIN RECORD	WATER SEMIVOLATILES	
M00681 DATA 000000000000000 0005	002322	07/21/94 04/30/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER AND SOIL PARAMETERS: TAL METALS AND MOLYBDENUM SDG: S1197	ADMIN RECORD	WATER METALS	SOUTHWEST DIVISION
M00681 DATA 32452 0079	000577	05/12/94 05/01/92 00166 02.2	CH2M HILL PEGGA. NORTON IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. INORGANICS REP# 32510, 32520	ADMIN RECORD	IOG	
M00681 DATA 32452 0148	000578	05/12/94 05/01/92 00166 02.2	CH2M HILL PEGGA. NORTON IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. ORGANICS, PESTICIDES, PCB, HERBICIDES, TPH	ADMIN RECORD	PESTICIDES PCB HERBICIDE TFH	
M00681 DATA 0034	000590	05/12/94 05/04/92 00166 02.2	WESTION MANGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. ORGANOPHOSPHOROUS PESTICIDES ANALYSIS SDG# S0848 RFW# 9203S463	ADMIN RECORD	PESTICIDES	
M00681 DATA 0040	000593	05/12/94 05/04/92 00166 02.2	WESTION MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. TOTAL EXTRACTABLE PETROLEUM HYDROCARBONS ANALYSIS SDG# S0909 RFW# 9204S485, 9204S501	ADMIN RECORD	TPH	
M00681 DATA 0027	000594	05/12/94 05/04/92 00166 02.2	WESTION MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. GC\MS SEMIVOLATILES ANALYSIS SDG# S0909 RFW# 9204S485, 9204S501	ADMIN RECORD	SOLVENTS	
M00681 DATA 0051	000595	05/12/94 05/04/92 00166 02.2	WESTION MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. INORGANICS ANALYSIS SDG# S0952 RFW# 9204S506	ADMIN RECORD	IOG	
M00681 DATA 0250	000607	05/13/94 05/04/92 00166 02.2	ENSECO CAL LAB MARK BECHTHOLD WESTION, INC. LYNDA KELLY	DATA VAIDATION REPORT FOR MCB CAMP PENDLETON DIXION FURAN ANALYSES LAB ID: 063255	ADMIN RECORD	HXCDD	
M00681 DATA 35548 0914	000609	05/13/94 05/04/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARKLY	ANALYTICAL DATA MCB CAMP PENDLETON ORGANIC AND INORGANIC PARAMETERS	ADMIN RECORD	IOG	

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . . . Site . . . . . Location . . . . .
M00681 DATA 0012	002061	06/29/94 05/04/92 166 01.2	INTERNATIONAL TECH MCB CAMP PENDLETON	CONSTRUCTION REPRESENTATIVES REPORT FOR CAMP PENDLETON	ADMIN RECORD	DATA	5 6 9 24 GROUP A OU1 SOUTHWEST DIVISION
M00681 DATA 0029	000596	05/12/94 05/05/92 00166 02.2	WESTION MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. GC\MS SEMIVOLATILES ANALYSIS SDG# S0952 RFW# 9204S506	ADMIN RECORD	SOLVENTS	
M00681 DATA 0021	000598	05/12/94 05/05/92 00166 02.2	WESTION MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. TOTAL PURGEABLE PETROLEUM HYDROCARBONS ANALYSIS SDG# S1105 RFW# 9204S622, 9204S623	ADMIN RECORD	TPH	
M00681 DATA 35569 0615	000608	05/13/94 05/05/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARKLY	ANALYTICAL DATA MCB CAMP PENDLETON ORGANIC AND INORGANIC PARAMETERS	ADMIN RECORD	IOG	
M00681 DATA 0006	001331	05/31/94 05/05/92 02.2	 MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER, SOIL PARAMETERS: SEMIVOALTILES LAB: ROY F. WESTON SDG# S1224	ADMIN RECORD	WATER SEMIVOLATILES	
M00681 DATA 000000000000000 0005	002327	07/21/94 05/05/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: SOIL AND WATER PARAMETERS: CLP METALS AND MOLYBDENUM SDG: S1224	ADMIN RECORD	WATER METALS	SOUTHWEST DIVISION
M00681 DATA 0039	000597	05/12/94 05/07/92 00166 02.2	WESTION MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. ORGANOCHLORINE PESTICIDES ANALYSIS SDG# S0848 RFW# 9203S463	ADMIN RECORD	PESTICIDES	
M00681 DATA 0035	000605	05/13/94 05/07/92 00166 02.2	WESTION MANAGERS MCB CAMP PENDLETON	DATA VALAIDATION REPORT FOR MCB CAMP PENDLETON ORGANOPHOSPHOROUS PESTICIDES ANALYSIS SDG# S0909 RFW# 9204S485	ADMIN RECORD	PESTICIDES	
M00681 DATA 0031	000599	05/12/94 05/08/92 00166 02.2	WESTION MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. TOTAL PURGEABLE PETROLEUM HYDROCARBONS ANALYSIS SDG# S0952 RFW# 9204S506	ADMIN RECORD	TPH	
M00681 DATA 0030	000600	05/12/94 05/08/92 00166 02.2	WESTION MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. GC\MS VOLATILES ANLYSIS SDG# S1105 RFW# 9204S622, 9204S623	ADMIN RECORD	VOC	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE / CONTR/GUID . . NO / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO / EPA . CAT#	FROM / FROM . SIGNATURE / TO / TO . SIGNATURE	SUBJECT	CLASSIFICATION	KEY WORDS	Site	Location
M00681 DATA 0059	000606	05/13/94 05/08/92 00166 02.2	WESTION MANGERS MCB CAMP PENDLETON	DATA VALAIDATION REPORT FOR MCB CAMP PENDLETON ORGANOPHOSPHOROUS PESTICIDES AND PCBs SDG# S0617 RFW# 9203S362, 9203S363, 923S364, 9203S399	ADMIN RECORD	PESTICIDES PCB		
M00681 DATA 0008	002062	06/29/94 05/08/92 166 01.2	INTERNATIONAL TECH MCB CAMP PENDLETON	CONSTRUCTION REPRESENTATIVES REPORT FOR CAMP PENDLETON	ADMIN RECORD	DATA	5 6 9 24 GROUP A OU1	SOUTH WEST DIVISION
M00681 DATA 32510 0275	000579	05/12/94 05/11/92 00166 02.2	CH2M HILL PEGGA. NORTON IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. ORGANICS, PESTICIDES, PCB, HERBICIDES, TFH	ADMIN RECORD	PESTICIDES PCB HERBICIDE TFH		
M00681 DATA 32521 0372	000585	05/12/94 05/12/92 00166 02.2	CH2M HILL PEGGA. NORTON IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. INORGANICS	ADMIN RECORD	IOG		
M00681 DATA 32521 0384	000586	05/12/94 05/12/92 00166 02.2	CH2M HILL PEGGA. NORTON IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. ORGANICS, PESTICIDES, PCB, HERBICIDES, TFH	ADMIN RECORD	PESTICIDES PCB HERBICIDE TFH		
M00681 DATA 0004	002063	06/29/94 05/12/92 166 01.2	INTERNATIONAL TECH MCB CAMP PENDLETON	CONSTRUCTION REPRESENTATIVES REPORT FOR CAMP PENDLETON	ADMIN RECORD	DATA	6 9 24 GROUP A OU1	SOUTH WEST DIVISION
M00681 DATA 32531 0130	000580	05/12/94 05/13/92 00166 02.2	CH2M HILL PEGGA. NORTON IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. ORGANICS, PESTICIDES, PCB, HERBICIDES, TFH	ADMIN RECORD	PESTICIDES PCB HERBICIDE TFH		
M00681 DATA 32576 0229	000581	05/12/94 05/13/94 00166 02.2	CH2M HILL PEGGA. NORTON IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. ORGANICS, PESTICIDES, PCB, HERBICIDES, TFH	ADMIN RECORD	PESTICIDES PCB HERBICIDE TFH		

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . . / TO . . . . . / TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. . . . . Site . . . . . Location . . . . .
M00681 DATA 32576 0100	000582	05/12/94 05/13/92 00166 02.2	CH2M HILL PEGGA. NORTON IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. ORGANICS, PESTICIDES, PCB, HERBICIDES, TFH REF# 32587, 32594	ADMIN RECORD	PESTICIDES PCB HERBICIDE TFH	
M00681 DATA 32531 0039	000583	05/12/94 05/13/92 00166 02.2	CH2M HILL PEGGA. NORTON IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. INORGANICS.	ADMIN RECORD	IOG	
M00681 DATA 32520 0268	000584	05/12/94 05/13/92 00166 02.2	CH2M HILL PEGGA. NORTON IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. ORGANICS, PESTICIDES, PCBs, HERBICIDES, TFH	ADMIN RECORD	PESTICIDES PCB HERBICIDE TFH	
M00681 DATA 0049	000592	05/12/94 05/13/92 00166 02.2	WESTION MANGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. GC\MS VOLATILE ANALYSIS SDG# S1126 RFW# 9204S635, 9204S646	ADMIN RECORD	VOC	
M00681 DATA 32520 0271	001183	05/25/94 05/13/92 00166 02.2	CH2M HILL PEGGA. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, PESTICIDES, PCBs, TFH, HERBICIDES	ADMIN RECORD	VOLATILES SEMIVOLATILES PESTICIDES PCB TFH HERBICIDE	
M00681 DATA 0004	002064	06/29/94 05/13/92 166 01.2	INTERNATIONAL TECH MCB CAMP PENDLETON	CONSTRUCTION REPRESENTATIVES REPORT FOR CAMP PENDLETON	ADMIN RECORD	DATA	6 9 24 GROUP A OU1
M00681 DATA 32587 0340	000569	05/12/94 05/14/92 00166 02.2	CH2M HILL PEGGA. NORTON IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. ORGANCIS, VOLATILES, SEMIVOLATILES, PESTICIDES\PCBs TFH, HERBICIDES	ADMIN RECORD	SOLVENTS PESTICIDES PCB TFH HERBICIDES	
M00681 DATA 32594 0176	000570	05/12/94 05/14/92 00166 02.2	CH2M HILL PEGGA. NORTON IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. ORGANCIS, VOLATILES, SEMIVOLATILES, PESTICIDES\PCBs TFH, HERBICIDES	ADMIN RECORD	SOLVENTS PESTICIDES PCB TFH HERBICIDES	

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . . . Site . . . . . Location . . . . .
M00681 DATA 0004	002065	06/29/94 05/14/92 166 01.2	INTERNATIONAL TECH MCB CAMP PENDLETON	CONSTRUCTION REPRESENTATIVES REPORT FOR CAMP PENDLETON	ADMIN RECORD	DATA	6 9 24
M00681 DATA 0047	000551	05/12/94 05/15/92 00166 02.2	WESTON MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. ORGANOCHLORINE PESTICIDES ANALYSIS SDG# S1105 RFW# 9204S622, 9204S623	ADMIN RECORD	PESTICIDES	
M00681 DATA 0030	000552	05/12/94 05/15/92 00166 02.2	WESTON MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. TOTAL PURGEABLE PETROLEUM HYDROCARBON ANALYSIS SDG# S1126 RFW# 9204S635, 9204S646	ADMIN RECORD	TPH	
M00681 DATA 0050	000553	05/12/94 05/15/92 00166 02.2	WESTON MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. ORGANOCHLORINE PESTICIDES ANALYSIS SDG# S1126 RFW# 9204S635, 9204S646	ADMIN RECORD	PESTICIDES	
M00681 DATA 32595 0330	000573	05/12/94 05/15/92 00166 02.2	CH2M HILL PEGGA. NORTON IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. ORGANICS, SEMIVOLATILES, PESTICIDES\PCBs, TFH, HERBICIDES	ADMIN RECORD	SOLVENTS PESTICIDES PCB TPH HERBICIDES	
M00681 DATA 32595 0187	000574	05/12/94 05/15/92 00166 02.2	CH2M HILL PEGGA. NORTON IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. INORGANICS	ADMIN RECORD	IOG	
M00681 DATA 0004	002066	06/29/94 05/15/92 00166 01.2	INTERNATIONAL TECH MCB CAMP PENDLETON	CONSTRUCTION REPRESENTATIVES REPORT FOR CAMP PENDLETON	ADMIN RECORD	DATA	6 9 24
M00681 DATA 0028	000563	05/12/94 05/18/92 00166 02.2	WESTON MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. TOTAL EXTRACTABLE PETROLEUM HYDRICARBONS ANALYSIS SDG# S1105 RFW# 9204S622, 9204S623	ADMIN RECORD	TPH	
M00681 DATA 0035	000564	05/12/94 05/18/92 00166 02.2	WESTON MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. TOTAL EXTRACTABLE PETROLEUM HYDRICARBONS ANALYSIS SDG# S1146 RFW# 9204S647, 9204S661	ADMIN RECORD	TPH	
M00681 DATA 0032	000565	05/12/94 05/18/92 00166 02.2	WESTON MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. TOTAL EXTRACTABLE PETROLEUM HYDRICARBONS ANALYSIS SDG# S1166 RFW# 9204S662, 9204S676, 9204S714	ADMIN RECORD	TPH	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681 000556 DATA 0039	05/12/94 05/19/92 00166 02.2	WESTON MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLTON IT CORP. GC/MS SEMIVOLATILES ANALYSIS SDG# S1146 RFW# 9204S647, 9204S661	ADMIN RECORD	SOLVENTS	
M00681 002359 DATA 00000000000000 0020	07/21/94 05/20/92 00166 02.2	ESE MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: PESTICIDES/PCBs SDG: G28606,G28641, G28346 CASE: NACPB1	ADMIN RECORD	WATER PESTICIDES PCB	SOUTHWEST DIVISION
M00681 002360 DATA 00000000000000 0025	07/21/94 05/20/92 00166 02.2	ESE MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: VOLATILES SDG: G29002, G28641, G28346 CASE: NACPB1	ADMIN RECORD	WATER VOLATILES	SOUTHWEST DIVISION
M00681 000554 DATA 0054	05/12/94 05/21/92 00166 02.2	WESTON MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. ORGANOPHOSPHOROUS PESTICIDES ANALYSIS SDG# S0952 RFW# 9204S571, 9204S580	ADMIN RECORD	PESTICIDES	
M00681 000555 DATA 0276	05/12/94 05/21/92 00166 02.2	WESTON MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. ORGANOPHOSPHOROUS PESTICIDES ANALYSIS SDG# S1069 RFW# 9204S597, 9204S607, 9204S615	ADMIN RECORD	PESTICIDES	
M00681 000557 DATA 0276	05/12/94 05/21/92 00166 02.2	WESTON MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. ORGANOPHOSPHOROUS PESTICIDES ANALYSIS SDG#S1069 RFW# 9204S597, 9204S607, 9204S615	ADMIN RECORD	PESTICIDES	
M00681 000558 DATA 0080	05/12/94 05/22/92 00166 02.2	WESTON MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. TOTAL PURGEABLE PETROLEUM HYDROCARBONS ANALYSIS SDG# S1188 RFW# 9204S715, 9204S721, 9204S754	ADMIN RECORD	TPH	
M00681 000559 DATA 0035	05/12/94 05/22/92 00166 02.2	WESTON MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. GC/MS VOLATILES ANALYSIS SDG# S1146 RFE# 9204S647, 9204S661	ADMIN RECORD	VOC	
M00681 000560 DATA 0045	05/12/94 05/22/92 00166 02.2	WESTON MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. ORGANOCHLORINE PESTICIDES ANALYSIS SDG# S0909 RFW# 9204S485, 9204S501	ADMIN RECORD	PESTICIDES	
M00681 000561 DATA 0037	05/12/94 05/22/92 00166 02.2	WESTON MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. ORGANOCHLORINE PESTICIDES ANALYSIS SDG# S0952 RFW# 9204S506	ADMIN RECORD	PESTICIDES	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681 DATA 0030	000562	05/12/94 05/22/92 00166 02.2	WESTON MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLTON IT CORP. ORGANOPHOSPHOROUS PESTICIDES ANALYSIS SDG# S1105 RFW# 9204S616, 9204S622	ADMIN RECORD	PESTICIDES	
M00681 DATA 32948 0613	000571	05/21/94 05/22/92 00166 02.2	CH2M HILL PEGGA. NORTON IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. INORGANICS, WATER, SOIL	ADMIN RECORD	IOG WATER	
M00681 DATA 32698 0425	000572	05/21/94 05/22/92 00166 02.2	CH2M HILL PEGGA. NORTON IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. INORGANICS	ADMIN RECORD	IOG	
M00681 DATA 32732 0292	000575	05/12/94 05/22/92 00166 02.2	CH2M HILL PEGGA. NORTON IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. ORGANICS, SEMIVOLATILES, TFH, PESTICIDES, PCBs, HERBICIDES	ADMIN RECORD	SOLVENTS TFH PESTICIDES PCB HERBICIDE	
M00681 DATA 0494	000993	05/18/94 05/23/92 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON RFW# 9205S880 DIXIONS	ADMIN RECORD	HPCCD	
M00681 DATA 0028	000568	05/12/94 05/26/92 00166 02.2	WESTON MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. TOTAL PURGEABLE PETROLEUM HYDROCARBONS ANALYSIS SDG# S1224 RFW# 9205S764, 920S771	ADMIN RECORD	TPH	
M00681 DATA 0028	000845	05/18/94 05/26/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL PURGEABLE PETROLEUM HYDROCARBONS ANALYSIS SDG# S1224 RFW# 9205S764, 9205S764, 9205S771	ADMIN RECORD	TPH	
M00681 DATA 0046	000846	05/18/94 05/26/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE PETROLEUM HYDROCARBONS ANALYSIS SDG# S1226 RFW# 9204S635, 9204S646	ADMIN RECORD	TPH	
M00681 DATA 0039	000847	05/18/94 05/26/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE PETROLEUM HYDROCARBONS ANALYSIS SDG# S1166 RFW# 9204S662, 9204S676, 9204S714	ADMIN RECORD	TPH	
M00681 DATA 0039	000848	05/18/94 05/26/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE PETROLEUM HYDROCARBONS ANALYSIS SDG# S1146 RFW# 9204S647, 9204S661	ADMIN RECORD	TPH	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681 000849 DATA 0042	05/18/94 05/26/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLTON GM/MS SEMIVOLATILES ANALYSIS SDG# S1126 RFW# 9204S635, 9204S646	ADMIN RECORD	SEMIVOLATILES	
M00681 000850 DATA 0026	05/18/94 05/26/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GC/MS SEMIVOLATILES ANALYSIS SDG# S1105 RFW# 9204S622, 9204S623	ADMIN RECORD	SEMIVOLATILES	
M00681 000994 DATA 32704 0443	05/18/94 05/26/92 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON SEMIVOLATILES	ADMIN RECORD	SEMIVOLATILES	
M00681 001004 DATA 32734 0697	05/18/94 05/26/92 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES	ADMIN RECORD	VOLATILES SEMIVOLATILES	
M00681 001005 DATA 32726 0367	05/18/94 05/26/92 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH, PESTICIDES	ADMIN RECORD	VOLATILES SEMIVOLATILES TFH PESTICIDES	
M00681 001006 DATA 32699 0048	05/18/94 05/26/92 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON METALS, INORGANICS	ADMIN RECORD	METALS IOG	
M00681 001007 DATA 32726 0670	05/18/94 05/26/92 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON METALS, INORGANICS	ADMIN RECORD	METALS IOG	
M00681 000851 DATA 0044	05/18/94 05/27/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GC/MS SEMIVOLATILES ANALYSIS SDG# S1166 RFW# 9204S662, 9204S676, 9204S714	ADMIN RECORD	SEMIVOLATILES	
M00681 000852 DATA 0040	05/18/94 05/28/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE PETROLEUM, HYDROCARBON ANALYSIS SDG# S1188 RFW# 9204S715, 9205S721, 9204S754	ADMIN RECORD	TPH	
M00681 000853 DATA 0041	05/18/94 05/28/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GC/MS SEMIVOLATILES ANALYSIS SDG# S1166 RFW# 9204S662, 9204S676, 9204S714	ADMIN RECORD	SEMIVOLATILES	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681	001012	05/18/94	WESTON MANAGERS	ANALYTICAL DATA FOR MCB CAMP PENDLETON SEMIVOLATILES, PESTICIDES	ADMIN RECORD	SEMIVOLATILES PESTICIDES	
DATA		05/28/92					
32703		00166	IT CORPORATION				
0867		02.2	DAVE MARK				
M00681	000995	05/18/94	WESTON MANAGERS	ANALYTICAL DATA FOR MCB CAMP PENDLETON SEMIVOLATILES, VOLATILES, TFH, HERBICIDES	ADMIN RECORD	SEMIVOLATILES VOLATILES TFH HERBICIDE	
DATA		05/29/92					
32717		00166	IT CORPORATION				
0123		02.2					
M00681	000996	05/18/94	WESTON MANAGERS	ANALYTICAL DATA FOR MCB CAMP PENDLETON SEMIVOLATILES, VOLATILES, TFH, HERBICIDES PESTICIDES, PCB	ADMIN RECORD	SEMIVOLATILES VOLATILES TFH HERBICIDE PESTICIDES PCB	
DATA		05/29/92					
32743		00166	IT CORPORATION				
0743		02.2					
M00681	002329	07/21/94	CH2M HILL	PARAMETER: VOLATILES SDG: 33024	ADMIN RECORD	VOLATILES WATER	SOUTHWEST DIVISION
DATA		05/29/92					
00000000000000		00166	MCB CAMP PENDLETON				
0015		02.2					
M00681	000882	05/18/94	WESTON MANAGERS	LABORTORY REPORT FOR MCB CAMP PENDLETON INORGANICS ANALYSIS SDG# S1226 RFW#9204S635, 9204S646, 9204S675	ADMIN RECORD	IOG	
DATA		06/01/92					
		00166	IT CORPORATION				
0108		02.2					
M00681	000879	05/18/94	WESTON MANAGERS	LABORATORY REPORT FOR MCB CAMP PENDLETON POLYCHLORINATED BIPHENYLS ANALYSIS SDG# S1226 RFW# 9205S893	ADMIN RECORD	PCB	
DATA		06/02/92					
		00166	IT CORPORATION				
0028		02.2					
M00681	000880	05/18/94	WESTON MANAGERS	LABORATORY REPORT FOR MCB CAMP PENDLETON GC/MS SEMIVOLATILES ANALYSIS SDG# S1224 RFE# 9205S764, 9205S771	ADMIN RECORD	SEMIVOLATILES	
DATA		06/02/92					
		00166	IT CORPORATION				
0028		02.2					
M00681	000881	05/18/94	WESTON MANAGERS	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE PETROLEUM HYDROCARBONS ANALYSIS SDG# S1224 RFW# 9205S764, 9205S771	ADMIN RECORD	TEH	
DATA		06/02/92					
		00166	IT CORPORATION				
0027		02.2					
M00681	002475	07/22/94	CH2M HILL	PARAMETERS: SEMIVOLATILES SDG: 33062	ADMIN RECORD	WATER SEMIVOLATILES	SOUTHWEST DIVISION
DATA		06/04/92					
00000000000000		00166	MCB CAMP PENDLETON				
0002		02.2					

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . . FROM . SIGNATURE . . . . . . TO . . . . . . TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681 000706 DATA 0006	05/13/94 06/08/92 00166 02.2	 MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON SEMIVOLATILES, SDG# S1525	ADMIN RECORD	SOLVENTS	
M00681 000707 DATA 0006	05/13/94 06/08/92 00166 02.2	 MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON VOLATILES, SDG# S1525	ADMIN RECORD	VOC	
M00681 000885 DATA 0043	05/18/94 06/08/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON ORGANOCHLORINE PESTICIEES ANALYSIS SDG# S1146 RFW# 9204S647, 9204S661	ADMIN RECORD	PESTICIDES	
M00681 000886 DATA 0052	05/18/94 06/08/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON ORGANOCHLORINE PESTICIDES ANALYSIS SDG# S1124 RFW# 9205S764, 9205S771	ADMIN RECORD	PESTICIDES	
M00681 001326 DATA 0006	05/31/94 06/08/92 02.2	 MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER, SOIL PARAMETERS: SEMIVOLATILES LAB: ROY F. WESTON SDG# S1525	ADMIN RECORD	WATER SEMIVOLATILES	
M00681 002309 DATA 00000000000000 0005	07/20/94 06/08/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: SOIL AND WATER PARAMETERS: TPH GASOLINE AND TPH DIESEL SDG: S1525	ADMIN RECORD	WATER FUEL	SOUTHWEST DIVISION
M00681 002328 DATA 0000000000000 0008	05/18/94 05/26/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: SOIL AND WATER PARAMETERS: CLP METALS AND MOLYBDENUM SDG: S1525	ADMIN RECORD	WATER METALS	SOUTHWEST DIVISION
M00681 000887 DATA 0040	07/21/94 06/08/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GC/MS VOLATILES ANALYSIS SDG# S1188 RFE# 9204S715, 9205S721, 9205S754	ADMIN RECORD	VOLATILES	
M00681 000888 DATA 0048	05/18/94 06/09/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GC/MS SEMIVOLATILES ANALYSIS SDG# S1188 RFW# 9204S715, 9205S721, 9205S754	ADMIN RECORD	SEMIVOLATILES	
M00681 000889 DATA 0032	05/18/94 06/09/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GC/MS VOLATILES ANALYSIS SDG: S1224 RFW# 9205S764. 9205S771	ADMIN RECORD	VOLATILES	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681 DATA 0100	000854	05/18/94 06/10/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANICS ANALYSIS SDG# S1188 RFW# 9204S715, 9205S721, 9205S754	ADMIN RECORD	IOG	
M00681 DATA 32948 1079	000694	05/13/94 06/11/92 00166 02.2	CH2M HILL PEGGS A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON ORGANICS	ADMIN RECORD	DATA	
M00681 DATA 32948 0606	000708	05/13/94 06/11/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON INORGANICS SDG# ITCORP17	ADMIN RECORD	IOG	
M00681 DATA 32943 1287	000710	05/13/94 06/11/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON ORGANICS	ADMIN RECORD	DATA	
M00681 DATA 0088	000884	05/18/94 06/11/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORTORY REPORT FOR MCB CAMP PENDLETON INORGANICS ANALYSIS SDG# S1166 RFW#9204S662, 9204S676, 9204S714	ADMIN RECORD	IOG	
M00681 DATA 32943 0298	001003	05/18/94 06/11/92 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON METALS	ADMIN RECORD	METALS	
M00681 DATA 32953 0083	000695	05/13/94 06/12/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON INORGANICS	ADMIN RECORD	IOG	
M00681 DATA 32946 0550	000697	05/13/94 06/12/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON ORGANICS	ADMIN RECORD	WATER	
M00681 DATA 32936 0220	000699	05/13/94 06/12/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON ORGANICS	ADMIN RECORD	PESTICIDES PCB TFH HERBICIDE	
M00681 DATA 32936 0088	000700	05/13/94 06/12/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON ORGANICS	ADMIN RECORD	WATER	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681 DATA 32953 0270	000701	05/13/94 06/12/92 00166 02.2	CH2M HILL PEGGY A NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON ORGANICS	ADMIN RECORD	PESTICIDES PCB TPH HERBICIDE	
M00681 DATA 32942 0156	000702	05/13/94 06/12/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON ORGANICS	ADMIN RECORD	PESTICIDES PCB TFH HERBICIDE	
M00681 DATA 0053	000704	05/13/94 06/15/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON ORGANOCHLORINES PESTICIDES ANALYSIS SDG# S1166 RFW# 92045622, 9204S676, 92045714	ADMIN RECORD	PESTICIDES	
M00681 DATA 0078	000705	05/13/94 06/15/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANICS ANALYSIS SDG# S1224 RFEW# 9205S764, 9205S771	ADMIN RECORD	IOG	
M00681 DATA 000000000000000 0050	002411	07/22/94 06/15/92 00166 02.2	ROY WESTON - STOCKTON MCB CAMP PENDLETON	MATRIX: SOIL PARAMETERS: SEMIVOLATILES SDG: 33141 (S1568)	ADMIN RECORD	SEMIVOLATILES	SOUTHWEST DEVISION
M00681 DATA 0076	000566	05/12/94 06/18/92 00166 02.2	WESTON MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. ORGANICHLORINE PESTICIDES ANALYSIS SDG# S1188 RFW# 9204S715, 9204S721, 9204S754	ADMIN RECORD	PESTICIDES	
M00681 DATA 0022	000567	05/12/94 06/19/92 00166 02.2.	WESTON MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON IT CORP. INORGANICS PESTICIDESANALYSIS SDG# S1284 RFW# 9205S868	ADMIN RECORD	IOG	
M00681 DATA 32990 0211	000686	05/13/94 06/25/92 00166 02.2	ROF F. WESTION INC IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON INORGANICS	ADMIN RECORD	IOG	
M00681 DATA 32990 0294	000687	05/13/94 06/25/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON ORGANICS, PESTICIDES, PCB, TFH	ADMIN RECORD	PESTICIDES PCB TFH	
M00681 DATA 33052 0100	000688	05/13/94 06/26/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON INORGANICS	ADMIN RECORD	IOG	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681 DATA 0233	001208	05/27/94 06/29/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP ORGANOCHLORINE PESTICIDES ANALYSIS SDG# S1577 RFW# 9206S093	ADMIN RECORD	PESTICIDES	
M00681 DATA 32998 0289	000709	05/13/94 07/06/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON ORGANICS SDG# S1548 RFW# 9206S082, 9206S087 GC\MS VOLATILES ANALYSIS	ADMIN RECORD	VOC	
M00681 DATA 33007 0476	000712	05/13/94 07/08/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON ORGANICS	ADMIN RECORD	PESTICIDES PCB TFH HERBICIDE	
M00681 DATA 0134	000883	05/18/94 07/08/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP/GCMS/SEMIVOLATILES ANALYSIS SDG# S1577 RFW# 9206S093	ADMIN RECORD	SEMIVOLATILES	
M00681 DATA 33007 0107	001002	05/18/94 07/08/92 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON METALS	ADMIN RECORD	METALS	SOUTHWEST DEVISION
M00681 DATA 33062 0168	000711	05/13/94 07/10/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON ORGANICS	ADMIN RECORD	SOLVENTS	
M00681 DATA 33042 0176	000713	05/13/94 07/10/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON ORGANICS	ADMIN RECORD	TFH	
M00681 DATA 33042 0073	000714	05/13/94 07/10/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON INORGANICS	ADMIN RECORD	IOG	
M00681 DATA 33062 0182	000715	05/13/94 07/10/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON INORGANICS	ADMIN RECORD	IOG	
M00681 DATA 33024 0353	000696	05/13/94 07/13/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON ORGANICS	ADMIN RECORD	PESTICIDES PCB HERBICIDES TFH	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681 DATA 33063 0183	000703	05/13/94 07/13/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON ORGANICS	ADMIN RECORD	PESTICIDES PCB TFH HERBICIDE	
M00681 DATA 33063 0084	000716	05/13/94 07/13/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON INORGANICS	ADMIN RECORD	IOG	
M00681 DATA 33019 0196	000717	05/13/94 07/13/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON ORGANICS	ADMIN RECORD	PESTICIDES PCB TFH	
M00681 DATA 33019 0104	000718	05/13/94 07/13/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON INORGANICS	ADMIN RECORD	IOG	
M00681 DATA 33043 0242	000698	05/13/94 07/16/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON ORGANICS	ADMIN RECORD	PESTICIDES PCB TFH HERBICIDES	
M00681 DATA 33053 0763	000689	05/13/94 07/17/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON INORGANICS	ADMIN RECORD	IOG	
M00681 DATA 33534 0860	000692	05/13/94 07/17/92 00166 02.2.	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON ORGANICS	ADMIN RECORD	DATA	
M00681 DATA 000000000000000 0316	002480	07/22/94 07/17/92 00166 02.2	MCB CAMP PENDLETON	INORGANIC ANALYSIS DATA REPORT FOR NAVY-CAMP PENDLETON SDG 29147	ADMIN RECORD	DATA QC	SOUTHWEST DIVISION
M00681 DATA 33064 0552	000691	05/13/94 07/18/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON ORGANICS	ADMIN RECORD ADMIN RECORD ADMIN RECORD	DATA HW DISPOSAL	
M00681 DATA 33141 0345	000690	05/13/94 07/20/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON INORGANICS	ADMIN RECORD	IOG	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681 DATA 33143 0075	000693	05/13/94 07/23/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON INORGANICS	ADMIN RECORD	IOG	
M00681 DATA 01F166S920066 0035	000735	05/16/94 07/23/92 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: ESE SDG# G30232	ADMIN RECORD	VOC	
M00681 DATA 33143 0282	001155	05/25/94 07/23/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH, PESTICIDES, PCBs	ADMIN RECORD	VOLATILES SEMIVOLATILES TFH PESTICIDES PCB	
M00681 DATA 33142 0264	001156	05/25/94 07/23/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH, PESTICIDES, PCBs HERBICIDES	ADMIN RECORD	VOLATILES SEMIVOLATILES TFH PESTICIDES PCB HERBICIDE	
M00681 DATA 000000000000000 0060	002274	07/20/94 07/23/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR CTO #166, LABORATORY REFERENCE #33142 INORGANICS	ADMIN RECORD	DATA	SOUTHWEST DIVISION
M00681 DATA 000000000000000 0015	002349	07/21/94 07/29/92 00166 02.2	ESE MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: CHLORINATED HERBICIDES CASE: NAPCW2D SDG: G30443, G31088	ADMIN RECORD	WATER HERBICIDE	
M00681 DATA 000000000000000 0030	002354	07/21/94 07/29/92 00166 02.2.	ESE MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: SEMIVOLATILES SDG: G30484 AND G30704	ADMIN RECORD	WATER SEMIVOLATILES	SOUTHWEST DIVISION
M00681 DATA 000000000000000 0017	002355	07/21/94 07/29/92 00166 02.2	ESE MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: PESTICIDES/PCBs SDG: G30482	ADMIN RECORD	PESTICIDES PCB WATER	SOUTHWEST DIVISION
M00681 DATA 000000000000000 0015	002357	07/21/94 07/29/92 00166 02.2	ESE MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TRIAZINE, ORGANOPHOSPHORUS, AND ORGANO- NITROGEN PESTICIDE SDG: G30483	ADMIN RECORD	WATER PESTICIDES	SOUTHWEST DIVISION

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681 DATA 000000000000000 0010	002347	0/21/94 07/31/92 00166 02.2	ESE MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH-GASOLINE AND TPH-DIESEL CASE: NACPW1A SDG: G30469	ADMIN RECORD	WATER FUEL	SOUTHWEST DIVISION
M00681 DATA 000000000000000 0020	002350	07/21/94 08/03/92 00166 02.2	ESE MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: VOLATILES CASE: NACPW1A SDG: G30553, G30281	ADMIN RECORD	WATER VOLATILES	SOUTHWEST DIVISION
M00681 DATA 000000000000000 0010	002348	07/21/94 08/05/92 00166 02.2	ESE MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH-GASOLINE AND TPH-DIESEL CASE: NACPW1A SDG: G30841SDG: G30841	ADMIN RECORD	WATER FUEL	SOUTHWEST DIVISION
M00681 DATA 000000000000000 0010	002356	07/21/94 08/05/92 00166 02.2	ESE MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH-GASOLINE, TPH-DIESEL SDG: G30689	ADMIN RECORD	WATER FUEL	SOUTHWEST DIVISION
M00681 DATA 0023	001333	05/31/94 08/18/92 02.2	 MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: BORON LAB: ROY F. WESTON SDG# W2206	ADMIN RECORD	WATER	
M00681 DATA 0079	001212	05/27/94 08/24/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANICS CLP ANALYSIS SDG# W2116 RFW# 9207S377 9027S434	ADMIN RECORD	IOG	
M00681 DATA 0062	001215	05/27/94 08/24/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANICS NON CLP ANALYSIS SDG# W2116 RFW# 9027S377, 9027S434	ADMIN RECORD	IOG	
M00681 DATA 0776	002476	07/22/94 08/28/92 02.2	ENVIRON & SCI ENG. MCB CAMP PENDLETON	ESE FIELD GROUP SAMPLES. CASE: NACPS2D'22-24	ADMIN RECORD	HERBICIDE TCO GC/MS TIC VOLATILES	
M00681 DATA 0662	002477	07/22/94 08/28/92 02.2	ENVIRON & SCI ENG. MCB CAMP PENDLETON	ESE FIELD GROUP SAMPLES. CASE: NACPS2D'20, 21	ADMIN RECORD	TPH HERBICIDE PESTICIDES VOC GC/MS SEMIVOLATILES VOLATILES	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681 DATA 33538 0180	001163	05/25/94 09/02/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH METALS	ADMIN RECORD	VOALTILES SEMICOLATILES TFH METALS	
M00681 DATA 0027	001336	05/31/94 09/02/92 02.2	 MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: BORON LAB: ROY F. WESTON SDG# W2272	ADMIN RECORD	WATER	
M00681 DATA 33577 0180	001161	05/25/94 09/03/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH METALS	ADMIN RECORD	VOALTILES SEMIVOALTILES TFH METALS	
M00681 DATA 33598 0180	001162	05/25/94 09/03/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH METALS	ADMIN RECORD	VOALTILES SEMIVOALTILES TFH METALS	
M00681 DATA 33599 0303	001165	05/25/94 09/03/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON METALS	ADMIN RECORD	METALS	
M00681 DATA 33560 0249	001166	05/25/94 09/03/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON TFH, VOLATILES, SEMIVOLATILES	ADMIN RECORD	TFH VOLATILES SEMIVOALTILES	
M00681 DATA 33599 0239	001167	05/25/94 09/03/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON TFH, VOLATILES,	ADMIN RECORD	TFH VOLATILES	
M00681 DATA 33584 0183	001171	05/25/94 09/03/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH, METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES TFH METALS	
M00681 DATA 33559 0197	001174	05/25/94 09/03/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH, METALS	ADMIN RECORD	VOALTILES SEMIVOLATILES TFH METALS	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . . Site . . . . . Location . . . . .
M00681 DATA 33560 0532	001175	05/25/94 09/03/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON METALS	ADMIN RECORD	METALS	
M00681 DATA 0018	001335	05/31/94 09/09/92 02.2	MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: CHLORINATED HERBICIDES LAB: ROY F. WESTON SDG# W2282	ADMIN RECORD	WATER HERBICIDE	
M00681 DATA 0007	001337	05/31/94 09/09/92 02.2	MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: ALKALINITY LAB: ROY F. WESTON SDG# W2282	ADMIN RECORD	WATER	
M00681 DATA 0007	001338	05/31/94 09/09/92 02.2	MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: TOTAL DISSOLVED SOLIDS LAB: ROY F. WESTON SDG# W2282	ADMIN RECORD	WATER	
M00681 DATA 0013	001339	05/31/94 09/09/92 02.2	MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: ANIONS LAB: ROY F. WESTON SDG# W2282	ADMIN RECORD	WATER	
M00681 DATA 0007	001340	05/31/94 09/09/92 02.2	MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: TPH GASOLINE & DIESEL LAB: ROY F. WESTON SDG# W2282	ADMIN RECORD	WATER	
M00681 DATA 0031	001341	05/31/94 09/09/92 02.2	MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARMETERS: ORGANOCHLORINE PESTICIDES LAB: ROY F. WESTON SDG#W2282	ADMIN RECORD	WATER PESTICIDES PCB	
M00681 DATA 0028	001342	05/31/94 09/09/92 02.2	MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: TAL METALS & MOLYBDENUM LAB: ROY F. WESTON SDG# W2282	ADMIN RECORD	WATER METALS	
M00681 DATA 0044	001343	05/31/94 09/09/92 02.2	MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: VOLATILES LAB: ROY F. WESTON SDG# W2282	ADMIN RECORD	WATER VOLATILES	
M00681 DATA 0043	001344	05/31/94 09/09/92 02.2	MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: SEMIVOLATILES LAB: ROY F. WESTON SDG# W2282	ADMIN RECORD	WATER SEMIVOLATILES	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . . FROM . SIGNATURE . TO . . . . . . TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . . Site . . . . . Location . . . . .
M00681 001164 DATA 33624 0219	05/25/94 09/11/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH, PESTICIDES, PCB, METALS, HERBICIDES	ADMIN RECORD	VOLATILES SEMIVOLATILES TFH PESTICIDES PCB METALS HERBICIDE	
M00681 001168 DATA 33611 0239	05/25/94 09/11/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, PESTICIDES, PCB, TFH, METALS HERBICIDES	ADMIN RECORD	VOLATILES SEMIVOLATILES PESTICIDES PCB TFH METALS HERBICIDE	
M00681 001170 DATA 33690 0028	05/25/94 09/11/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON METALS	ADMIN RECORD	METALS	
M00681 001169 DATA 33642 0283	05/25/94 09/14/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, PESTICIDES, PCB, TFH, METALS, HERBICIDES	ADMIN RECORD	VOALTILES SEMIVOLATILES PESTICIDES PCB TFH METALS HERBICIDE	
M00681 001172 DATA 33666 0055	05/25/94 09/14/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON CYANIDE, SDG# W222 RFW# 92085628	ADMIN RECORD	CYANIDE	
M00681 002237 DATA 000000000000000 0007	07/19/94 09/14/92 00000 02.2	ROY WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: ALKALINITY SDG: W2294	ADMIN RECORD	WATER	SOUTHWEST DIVISION
M00681 002238 DATA 000000000000000 0007	07/19/94 09/14/92 00000 02.2	ROY WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TOTAL DISSOLVED SOLIDS SDG: W2294	ADMIN RECORD	WATER	SOUTHWEST DIVISION
M00681 002239 DATA 000000000000000 0007	07/19/94 09/14/92 00000 02.2	ROY WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: ANIONS SDG: W2294 (CHLORIDE, NITRATE-N, NITRATE-N, AND SULFATE)	ADMIN RECORD	WATER	SOUTHWEST DIVISION

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . . FROM . SIGNATURE . TO . . . . . . TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . . Site . . . . . Location . . . . .
M00681 002240 DATA 000000000000000 0009	07/20/94 09/14/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: SEMIVOLATILES SDG: W2294	ADMIN RECORD	WATER SEMIVOLATILES	SOUTHWEST DIVISION
M00681 002257 DATA 000000000000000 0004	07/20/94 09/14/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH GASOLINE AND TPH DIESEL SDG: W2590S	ADMIN RECORD	WATER FUEL	SOUTHWEST DIVISION
M00681 002258 DATA 000000000000000 0025	07/20/94 09/14/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: BORON SDG: W2282 AND W2294	ADMIN RECORD	WATER	SOUTHWEST DIVISION
M00681 002259 DATA 000000000000000 0009	07/20/94 09/14/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TAL METALS AND MOLYBDENUM SDG: W2294	ADMIN RECORD	WATER METALS	SOUTHWEST DIVISION
M00681 001001 DATA 33643 0927	05/18/94 09/16/92 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH, METALS, PESTICIDES, PCB HERBICIDES	ADMIN RECORD	VOLATILES SEMIVOLATILES TFH METALS PESTICIDES PCB HERBICIDE	
M00681 001173 DATA 33643 0063	05/25/94 09/16/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON CYANIDE, SDG# W2231 RFW# 9208S633	ADMIN RECORD	CYANIDE	
M00681 001179 DATA 33666 0252	05/25/94 09/16/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, PESTICIDES, PCBs, TFH, METALS, HERBICIDES	ADMIN RECORD	VOLATILES SEMIVOLATILES PESTICIDES PCB TFH METALS HERBICIDE	
M00681 001180 DATA 33673 0226	05/25/94 09/16/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, PESTICIDES, PCBs, TFH, METALS, HERBICIDES	ADMIN RECORD	VOLATILES SEMIVOLATILES PESTICIDES PCB TFH METALS HERBICIDE	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . FROM . SIGNATURE . TO . . . . . TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . . Site . . . . . Location . . . . .
M00681 001210 DATA 0061	05/27/94 09/17/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATIORY REPORT FOR MCB CAMP PENDLETON GC/MS VOLATILES ANALYSIS SDG# W2116 RFW# 9207S377 9207S434	ADMIN RECORD	VOLATILES	
M00681 001211 DATA 0109	05/27/94 09/17/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATIORY REPORT FOR MCB CAMP PENDLETON GC/MS SEMIVOLATILES ANALYSIS SDG# W2116 RFW# 9207S377 9207S434	ADMIN RECORD	SEMIVOLATILES	
M00681 001213 DATA 0070	05/27/94 09/17/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE PETROLEUM HYDROCARBONS ANALYSIS SDG#: W2116 RFW# 9207S377, 9207S434	ADMIN RECORD	TEH	
M00681 001216 DATA 0035	05/27/94 09/17/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENLETON METALS SDG# W2116 RFW# 9207S377, 9207S434	ADMIN RECORD	METALS	
M00681 001217 DATA 0041	05/27/94 09/17/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL PURGEABLE PETROLEUM HYDROCARBONS ANALYSIS SDG# W2116 RFW# 9207S377, 9207S434	ADMIN RECORD	TPH	
M00681 002233 DATA 000000000000000 0028	07/19/94 09/21/92 00000 02.2	WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TAL METALS AND MOLYBDENUM SDG: W2506	ADMIN RECORD	WATER METALS	SOUTHWEST DIVISION
M00681 002318 DATA 000000000000000 0008	07/21/94 09/21/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TAL METALS AND MOLYBDENUM SDG: W2506	ADMIN RECORD	WATER METALS	SOUTHWEST DIVISION
M00681 001008 DATA 33682 0212	05/18/94 09/22/92 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON METALS, VOLATILES, SEMIVOLATILES, PESTICIDES, PCB, TFH, HERBICIDES	ADMIN RECORD	METAL VOLATILES SEMIVOLATILES PESTICIDES PCB TFH HERBICIDE	
M00681 001009 DATA 33683 0795	05/18/94 09/22/92 00166 02.2	WESTON MANAGERS IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON METALS, VOLATILES, SEMIVOLATILES, PESTICIDES, PCB TFH, HERBICIDES	ADMIN RECORD	VOLATILES SEMIVOLATILES PESTICIDES	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . . FROM . SIGNATURE . TO . . . . . . TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . . Site . . . . . Location . . . . .
M00681 001184 DATA 33696 0059	05/25/94 09/22/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON CYANIDE	ADMIN RECORD	CYANIDE	
M00681 001018 DATA 33719 1003	05/18/94 09/24/92 00166 02.2	WESTON MANAGERS IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES	ADMIN RECORD	VOLATILES SEMIVOLATILES	
M00681 001019 DATA 33718 0223	05/18/94 09/25/92 00166 02.2	WESTON MANAGERS IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, PESTICIDES, PCB, TFH, HERBICIDES, METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES PESTICIDES PCB TFH HERBICIDE METALS	
M00681 002260 DATA 000000000000000 0015	07/20/94 09/25/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: ANIONS (CHLORIDE, NITRATE-N, NITRATE-N AND SULFATE) SDG: W2294	ADMIN RECORD	WATER	SOUTHWEST DIVISION
M00681 002261 DATA 000000000000000 0008	07/20/94 09/25/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TOTAL DISSOLVED SOLIDS SDG: W2336	ADMIN RECORD	WATER	SOUTHWEST DIVISION
M00681 002262 DATA 000000000000000 0009	07/20/94 09/25/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH GASOLINE TPH DIESEL SDG: W2336	ADMIN RECORD	WATER FUEL	SOUTHWEST DIVISION
M00681 002263 DATA 000000000000000 0010	07/20/94 09/25/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: VOLATILES SDG: W2336	ADMIN RECORD	WATER VOLATILES	SOUTHWEST DIVISION
M00681 002264 DATA 000000000000000 0006	07/20/94 09/25/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: CHLORINATED HERBICIDES SDG: W2336	ADMIN RECORD	WATER HERBICIDE	SOUTHWEST DIVISION
M00681 002265 DATA 000000000000000 0035	07/20/94 09/25/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TAL METALS AND MOLYBDENUM SDG# W2336	ADMIN RECORD	WATER METALS	SOUTHWEST DIVISION

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . . Site . . . . . Location . . . . .
M00681 002266 DATA 000000000000000 0009	07/20/94 09/25/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: SEMIVOLATILES SDG: W2336	ADMIN RECORD	WATER SEMIVOLATILES	SOUTHWEST DIVISION
M00681 002267 DATA 000000000000000 0009	07/20/94 09/25/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH GASOLINE AND TPH DIESEL SDG: W2336	ADMIN RECORD	WATER FUEL	SOUTHWEST DIVISION
M00681 002268 DATA 000000000000000 0007	07/20/94 09/25/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: ORGANOCHLORINE PESTICIDES/PCBs SDG: W2336	ADMIN RECORD	WATER PCB PESTICIDES	SOUTHWEST DIVISION
M00681 001010 DATA 33733 0301	05/18/94 09/26/92 00166 02.2	WESTON MANAGERS IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON METALS, VOLATILES, SEMIVOLATILES, PESTICIDES, PCB, TFH, HERBICIDES	ADMIN RECORD	METALS VOLATILES SEMIVOLATILES PESTICIDES PCB TFH HERBICIDE	
M00681 001011 DATA 33696 0230	05/18/94 09/26/92 00166 02.2	WESTON MANAGERS IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON METALS, VOLATILES, SEMIVOLATILES, PESTICIDES, PCB, TFH, HERBICIDES	ADMIN RECORD	METALS VOLATILES SEMIVOLATILES PESTICIDES PCB TFH HERBICIDE	
M00681 001020 DATA 33740 0218	05/18/94 09/28/92 00166 02.2	WESTON MANAGERS IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, PESTICIDES, PCB, TFH, METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES PESTICIDES PCB TFH METALS	
M00681 000866 DATA 0109	05/18/94 09/30/92 00166 02.2	WESTON MANAGERS IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL VOLATILE PETROLEUM HYROCARBONS ANALYSIS SDG# W2272 RFW# 9209S726, 9209S748, 9209S765, 9209S780	ADMIN RECORD	TPH	
M00681 000867 DATA 0082	05/18/94 09/30/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL VOLATILE PETROLEUM HYROCARBONS ANALYSIS SDG# W2206 RFW# 9208S595, 9209S697, 9209S719	ADMIN RECORD	TPH	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / .DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681 DATA 0079	000868	05/18/94 09/30/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE PETROLEUM HYROCARBONS ANALYSIS SDG# W2206 RFW# 9208S595, 9208S674, 9208S697, 9209S719	ADMIN RECORD	TPH	
M00681 DATA 0088	000869	05/18/94 09/30/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON ORGANOCHLORINE PESTICIDES ANALYSIS SDG# W2272 RFW# 9209S765, 9209S780, 9209S791, 9209S804	ADMIN RECORD	PESTICIDES	
M00681 DATA 0100	000903	05/18/94 10/02/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INOGRANICS CLP ANALYSIS SDG# W2206 RFW# 9208S595, 9208S674, 9209S697, 9209S719	ADMIN RECORD	IOG	
M00681 DATA 0100	000904	05/18/94 10/02/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INOGRANICS NON CLP ANALYSIS SDG# W2206 RFW# 9208S595, 9208S674, 9209S697, 9209S719	ADMIN RECORD	IOG	
M00681 DATA 33820 0277	001014	05/18/94 10/02/92 00166 02.2	WESTON MANAGERS IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, PESTICIDES, PCB, SEMIVOLATILES, TFH, HERBICIDES, METALS	ADMIN RECORD	SEMIVOLATILES VOLATILES PCB PESTICIDES TFH HERBICIDE METALS	
M00681 DATA 33806 0224	001015	05/18/94 10/02/92 00166 02.2	WESTON MANAGERS IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, PESTICIDES, PCB, SEMIVOLATILES, TFH, HERBICIDES, METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES TFH PESTICIDES PCB HERBICIDE METALS	
M00681 DATA 0032	001301	05/31/94 10/02/92 02.2	 MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: ORGANOCHLORINE PESTICIDES PCBs LAB: ROY F. WESTON SDG# W2376	ADMIN RECORD	WATER PESTICIDES PCB	
M00681 DATA 0009	001302	05/31/94 10/02/92 02.2	 MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: TPH DIESEL LAB: ROY F. WESTON SDG# W2376	ADMIN RECORD	WATER TPH	
M00681 DATA 0008	001303	05/31/94 10/02/92 02.2	 MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: TOTAL DISOLVED SOLIDS LAB: ROY F. WESTON SDG# W2376	ADMIN RECORD	WATER	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO. / PRC . DATE / .DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681 DATA 0008	001304 02.2	05/31/94 10/02/92 MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB AMP PENDLETON MATRIX: WATER PARAMETERS: ALKALINITY LAB: ROY F. WESTON SDG# W2376	ADMIN RECORD	WATER	
M00681 DATA 0036	001305 02.2	05/31/94 10/02/92 MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: VOLATILES LAB: ROY F. WESTON SDG# W2376	ADMIN RECORD	WATER VOLATILES	
M00681 DATA 0019	001306 02.2	05/31/94 10/02/92 MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: CHLORINATED HERBICIDES LAB: ROY F. WESTON SDG# W2376	ADMIN RECORD	WATER HERBICIDE	
M00681 DATA 0150	000870 02.2	05/18/94 10/05/92 00166	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON HERBICIDES ANAYSIS SDG# W2272 RFW# 9209S765, 9209S780, 9209S791, 9209S804	ADMIN RECORD	HERBICIDE
M00681 DATA 0098	000871 02.2	05/18/94 10/05/92 00166	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE PETROLEUM HYDROCARBONS ANALYSIS SDG# W2272 RFW# 9209S726, 9209S748, 9209S765, 9209S780	ADMIN RECORD	TPH
M00681 DATA 0027	001316 02.2	05/31/94 10/05/92 MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: TAL METALS & MOYBDENUM LAB: ROY F. WESTON SDG# W2383	ADMIN RECORD	WATER METALS	
M00681 DATA 0013	001317 02.2	05/31/94 10/05/92 MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: ANIONS LAB: ROY F. WESTON SDG# W2383	ADMIN RECORD	WATER	
M00681 DATA 0018	001318 02.2	05/31/94 10/05/92 MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: CHLORINATED HERBICIDES LAB: ROY F. WESTON SDG# W2383	ADMIN RECORD	WATER HERBICIDE	
M00681 DATA 0008	001319 02.2	05/31/94 10/05/92 MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: TPH GASOLINE & DIESEL LAB: ROY F. WESTON SDG# W2383	ADMIN RECORD	WATER TPH	
M00681 DATA 0006	001320 02.2	05/31/94 10/05/92 MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: TOTAL DISSOLVED SOLIDS LAB: ROY F. WESTON SDG# W2383	ADMIN RECORD	WATER	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / .DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681 DATA 0029	001321	05/31/94 10/05/92 02.2	MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: ORGANOCHLORINE PESTICIDE PCBs LAB: ROY F. WESTON SDG# W2383	ADMIN RECORD	WATER PESTICIDES PCB	
M00681 DATA 0007	001322	05/31/94 10/05/92 02.2	MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: ALKALINITY LAB: ROY F. WESTON SDG# W2383	ADMIN RECORD	WATER	
M00681 DATA 0058	001323	05/31/94 10/05/92 02.2	MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: SEMIVOLATILES LAB: ROY F. WESTON SDG# W2383	ADMIN RECORD	WATER SEMIVOLATILES	
M00681 DATA 0041	001324	05/31/94 10/05/92 02.2	MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: VOLATILES LAB: ROY F. WESTON SDG# W2383	ADMIN RECORD	WATER VOLATILES	
M00681 DATA 0017	001325	05/31/94 10/05/92 00166 02.2	MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: ANIONS LAB: ROY F. WESTON SDG# W2376	ADMIN RECORD	WATER	
M00681 DATA 0194	000872	05/18/94 10/13/92 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP/ORGANOCHLORINE PESTICIDES ANALYSIS SDG# W2282 RFW# 9209S779	ADMIN RECORD	PESTICIDES	
M00681 DATA 0207	000899	05/18/94 10/13/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP/GCMS/SEMIVOLATILE ANALYSIS SDG# W2282 RFW# 9209S779, 9209S909	ADMIN RECORD	SEMIVOLATILES	
M00681 DATA 0114	000901	05/18/94 10/13/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON VOLATILE PURGEABLE PETROLEUM HYDROCARBONS ANAYSIS SDG# W2282 RFW# 9209S779, 9209S909	ADMIN RECORD	VOLATILES	
M00681 DATA 0144	000905	05/18/94 10/13/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON HERBICIDES ANALYSIS SDG# W2282 RFW# 9209S779	ADMIN RECORD	HERBICIDE	
M00681 DATA 0101	000906	05/18/94 10/13/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE HYDROCARBONS ANALYSIS SDG# W2282 RFW# 9209S779, 9209S909	ADMIN RECORD	TEH	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / .DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681 DATA 0137	000890	05/18/94 10/14/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GC/MS SEMIVOLATILES ANALYSIS SDG# W2206 RFW# 92098S595, 9208S674, 9209S697, 9209S719	ADMIN RECORD	SEMIVOLATILES	
M00681 DATA 0084	000902	05/18/94 10/14/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GC/MS VOLATILES ANALYSIS SDG# W2206 RFW# 9208S595, 9208S674, 9209S697, 9209S719	ADMIN RECORD	VOLATILES	
M00681 DATA 0174	000891	05/18/94 10/15/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP/GCMS/VOLATILES ANALYSIS SDG# W2282 RFW# 9209S779, 9209S909	ADMIN RECORD	VOLATILES	
M00681 DATA 0130	000894	05/18/94 10/19/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPROT FOR MCB CAMP PENDLETON GC/MS VOLATILES ANALYSIS SDG# W2272 RFW# 9209S726, 9209S748, 9209S780, 9209S791	ADMIN RECORD	VOLATILES	
M00681 DATA 0008	001311	05/31/94 10/19/92 02.2	MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: ALKALINITY LAB: ROY F. WESTON SDG# S2506	ADMIN RECORD	WATER	
M00681 DATA 0250	000892	05/18/94 10/20/92 00166 02.2	ROY F. WESTON IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANICS NON CLP ANALYSIS SDG: W2272 RFW# 9209S726, 9209S765, 9209S765, 9209S780	ADMIN RECORD	IOG	
M00681 DATA 0200	000895	05/18/94 10/20/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANICS CLP ANALYSIS SDG: W2272 RFW# 9209S726, 9209S748, 9209S765, 9209S780	ADMIN RECORD	IOG	
M00681 DATA 0102	000893	05/18/94 10/21/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL VOLATILE PETROLEUM HYDROCARBONS ANALYSIS SDG: W2336 RFW# 9209S942, 9209S949, 9209S957, 9210S004	ADMIN RECORD	TPH	
M00681 DATA 0120	000896	05/18/94 10/21/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GC/MS MOLATILES ANALYSIS SDG# W2336 RFW# 9209S942, 9209S949, 9209S957, 9210S004	ADMIN RECORD	VOLATILES	
M00681 DATA 0090	000897	05/18/94 10/21/92 00166 02.2	WESTON MANAGERS IT CORPORATIONS	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL VOLATILE PETROLEUM HYDROCARBONS ANALYSIS SDG# W2294 RFW# 9209S816, 9209S832, 9209S886, 9209S910	ADMIN RECORD	TPH	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / .DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681 DATA 0136	000898	05/18/94 10/21/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON VOLATILE PURGEABLE PETROLEUM HYDROCARBONS ANALYSIS SDG# W2383 RFW# 9210S064, 9210S038	ADMIN RECORD	VOLATILES	
M00681 DATA 0072	000947	05/18/94 10/21/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE PETROLEUM HYDROCARBONS ANALYSIS SDG# W2294 RFW# 9209S816, 9209S832, 9209S886, 9209S910	ADMIN RECORD	TEH	
M00681 DATA 0078	000952	05/18/94 10/21/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE PETROLEUM HYDROCARBONS ANALYSIS SDG: W2336 RFW# 9209S942, 9209S949, 9209S957, 9201S004	ADMIN RECORD	TEH	
M00681 DATA 0034	001307	05/31/94 10/21/92 02.2	MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: ORGANOCHLORINE PESTICIDES PCBs LAB: ROY F. WESTON SDG# S2506	ADMIN RECORD	WATER PESTICIDE PCB	
M00681 DATA 0019	001308	05/31/94 10/21/92 02.2	MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: CHLORINATED HERBICIDES LAB: ROY F. WESTON SDG# W2506	ADMIN RECORD	WATER HERBICIDE	
M00681 DATA 0008	001309	05/31/94 10/21/92 02.2	MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: TPH GASOLINE & DIESEL LAB: ROY F. WESTON SDG# W2506	ADMIN RECORD	WATER TPH	
M00681 DATA 0052	001310	05/31/94 10/21/92 02.2	MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: VOLATILES LAB: ROY F. WESTON SDG# S2506	ADMIN RECORD	WATER VOLATILES	
M00681 DATA 0016	001312	05/31/94 10/21/92 02.2	MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: ANIONS (CHLORIDE, NITRATE-N, NITRITE-N & SULFATE) LAB: ROY F. WESTON SDG# W2506	ADMIN RECORD	WATER	
M00681 DATA 0005	001313	05/31/94 10/21/92 02.2	MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: TOTAL DISSOLVED SOLIDES LAB: ROY F. WESTON SDG# W2506	ADMIN RECORD	WATER	
M00681 DATA 0062	001314	05/31/94 10/21/92 02.2	MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: SEMIVOLATILES LAB: ROY F. WESTON SDG# S2506	ADMIN RECORD	WATER SEMIVOLATILES	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / .DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681 DATA 0029	001315	05/31/94 10/21/92 02.2	 MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETRS: METAL & MOLYBDENUM LAB: ROY F. WESTON SDG# W2506	ADMIN RECORD	WATER METALS	
M00681 DATA 0080	000950	05/18/94 10/22/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON ORGANOCHLORINE PESTICIDES ANALYSIS SDG# W2294 RFW# 9209S816, 9209S832, 9209S886, 9209S919, 9209S934	ADMIN RECORD	PESTICIDES	
M00681 DATA 0224	000951	05/18/94 10/22/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON ORGANOCHLORINE PESTICIDES ANALYSIS SDG# W2336 RFW# 9209S942, 9209S949, 9209S957, 9201S004, 9210S015	ADMIN RECORD	PESTICIDES	
M00681 DATA 0090	000944	05/18/94 10/23/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANICS CLP ANALYSIS SDG# W2294 RFW# 9209S816, 9209S832, 9209S886, 9209S910, 9209S919, 9209S934	ADMIN RECORD	IOG	
M00681 DATA 0180	000945	05/18/94 10/23/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANICS NON CLP ANALYSIS SDG# 2282 RFW# 9209S779, 9209S909	ADMIN RECORD	IOG	
M00681 DATA 0325	000953	05/18/94 10/23/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANICS NON CLP ANALYSIS SDG# W2294 RFW# 9209S816 9209S832, 9209S886, 9209S910, 9209S919, 9209S934	ADMIN RECORD	IOG	
M00681 DATA 0093	000956	05/18/94 10/23/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE HYDROCARBONS ANALYSIS SDG# W2383 RFW# 9210S038, 9210S064	ADMIN RECORD	TEH	
M00681 DATA 0162	000957	05/18/94 10/23/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP INORGANIC METALS ANALYSIS SDG# W2282 RFW# 9209S779 9209S909	ADMIN RECORD	IOG METALS	
M00681 DATA 0180	000946	05/18/94 10/26/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENEDLETON GC/MS SEMIVOLATILES ANALYSIS SDG# W2336 RFW# 9209S942, 9209S949, 9209S957, 9210S004, 9210S015	ADMIN RECORD	SEMIVOLATILES	
M00681 DATA 0100	000948	05/18/94 10/28/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON HERBICIDES ANALYSIS SDG# W2336 RFW# 9209S942, 9209S949, 9209S957, 9210S004, 9210S015	ADMIN RECORD	HERBICIDE	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO. / PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . Site . . . . . Location . . . . .
M00681 DATA 0150	001187 05/26/94 10/28/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON HERBICIDES ANALYSIS SDG# W2294 RFW# 9209816, 9209S832, 9209S886, 9209S910, 9209S919, 9209S832	ADMIN RECORD	HERBICIDE	
M00681 DATA 0150	001188 05/26/94 10/28/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GC/MS SEMIVOLATILES ANALYSIS SDG# W2294 RFW# 9209S816, 9209S006, 9209S910, 9209S919, 9209S934, 9209S832	ADMIN RECORD	SEMIVOLATILES	
M00681 DATA 0037	001334 05/31/94 10/28/92 02.2	MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER, SOIL PARAMETERS: TAL METALS & MOLYBDENU LAB: ROY F. WESTON SDG# W2555	ADMIN RECORD	WATER METALS	
M00681 DATA 0072	001347 05/31/94 10/28/92 02.2	MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: SOIL & WATER PARAMETERS: SEMIVOLATILES LAB: ROY F.WESTON SDG# W2555	ADMIN RECORD	WATER SEMIVOLATILES	
M00681 DATA 0011	001348 05/31/94 10/28/92 02.2	MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: SOIL & WATER PARAMETERS: TPH GASOLINE & DIESEL LAB: ROY F.WESTON SDG# W2555	ADMIN RECORD	WATER	
M00681 DATA 0017	001349 05/31/94 10/28/92 02,2	MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: ANIONS LAB: ROY F. WESTON SDG# W2555	ADMIN RECORD	WATER	
M00681 DATA 0037	001350 05/31/94 10/28/92 02.2	MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER, SOIL PARAMETERS: TAL METALS & MOLYBDENU LAB: ROY F. WESTON SDG# W2555	ADMIN RECORD	WATER METALS	
M00681 DATA 0086	001351 05/31/94 10/28/92 02.2	MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER, SOIL PARAMETERS: VOLATILES LAB: ROY F.WESTON SDG# W2555	ADMIN RECORD	WATER VOLATILES	
M00681 DATA 0042	001352 05/31/94 10/28/92 02.2	MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: ORGANOCHLORINE PESTICIDES PCBS LAB: ROY F.WESTON SDG# W2555	ADMIN RECORD	WATER PESTICIDES PCB	
M00681 DATA 000000000000000 0011	002275 07/20/94 10/28/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER AND SOIL PARAMATERS: TPH GASOLINE AND TPH DIESEL SDG: W2555	ADMIN RECORD	WATER FUEL	SOUTHWEST DIVISION

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . . FROM . SIGNATURE . . . TO . . . . . . TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS . . . . . .Site . . . . . Location
M00681 002276 DATA 000000000000000 008	07/20/94 10/28/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: ALKALINITY SDG: W2555	ADMIN RECORD	WATER SOUTHWEST DIVISION
M00681 002277 DATA 000000000000000 0008	07/20/94 1028/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TOTAL DISSOLVED SOLIDS SDG: W2555	ADMIN RECORD	WATER SOUTHWEST DIVISION
M00681 002278 DATA 000000000000000 0021	07/20/94 10/28/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: CHLORINATED HERBICIDES SDG: W2555	ADMIN RECORD	WATER HERBICIDE SOUTHWEST DIVISION
M00681 002279 DATA 000000000000000 0008	07/20/94 10/28/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TOTAL DISSOLVED SOLIDS SDG: W2555	ADMIN RECORD	WATER SOUTHWEST DIVISION
M00681 002280 DATA 000000000000000 0008	07/20/94 10/28/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: ANIONS (CHLORIDE, NITRATE-N, NITRATE-N AND SULFATE) SDG: W2555	ADMIN RECORD	WATER SOUTHWEST DIVISION
M00681 002298 DATA 000000000000000 0040	07/20/94 10/28/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: ORGANOCHLORINE PESTICIDES/PCBs SDG: W2555	ADMIN RECORD	WATER PESTICIDES PCB SOUTHWEST DIVISION
M00681 002319 DATA 0000000000000000 0011	07/21/94 10/28/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER AND SOIL PARAMETERS: TAL METALS AND MOLYBDENUM SDG: W2555	ADMIN RECORD	WATER METALS SOUTHWEST DIVISION
M00681 000949 DATA 0223	05/18/94 10/29/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GC/MS VOLATILES ANALYSIS SDG# W2294 RFW# 9209S816, 9209S832, 9209S886, 9209S910, 9209S919, 9209S934	ADMIN RECORD	VOLATILES
M00681 001346 DATA 0036	05/31/94 10/29/92 02.2	 MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: SOIL & WATER PARAMETERS: VOLATILES LAB: ROY F. WESTON SDG# W2582	ADMIN RECORD	WATER VOLATILES
M00681 002281 DATA 000000000000000 0016	07/20/94 10/29/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: ANIONS (CHLORIDE, NITRATE-N, NITRATE-N AND SULFATE) SDG: W2582	ADMIN RECORD	WATER SOUTHWEST DIVISION

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . . FROM . SIGNATURE . . . TO . . . . . . TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS . . . . . .Site . . . . . Location
M00681 002282 DATA 0000000000000000 0008	07/20/94 10/29/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: ALKALINITY SDG: W2582	ADMIN RECORD	WATER SOUTHWEST DIVISION
M00681 002286 DATA 000000000000000 0040	07/20/94 10/29/92 00000 02.0	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER AND SOIL PARAMETERS: SEMIVOLATILES SDG: W2582	ADMIN RECORD	WATER SEMIVOLATILES SOUTHWEST DIVISION
M00681 002288 DATA 0000000000000000 0008	07/20/94 10/29/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TOTAL DISSOLVED SOLIDS SDG: W2582	ADMIN RECORD	WATER SOUTHWEST DIVISION
M00681 002289 DATA 0000000000000000 0040	07/20/94 10/29/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER AND SOIL PARAMETERS: TAL METALS AND MOLYBDENUM SDG: W2582	ADMIN RECORD	WATER METALS SOUTHWEST DIVISION
M00681 002291 DATA 0000000000000000 0007	07/20/9 10/29/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER AND SOIL PARAMETERS: TPH GASOLINE AND TPH DIESEL SDG: W2582	ADMIN RECORD	WATER FUEL SOUTHWEST DIVISION
M00681 002317 DATA 0000000000000000 0010	07/21/94 10/29/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER AND SOIL PARAMETERS: TAL METALS AND MOLYBDENUM SDG: W2582	ADMIN RECORD	WATER METALS SOUTHWEST DIVISION
M00681 001214 DATA 0224	05/27/94 11/02/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP ORGANOCHLORINE PTESTICIDES ANALYSIS SDG# W2383 RFW# 9210S038, 9210S064	ADMIN RECORD	PESTICIDES
M00681 001218 DATA 0178	05/27/94 11/02/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON HERBICIDES ANALYSIS SDG# W2383 RFW# 9210S038, 9210S064	ADMIN RECORD	HERBICIDE
M00681 002253 DATA 0000000000000000 0045	07/20/94 11/02/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER AND SOIL PARAMETERS: SEMIVOLATILES SDG: W2590	ADMIN RECORD	WATER SEMIVOLATILES SOUTHWEST DIVISION
M00681 002254 DATA 000000000000000 0040	07/20/94 11/02/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER AND SOIL PARAMETERS: TAL METALS AND MOLYBDENUM SDG: W2590	ADMIN RECORD	WATER METLAS SOUTHWEST DIVISION

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . . FROM . SIGNATURE . . . TO . . . . . . TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS . . . . . .Site . . . . . Location
M00681 002255 DATA 00000000000000 0008	07/20/94 11/02/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER AND SOIL PARAMETERS: TPH GASOLINE AND TPH DIESEL SDG: W2590	ADMIN RECORD	WATER FUEL SOUTHWEST DIVISION
M00681 002256 DATA 000000000000000 0050	07/20/94 11/02/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER AND SOIL PARAMETERS: VOLATILES SDG: W2590	ADMIN RECORD	WATER VOLATILES SOUTHWEST DIVISION
M00681 002292 DATA 0000000000000000 0013	07/20/94 11/02/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: ANIONS (CHLORIDE, NITRATE-N, NITRATE-N AND SULFATE) SDG: W2590	ADMIN RECORD	WATER SOUTHWEST DIVISION
M00681 002295 DATA 0000000000000000 0006	07/20/94 11/02/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: ALKALINITY SDG: W2590	ADMIN RECORD	WATER SOUTHWEST DIVISION
M00681 002296 DATA 000000000000000 0008	07/20/94 11/02/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TOTAL DISSOLVED SOLIDS SDG: W2590	ADMIN RECORD	WATER SOUTHWEST DIVISION
M00681 002287 DATA 0000000000000000 0034	07/20/94 11/04/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: ORGANOCHLORINE PESTICIDES/PCBs SDG: W2582	ADMIN RECORD	WATER PCB PESTICIDES SOUTHWEST DIVISION
M00681 002290 DATA 0000000000000000 0020	07/20/94 11/04/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: CHLORINATED HERBICIDES SDG# W2582	ADMIN RECORD	WATER HERBICIDE SOUTHWEST DIVISION
M00681 002297 DATA 0000000000000000 0001	07/20/94 11/ 04/92 00166 02.2	IT CORPORATION E.T. BUENCAMINO SOUTHWEST DIVISION CHRIS POTTER	PARTIAL ANALYTICAL RESULTS DATA FOR THE MCB CAMP PENDLETON RI/FS.	ADMIN RECORD	DATA RI FS SOUTHWEST DIVISION
M00681 001221 DATA 0192	05/27/94 11/05/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP VOLATILE ANALYSIS SDG# W2383 RFW# 9210S038, 0210S064	ADMIN RECORD	VOLATILES
M00681 001222 DATA 0282	05/27/94 11/09/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON ORGANOCHLORINE PESTICIDES ANALYSIS SDG# W2376 RFW# 9210S027, 9210S039, 9210S108	ADMIN RECORD	PESTICIDES

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . . FROM . SIGNATURE . . TO . . . . . . TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS . . . . . .Site . . . . . Location
M00681 001223 DATA 0199	05/27/94 11/09/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE PETROLEUM HYDROCARBONS ANALYSIS SDG# W2376 RFW# 9210S027, 9210S039, 9210S065, 9210S108	ADMIN RECORD	TEH TPH
M00681 001227 DATA 0349	05/27/94 11/09/92 00166 02.0	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GC/MS VOLATILES ANALYSIS SDG# W2376 RFW# 9210S027, 9210S039, 9210S065, 9210S108	ADMIN RECORD	VOLATILES
M00681 002293 DATA 0000000000000000 0035	07/20/94 11/10/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: ORGANOCHLORINE PESTICIDES/PCBs SDG: W2590	ADMIN RECORD	WATER PESTICIDES PCB SOUTHWEST DIVISION
M00681 002294 DATA 0000000000000000 0018	07/20/94 11/10/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: CHLORINATED HERBICIDES SDG: W2590	ADMIN RECORD	WATER HERBICIDE SOUTHWEST DIVISION
M00681 001219 DATA 0186	05/27/94 11/11/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANICS NON CLP ANALYSIS SDG# W2336 RFW# 9209S942, 9209S949, 9209S957, 9210S004, 9210S015	ADMIN RECORD	IOG
M00681 001220 DATA 0173	05/27/94 11/11/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANICS CLP ANALYSIS SDG# W2336 RFW# 9209S942, 9209S949, 9209S957, 9210S004, 9210S9015	ADMIN RECORD	IOG
M00681 001181 DATA 34118 0319	05/25/94 11/12/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, PESTICIDES, PCBs, TFH	ADMIN RECORD	VOLATILES SEMIVOLATILES PESTICIDES PCB TFH
M00681 001182 DATA 34117 0255	05/25/94 11/12/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, PESTICIDES, PCBs, TFH, HERBICIDES AND METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES PESTICIDES PCB TFH HERBICIDE METALS
M00681 001230 DATA 0323	05/27/94 11/13/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP SEMI VOLATILES ANALYSIS SDG# W2383 RFW# 9210S038 9210S064	ADMIN RECORD	SEMIVOLATILES

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . . FROM . SIGNATURE . . . TO . . . . . . TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681 001345 DATA 0030	05/31/94 11/16/92 02.2	 MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: SOIL PARAMETERS: SEMIVOLATILES LAB: ROY F. WESTON SDG# W2628	ADMIN RECORD	SEMIVOLATILES	
M00681 002269 DATA 0000000000000000 0036	07/20/94 11/16/92 00000 02.0	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER AND SOIL PARAMETERS: VOLATILES SDG: W2630	ADMIN RECORD	WATER VOLATILES	SOUTHWEST DIVISION
M00681 002270 DATA 0000000000000000 0008	07/20/94 11/16/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER AND SOIL PARAMETERS: TPH GASOLINE AND TPH DIESEL SDG: W2630	ADMIN RECORD	WATER FUEL	SOUTHWEST DIVISION
M00681 002271 DATA 0000000000000000 0018	07/20/94 11/16/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: CHLORINATED HERBICIDES SDG: W2630	ADMIN RECORD	WATER HERBICIDE	SOUTHWEST DIVISION
M00681 002272 DATA 0000000000000000 0033	07/20/9 11/16/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: ORGANOCHLORINE PESTICIDES/PCBs SDG: W2630	ADMIN RECORD	WATER PESTICIDES	SOUTHWEST DIVISION
M00681 002273 DATA 0000000000000000 0040	07/20/94 11/16/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER AND SOIL PARAMETERS: SEMIVOLATILES SDG: W2630	ADMIN RECORD	WATER SEMIVOLATILES	SOUTHWEST DIVISION
M00681 002299 DATA 0000000000000000 0006	07/20/94 11/16/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: SOIL PARAMETERS: TPH GASOLINE AND TPH DIESEL SDG: W2628	ADMIN RECORD	FUEL	SOUTHWEST DIVISION
M00681 002300 DATA 0000000000000000 0040	07/20/94 11/16/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER AND SOIL PARAMETERS: TAL METALS AND MOLYBDENUM SDG: W2628/W2630	ADMIN RECORD	WATER METALS	SOUTHWEST DIVISION
M00681 002301 DATA 0000000000000000 0006	07/20/94 11/16/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: ALKALINITY SDG: W2628/W2630	ADMIN RECORD	WATER	SOUTHWEST DIVISION
M00681 002302 DATA 000000000000000 0006	07/20/94 11/16/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMATERS: TOTAL DISSOLVED SOLIDS SDG: W2628/W2630	ADMIN RECORD	WATER	SOUTHWEST DIVISION

UIC No. / DOCUMENT . TYPE . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO. / DOC . DATE / CTO . NO . . / EPA . CAT#	PRC . DATE / FROM . SIGNATURE . . . . . / TO . SIGNATURE	FROM . . . . . / TO	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	...Site . . . . Location . . . . .
M00681 DATA 000000000000000 0011	002303	07/20/94 11/16/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: ANIONS (CHLORIDE, NITRATE-N, NITRATE-N AND SULFATE) SDG: W2628/W2630	ADMIN RECORD	WATER	SOUTHWEST DIVISION
M00681 DATA 000000000000000 0030	002304	07/20/94 11/16/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: SOIL PARAMETERS: VOLATILES SDG: W2628	ADMIN RECORD	VOLATILES	
M00681 DATA 000000000000000 0010	002316	07/21/94 11/16/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER AND SOIL PARAMETERS: TAL METALS AND MOLYBDENUM SDG: W2628/W2630	ADMIN RECORD	WATER METALS	
M00681 DATA 0111	000873	05/18/94 11/17/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON BORON ANALYSIS SDG# W2282 & W2294 RFW# 9209S779, 9209S816, 9209S832	ADMIN RECORD	DATA	
M00681 DATA 0098	000874	05/18/94 11/17/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON BORON ANALYSIS SDG# W2272 RFW# 9209S726, 9209S748, 9209S765, 9209S780	ADMIN RECORD	DATA	
MO0681 DATA 0072	000875	05/18/94 11/17/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON BORON ANALYSIS SDG# W2206 RFW# 9208S595, 9208S674, 9209S697, .9209S719	ADMIN RECORD	DATA	
M00681 DATA 0232	000878	05/18/94 11/17/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP/GCMS/SEMIVOLATILE ANALYSIS SDG# W2582 RFW# 9210S249, 920S278, 9210S292, 9211S306	ADMIN RECORD	SEMIVOLATILE	
M00681 DATA 34237 0176	000998	05/18/94 11/17/92 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH, METALS	ADMIN RECORD	VOIATILES SEMIVOLATILES TFH METALS	
M00681 DATA 34218 0245	000999	05/18/94 11/17/92 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH, METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES TFH METALS	
M00681 DATA 0274	000857	05/18/94 11/18/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON VOLATILE PURGEABLE PETROLEUM HYDROCARBONS ANALYSIS SDG# W2582 RFW# 9210S249, 9290S292, 9210S278, 9210S306	ADMIN RECORD	VOLATILES	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS . . . . . Site . . . . . Location
M00681 DATA 0324	000858	05/18/94 11/19/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP/GC/MS VOLATILES ANALYSIS SDG# W2582 RFW# 9210S249, 9211S278, 9211S292, 9211S306	ADMIN RECORD	VOLATILES
M00681 DATA 0357	000859	05/18/94 11/19/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON HERBICIDES ANALYSIS SDG# W2376 RFW# 9210S027, 9210S039, 9210S065, 9210S108	ADMIN RECORD	HERBICIDE
M00681 DATA 0171	000855	05/18/94 11/20/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP/INORGANIC METALS ANALYSIS SDG# W2383 RFW# 9210S038, 9210S064	ADMIN RECORD	IOG METALS
M00681 DATA 0188	000856	05/18/94 11/20/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANIC NON CLP ANALYSIS SDG# W2383 RFW# 9210S038, 9210S064	ADMIN RECORD	IOG
M00681 DATA 0536	000876	05/18/94 11/20/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GC/MS SEMIVOLATILE ANALYSIS SDG# W2506 RFW# 9210S164, 9210S192, 9210S219, 9210S248	ADMIN RECORD	SEMIVOLATILES
M00681 DATA 0354	000877	05/18/94 11/20/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GC/MS VOLATILE ANALYSIS SDG# W2506 RFW# 9210S164, 9210S192, 9210S219, 9210S248	ADMIN RECORD	VOLATILES
M00681 DATA 3427 0223	001141	05/25/94 11/23/92 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH, METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES TFH METALS
M00681 DATA 34314 0191	001145	05/25/94 11/23/92 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH, METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES TFH METALS
M00681 DATA 34297 0178	001146	05/25/94 11/23/92 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH, METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES TFH METALS
M00681 DATA 0573	001185	05/26/94 11/24/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCBCAMP PENDLETON GC/MS VOLATILES ANALYSIS SDG# W2555 RFW# 9210S237, 9210S265, 9211S293, 9211S307, 9211S323	ADMIN RECORD	VOLATILES

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS . . . . . Site . . . . . Location
M00681 DATA 34369 0072	001142	05/25/94 11/25/92 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON METALS	ADMIN RECORD	METALS
M00681 DATA 34370 0063	001143	05/25/94 11/25/92 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON METALS, SDG# WESTON4	ADMIN RECORD	METALS
M00681 DATA 34372 0066	001144	05/25/94 11/25/92 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON METALS SDG# WESTON5	ADMIN RECORD	METALS
M00681 DATA 34372 0066	001147	05/25/94 11/25/92 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON METALS SDG# WESTON5	ADMIN RECORD	METALS
M00681 DATA 34325 0188	001148	05/25/94 11/25/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH, METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES TPH METALS
M00681 DATA 34296 0719	001153	05/25/94 11/25/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH	ADMIN RECORD	VOLATILES SEMIVOLATILES TPH
M00681 DATA 0229	001186	05/26/94 11/25/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON VOLATILE PURGEABLE PETROLEUM HYDORCARBONS ANALYSIS SDG# W2506, RFW# 9210S192, 9210S219, 9210S248	ADMIN RECORD	TPH
M00681 DATA 0652	001189	05/26/94 11/25/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GC/MS SEMIVOLATILES ANALYSIS SDG# W2555 RFW# 9210S237, 9210S265, 9210S265, 9211S293, 9211S307, 9211323	ADMIN RECORD	SEMIVOLATILES
M00681 DATA 0374	001193	05/26/94 11/25/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON VOLATILE PURGEABLE PETROLEUM HYDROCARBONS ANALYSIS SDG# W2555 RFW# 9210S237, 9210S265, 9211S293, 9211S307	ADMIN RECORD	TPH
M00681 DATA 000000000000000 0022	002315	07/21/94 11/28/92 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: CHLORINATED HERBICIDES SDG: W2555	ADMIN RECORD	WATER HERBICIDE

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS . . . . . Site . . . . . Location
M00681 DATA 34348 0239	001152	05/25/94 11/30/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, PESTICIDES, PCBs, TFH, HERBICIDES METALS	ADMIN RECORD	VOLATILES PESTICIDES PCB TFH HERBICIDES METALS
M00681 DATA 0243	001190	05/26/94 11/30/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP ORGANOCHLORINE PESTICIDES ANALYSIS SDG# W2506 RFW# 9210S192	ADMIN RECORD	PESTICIDES
M00681 DATA 0257	001194	05/27/94 11/30/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP ORGANOCHLORINE PESTICIDES ANALYSIS SDG# W2555 RFW# 9210S237, 9210S307	ADMIN RECORD	PESTICIDES
M00681 DATA 34349 0406	00988	05/18/94 12/01/92 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES	ADMIN RECORD	VOLATILES
M00681 DATA 0124	000862	05/18/94 12/02/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP/GC/MS SEMIVOLATILE ANALYSIS SDG# W2582 (ADDITION) RFW# 9211S358	ADMIN RECORD	SEMIVOLATI LES
M00681 DATA 0068	000863	05/18/94 12/02/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON VOLATILE PURGEABLE PETROLEUM HYDROCARBONS ANALYSIS SDG# W2582 RFW# 9211S358	ADMIN RECORD	VOLATILE
M00681 DATA 0110	000864	05/18/94 12/02/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP/GC/MS VOLATILE ANALYSIS SDG# W2582 (ADDITIONAL) RFW# 9211S358	ADMIN RECORD	VOLATILES
M00681 DATA 0328	000865	05/18/94 12/02/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON VOLATILE PURGEABLE PETROLEUM HYROCARBONS ANALYSIS SDG# W2590 RFW# 9211S277, 9211S359, 9211S370, 9211S400	ADMIN RECORD	VOLATILES
M00681 DATA 0252	000861	05/18/94 12/03/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE HYDROCARBONS ANALYSIS SDG# W2506 RFW# 9210S192, 9210S219, 9210S248	ADMIN RECORD	TEH
M00681 DATA 34374 0069	000982	05/18/94 12/03/92 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON INORGANIC	ADMIN RECORD	IOG

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS . . . . . Site . . . . . Location
M00681 DATA 34403 0057	000997	05/18/94 12/03/92 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON METALS	ADMIN RECORD	METALS
M00681 DATA 0072	002236	07/19/94 12/03/92 02.2	CH2M HIL PEGGY A. NORTON ROY F. WESTON, INC. KELLY MORGAN	ANALYTICAL DATA FOR JACOBS ENGINEERING, LRD LAB REFERENCE NO. 34374.	ADMIN RECORD	DATA DISPOSAL HAZ WASTE
M00681 DATA 34376 0267	001000	05/18/94 12/04/92 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH, METALS, PESTICIDES, PCB HERBICIDES	ADMIN RECORD	VOLATILES SEMIVOLATILES TFH METALS PESTICIDES PCB HERBICIDE
M00681 DATA 34364 0382	001017	05/18/94 12/04/92 00166 02.2	WESTON MANAGERS IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES	ADMIN RECORD	VOLATILES SEMIVOLATILES
M00681 DATA 0514	000838	05/17/94 12/07/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GC/MS VOLATILE ANALYSIS SDG# W2590 RFW# 9211S277, 9211S359, 9211S370, 9211S400	ADMIN RECORD	VOLATILE
M00681 DATA 0168	000839	05/17/94 12/07/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GC/MS SEMIVOLATILE ANALYSIS SDG# W2628 RFW# 9211S401, 9211S413	ADMIN RECORD	SEMIVOLATILE
M00681 DATA 0328	000966	05/18/94 12/07/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE HYDROCARBONS SDG# W2555 RFW# 9210S237, 9210S265, 9211S293, 9211S307, 9211S323	ADMIN RECORD	TEH
M00681 DATA 0216	000942	05/18/94 12/08/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON VOLATILE PURGEABLE PETROLEUM HYROCARBONS ANALYSIS SDG# W2630 RFW# 9211S402, 9211S414	ADMIN RECORD	VOLATILES
M00681 DATA 0218	000943	05/18/94 12/08/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON ORGANOCHLORINE PESTICIDES ANALYSIS SDG# W2590 RFW# 9211S359, 9211S370	ADMIN RECORD	PESTICIDES

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS . . . . . Site . . . . . Location
M00681 DATA 0349	000960	05/18/94 12/08/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GC/MS SEMIVOLATILE ANALYSIS SDG# W2630 RFW# 9211S402, 9211S414	ADMIN RECORD	SEMIVOLATILES
M00681 DATA 0223	000967	05/18/94 12/08/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP/ORGANOCHLORINE PESTICIDES ANALYSIS SDG# W2582 RFW# 9211S306, 9211S358	ADMIN RECORD	PESTICIDES
M00681 DATA 34429 0322	001016	05/18/94 12/08/92 00166 02.2	WESTON MANAGERS IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR CAMP PENDLETON VOLATILES, PESTICIDES, PCB SEMIVOLATILES, TFH HERBICIDES, METALS	ADMIN RECORD	VOLATILES PESTICIDES PCB SEMIVOLATILES TFH HERBICIDE METALS
M00681 DATA 0525	000835	05/17/94 12/09/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GC/MS SEMIVOLATILE ANALYSIS SDG# W2590 RFW# 9211S277, 9211S359, 9211S370. 9211S400	ADMIN RECORD	SEMIVOLATILES
M00681 DATA 0135	000959	05/18/94 12/09/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP/GC/MS VOLATILE ANALYSIS SDG# W2628 RFW# 9211S401, 9211S416	ADMIN RECORD	VOLATILES
M00681 DATA 0262	000837	05/17/94 12/10/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE HYDROCARBONS ANALYSIS SDG# W2582 RFW# 9210S249, 9211S278, 9211S292, 9211S306, 9211S358	ADMIN RECORD	TEH
M00681 DATA 0251	000836	05/17/94 12/11/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP/ORGANOCHLORINE HYDROCARBONS ANALYSIS SDG# W2630 RFW# 9211S402, 9211S414	ADMIN RECORD	PESTICIDES
M00681 DATA 0245	000963	05/18/94 12/14/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON HERBICIDES ANALYSIS SDG# W2506 RFW# 9210S192	ADMIN RECORD	HERBICIDE
M00681 DATA 0095	000964	05/18/94 12/14/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE HYDROCARBONS ANALYSIS SDG# W2628 RFW# 9211S401, 9211S413	ADMIN RECORD	TEH

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOC. NO. / DOCUMENT . TYPE / CONTR/GUID . . NO / APPROX. # . OF . PAGES	PRC . DATE / DOC . DATE / CTO . NO / EPA . CAT#	FROM / FROM . SIGNATURE / TO / TO . SIGNATURE	SUBJECT	CLASSIFICATION	KEY WORDS	Site / Location
M00681 000965 DATA 0353	05/18/94 12/14/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GC/MS VOLATILE ANALYSIS SDG# W2630 RFW# 9211S402, 9211S414	ADMIN RECORD	VOLATILES	
M00681 000841 DATA 0114	05/17/94 12/15/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON VOLATILE PURGEABLE PETROLEUM HYDROCARBONS ANALYSIS SDG# W2628 RFW# 9211S401, 9211S413	ADMIN RECORD	VOLATILE	
M00681 002352 DATA 000000000000000 0015	07/21/94 12/16/92 00166 02.2	CH2M NILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: PESTICIDES/PCBs SDG: 34688	ADMIN RECORD	PESTICIDES PCB	
M00681 000834 DATA 0302	05/17/94 12/17/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE HYDROCARBONS ANALYSIS SDG# W2590 RFW# 9211S277, 9211S359, 9211S370, 9211S400	ADMIN RECORD	TEH	
M00681 000840 DATA 0205	05/17/94 12/17/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE HYDROCARBONS ANALYSIS SDG# W2630 RFW# 9211S402, 9211S414	ADMIN RECORD	TEH	
M00681 002234 DATA 0008	07/19/94 12/17/92 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH - GASOLINE SDG: 34729	ADMIN RECORD	WATER TPH	
M00681 000843 DATA 0376	05/17/94 12/18/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON HERBICIDES ANALYSIS SDG# W2582 RFW# 9211S308, 9211S358	ADMIN RECORD	HERBICIDE	
M00681 000822 DATA 0425	05/17/94 12/22/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON HERBICIDES ANALYSIS SDG# W2555 RFW# 9210S237, 9210S307	ADMIN RECORD	HERBICIDE	
M00681 000824 DATA 0387	05/17/94 12/22/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON HERBICIDES ANALYSIS SDG# W2590 RFW# 9211S359, 9211S370	ADMIN RECORD	HERBICIDE	
M00681 000842 DATA 0292	05/17/94 12/22/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANICS NON CLP ANALYSIS SDG# W2506 RFW# 9210S164, 9210S192, 9210S219, 9210S248	ADMIN RECORD	IOG	

UIC No. / DOCUMENT . TYPE / CONTR/GUID / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO / EPA . CAT#	FROM / FROM . SIGNATURE / TO / TO . SIGNATURE	SUBJECT	CLASSIFICATION	KEY WORDS	Site	Location
M00681 DATA 0386	000844	05/17/94 12/22/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP/INORGANIC METALS ANALYSIS SDG# W2555 RFW# 9210S237, 9210S265, 9211S293, 9211S307	ADMIN RECORD	IOG METALS		
M00681 DATA 0247	000961	05/18/94 12/22/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP INORGANICS METALS ANALYSIS SDG# W2506 RFW# 9210S192, 9210S219, 9210S248	ADMIN RECORD	IOG METALS		
M00681 DATA 0442	000962	05/18/94 12/22/92 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANICS NON CLP ANALYSIS SDG# W2555 RFW# 9210S237, 9210S293, 9211S293, 9211S307, 9211S323	ADMIN RECORD	IOG		
M00681 DATA 0276	000823	05/17/94 12/23/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON HERBICIDES ANALYSIS SDG# W2630 RFW# 9211S402, 9211S411	ADMIN RECORD	HERBICIDE		
M00681 DATA 0291	000818	05/17/94 12/29/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP\INORGANICS METALS ANALYSIS SDG# W2582 RFW# 9210S249, 9211S278, 9211S292, 9211S306, 9211S358	ADMIN RECORD	METALS IOG		
M00681 DATA 0390	000819	05/17/94 12/29/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANICS NON CLP ANALYSIS RFW# 9210S249, 9211S278, 9211S292, 9211S306, 9211S358	ADMIN RECORD	IOG		
M00681 DATA 0363	000826	05/17/94 12/29/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANICS NON CLP ANALYSIS SDG# W2590 RFW# 9211S277, 9211S359, 9211S370, 9211S400	ADMIN RECORD	IOG		
M00681 DATA 0362	000821	05/17/94 12/30/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP INORGANIC METALS ANALYSIS SDG# W2590 RFW# 9211S277, 9211S359, 9211S370 9211S400	ADMIN RECORD	IOG METALS		
M00681 DATA 34573 0222	000831	05/17/94 12/30/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, PESTICIDES, PCB, TPH, METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES PESTICIDES PCB TPH METALS		
M00681 DATA 0408	000820	05/17/94 12/31/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANICS CLP ANALYSIS SDG# W2628, W2630 RFW# 9211S401, 9211S402, 9211S413 9211S414	ADMIN RECORD	IOG		

UIC No. / DOCUMENT . TYPE / CONTR/GUID / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO / EPA . CAT#	FROM / FROM . SIGNATURE / TO / TO . SIGNATURE	SUBJECT	CLASSIFICATION	KEY WORDS	Site	Location
M00681 DATA 0212	000825	05/17/94 12/31/92 00166 02.2	WESTION MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANICS NON CLP ANALYSIS SDG# W2628 & W2630 RFW# 9211S401, 9211S402, 9211S413, 9211S414	ADMIN RECORD	IOG		
M00681 DATA 34585 0061	000827	05/17/94 12/31/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON VOLATILES SEMIVOLATILES	ADMIN RECORD	VOLATILES SEMIVOLATILES		
M00681 DATA 34563 0245	000828	05/17/94 12/31/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON VOLATILES SEMIVOLATILES, PESTICIDES, PCB, HERBICIDES TFH	ADMIN RECORD	VOLATILES SEMIVOLATILES PESTICIDES PCB HERBICIDE TFH		
M00681 DATA 34583 0284	000829	05/17/94 12/31/92 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON VOLATILES SEMIVOLATILES, PESTICIDES, PCB, HERBICIDES TFH, METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES PESTICIDES PCB HERBICIDE TFH METALS		
M00681 DATA 34633 0241	000972	05/18/94 01/04/93 00166 02. 2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON TFH, VOLATILES, SEMIVOLATILES, PESTICIDES, PCB, HERBICIDES, METALS	ADMIN RECORD	TFH VOLATILES SEMIVOLATILES PESTICIDES PCB HERBICIDE METALS		
M00681 DATA 34652 0226	000990	05/18/94 01/15/93 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES,SEMIVOLATILES, PESTICIDES, PCB, TFH, HERBICIDES METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES PESTICIDES PCB TFH HERBICIDE METALS		
M00681 DATA 34688 0277	000968	05/18/94 01/18/93 0166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILIES, SMIVOLATILES, PESTICIDES, PCB, TFH, HERBICIDES, METALS	ADMIN RECORD	PESTICIDES PCB TFH HERBICIDE METALS VOLATILES SEMIVOLATILES		

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681 DATA 34640 0260	000969	05/18/94 01/18/93 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, PESTICIDES, PCB, TFH, HERBICIDES, METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES PESTICIDES PCB TFH HERBICIDE METALS	
M00681 DATA 34689 1014	001013	05/18/94 01/18/93 00166 02.2	WESTON MANAGERS IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON SEMIVOLATILES, PESTICIDES	ADMIN RECORD	SEMIVOLTILES PESTICIDES	
M00681 DATA 34678 0223	000986	05/18/94 01/28/93 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, PESTICIDES, PCB, TFH, METALS HERBICIDES	ADMIN RECORD	VOLATILES SEMIVOLATILES PESTICIDES PCB TFH METALS HERBICIDE	
M0681 DATA 000000000000000 0020	002335	07/21/94 02/02/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: SOIL PARAMETERS: SEMIVOLATILES SDG: 35073	ADMIN RECORD	SEMIVOLATILES	
M00681 DATA 000000000000000 0030	002341	07/21/94 02/02/93 00166 02.2	ESE MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TRIAZINE PESTICIDES CASE NUMBER: NACPW7G SDG: G36215 AND G35443	ADMIN RECORD	WATER PESTICIDES	
M00681 DATA 000000000000000 0027	002366	07/21/94 02/02/93 00166 02.2	ESE MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: CARBAMATE/UREA PESSTICIDES CASE: NACPW7G SDD: G35130 AND G35999	ADMIN RECORD	WATER PESTICIDES	
M00681 DATA 000000000000000 0040	002392	07/22/94 02/02/93 00166 02.2	ESE MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: PESTICIDES/PCBs SDG: G35546 AND G36508 CASE: NACPW7G	ADMIN RECORD	WATER PESTICIDES PCB	
M00681 DATA 0010	002406	07/22/94 02/02/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: SOIL PARAMETERS: TPH-DIESEL SDG: 35073	ADMIN RECORD	FUEL	
M00681 DATA 000000000000000 0032	002442	07/22/94 02/02/93 00166 02.2	ESE MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: CHLORINATED HERBICIDES CASE: NACPW7G SDG: G35201,G36167	ADMIN RECORD	WATER HERBICIDE	SOUTHWEST DIVISION

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . FROM . SIGNATURE . . TO . . . . . TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681 002342 DATA 000000000000000 0019	07/21/94 02/03/93 00166 02.2	ESE MCB CAMP PENDLETON	PARAMETERS: TRIAZINE PESTICIDES CASE NUMBER: NACPS4E SDG: G35419 AND G35426	ADMIN RECORD	PESTICIDES	
M00681 002364 DATA 000000000000000 0015	07/21/94 02/03/93 00166 02.2	ESE MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: GENERAL CHEMISTRY CASE: NACPW8D SDG:G36526, G36446, G36442, G36029, G35334, G35493, G35103	ADMIN RECORD	WATER	
M00681 002365 DATA 000000000000000 0018	07/21/94 02/03/93 000166 02.2	ESE MCB CAMP PENDLETON	PARAMETERS: CARBAMATE/UREA PESSTICIDES CASE: NACPS4E SDG: G35299 AND G35301	ADMIN RECORD	PESTICIDES WATER	
M00681 002393 DATA 000000000000000 0032	07/22/94 02/03/93 00166 02.2	ESE MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: PESTICIDES/PCBs SDG: G35671 AND G36519 CASE: NACPW8D	ADMIN RECORD	WATER PESTICIDES PCB	
M00681 002397 DATA 000000000000000 0015	07/22/94 02/03/93 00166 02.2	ESE MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: CARBANATE/UREA PESTICIDES SDG: G35284 AND G35941 CASE: NACPW7G	ADMIN RECORD	WATER PESTICIDES	
M00681 002399 DATA 000000000000000 0022	07/22/94 02/03/93 00166 02.2	ESE MCB CAMP PENDLETON	MATRIX: WATER CASE: NACPW8D PARAMETERS: TRIAZINE PESTICIDES SDG: G35408 AND G36215	ADMIN RECORD	WATER PESTICIDES	
M00681 002441 DATA 000000000000000 0020	07/22/94 02/03/93 00166 02.2	ESE MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: CHLORINATED HERBICIDES CASE: NACPW8D SDG: G35333 , G36167	ADMIN RECORD	WATER HERBICIDE	SOUTHWEST DIVISION
M00681 002331 DATA 000000000000000 0021	07/21/94 02/04/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: SEMIVOLATILES SDG: 35078	ADMIN RECORD	WATER SEMIVOLATILES	
M00681 002374 DATA 000000000000000 0030	07/21/94 02/04/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: SOIL AND WATER PARAMETERS: TCL METALS WITH MOLYBDENUM SDG: 35104	ADMIN RECORD	WATER METALS	
M00681 002396 DATA 000000000000000 0015	07/22/94 02/04/93 00166 02.2	ESE MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH-GASOLINE AND TPH-DIESEL SDG: G35304 CASE: NACPW7G	ADMIN RECORD	WATER FUEL	

UIC No. / DOC. NO. / DOCUMENT . TYPE / CONTR/GUID . . NO / APPROX. # . OF . PAGES	PRC . DATE / DOC . DATE / CTO . NO / EPA . CAT#	FROM / FROM . SIGNATURE / TO / TO . SIGNATURE	SUBJECT	CLASSIFICATION	KEY WORDS	Site	Location
M00681 002246 DATA 0006	07/20/94 02/10/93 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER AND SOIL PARAMETERS: CLP METALS AND MOLYBDENUM SDG: W2666	ADMIN RECORD	WATER METALS		
M00681 002247 DATA 0004	07/20/94 02/10/93 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER AND SOIL PARAMETERS: TPH GASOLINE AND TPH DIESEL SDG: W2666	ADMIN RECORD	WATER FUEL		
M00681 002248 DATA 000000000000000 0004	07/20/94 02/10/93 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER AND SOIL PARAMETERS: VOLATILES SDG: W2666	ADMIN RECORD	WATER VOA		SOUTHWEST DIVISION
M00681 002249 DATA 000000000000000 0010	07/20/94 02/10/93 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER AND SOIL PARAMETERS: SEMIVOLATILES SDG: W2666	ADMIN RECORD	WATER SEMIVOLATILES		SOUTHWEST DIVISION
M00681 002241 DATA 0008	07/20/94 02/11/93 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER AND SOIL PARAMETERS: CLP METALS AND MOLYBKENUM SDG: W2684	ADMIN RECORD	WATER		
M00681 002250 DATA 000000000000000 0008	07/20/94 02/11/93 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER AND SOIL PARAMETERS: VOLATILES SDG: W2684	ADMIN RECORD	WATER VOA		SOUTHWEST DIVISION
M00681 002251 DATA 000000000000000 0004	07/20/94 02/11/93 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER AND SOIL PARAMETERS: TPH GASOLINE AND TPH DIESEL SDG: W2684	ADMIN RECORD	WATER FUEL		SOUTHWEST DIVISION
M00681 002252 DATA 000000000000000 0008	07/20/94 02/11/93 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER AND SOIL PARAMETERS: SEMIVOLATILES SDG: W2684	ADMIN RECORD	WATER SEMIVOLATILES		SOUTHWEST DIVISION
M00681 000830 DATA 34729 0847	05/17/94 02/12/93 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON VOLATILES	ADMIN RECORD	VOLATILES		
M00681 000832 DATA 34728 0326	05/17/94 02/12/93 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, PESTICIDES, PCB, TPH, METALS, HERBICIDES	ADMIN RECORD	VOLATILES SEMIVOLATILES PESTICIDES PCB TPH METALS HERBICIDE		

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE / TO . . . . . / TO . SIGNATURE . . .	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681 DATA 34681 0328	000833	05/17/94 02/12/93 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, PESTICIDES, PCB, TFH, METALS, HERBICIDES	ADMIN RECCORD	VOLATILES SEMIVOLATILES PESTICIDES PCB TFH METALS HERBICIDE	
M00681 DATA 0028	002242	07/20/94 02/12/93 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: SOIL PARAMETERS: SEMIVOLATILES SDG: W2684	ADMIN RECORD	SEMIVOLATILES	
M00681 DATA 0027	002243	07/20/94 02/12/93 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: SOIL PARAMETERS: VOLATILES SDG: W2684	ADMIN RECORD	VOA	
M00681 DATA 0006	002244	07/20/94 02/12/93 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER AND SOIL PARAMETERS: TPH GASOLINE AND TPH DIESEL SDG: W2684	ADMIN RECORD	WATER FUEL	
M00681 DATA 0030	002245	07/20/94 02/12/93 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER AND SOIL PARAMETERS: CLP METALS AND MOLYBDENUM SDG: W2684	ADMIN RECORD	WATER METALS	
M00681 DATA 000000000000000 0050	002343	07/21/94 02/16/93 00166 02.2	ESE MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: VOLATILES CASE NUMBER: NACPW5E SDG: G35790, G35792, G35793, G36496	ADMIN RECORD	WATER VOLATILES	
M00681 DATA 000000000000000 0050	002367	07/21/94 02/16/93 00166 02.2	ESE MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TCL METALS WITH BORON, CYANIDE, AND CARBAMA MOLYBDENUM SDG: G35648, G35733, G35767, G35818.	ADMIN RECORD	WATER METALS CYANIDE	SOUTHWEST DIVISION
M00681 DATA 000000000000000 0029	002394	07/22/94 02/16/93 00166 02.2	ESE MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH-GASOLINE AND TPH-DIESEL SDG: G35623, G35615, G36420, G365503, G36494, G35812.	ADMIN RECORD	WATER FUEL	SOUTHWEST DIVISION
M00681 DATA 000000000000000 0030	002438	07/22/94 02/16/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: GENERAL CHEMISTRY CASE: NACPW5E SDG: G35849, G35881, G36526, G35950, G35951, G36442, G35896	ADMIN RECORD	WATER	SOUTHWEST DIVISION

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . . FROM . SIGNATURE . . TO . . . . . . TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681 001255 DATA 0016	05/27/94 02/18/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANIC RFW# 9302S098	ADMIN RECORD	IOG	
M00681 002361 DATA 000000000000000 0015	07/21/94 02/25/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: CHLORINATED HERBICIDES SDG: 35235	ADMIN RECORD	WATER HERBICIDE	
M00681 000722 DATA 0238	05/16/94 02/26/93 00166 02.2	WESTON MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLTON TOTAL EXTRACTABLE HYDROCARBONS ANALYSIS SDG# W2666 RFW# 9302S098, 9302S111	ADMIN RECORD	TPH	
M00681 000723 DATA 0158	05/16/94 02/26/93 00166 02.2	WESTON MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLTON VOLATILE PURGEABLE PETROLEUM HYDROCARBON ANALYSIS SDG# W2666 RFW# 9302S098, 9302S111	ADMIN RECORD	TPH	
M00681 000724 DATA 0156	05/16/94 02/26/93 00166 02.2	WESTON MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLTON TOTAL EXTRACTABLE HYDROCARBONS ANALYSIS SDG# W2684 RFW# 9302S1112	ADMIN RECORD	TEH	
M00681 000721 DATA 0318	05/16/94 02/28/93 00166 02.2	WESTON MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLTON CLP\GS\MS VOLATILE ANALYSIS SDG# W2666 RFW# 9302S098, 9302S111	ADMIN RECORD	VOC	
M00681 000619 DATA 0496	05/13/94 03/01/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP\GC\MS VOLATILE ANALYSIS SDG# W2684 RFW# 9302S112, 9302S133	ADMIN RECORD	VOC	
M00681 000726 DATA 0542	05/16/94 03/01/93 00166 02.2	WESTON MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLTON CLP/GS/MS SEMIVOLATILE ANALYSIS SDG# W2666 RFW# 9302S098, 9302S111	ADMIN RECORD	SOLVENTS	
M00681 000727 DATA 0121	05/16/94 03/01/93 00166 02.2	WESTON MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLTON VOALTILE PURGEABLE PETROLEUM HYDROCARBONSANALYSIS SDG# W2684 RFW# 9302S112	ADMIN RECORD	TPH	
M00681 000728 DATA 0316	05/16/94 03/01/93 00166 02.2	WESTON MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLTON CLP AND NO-CLP\ INOGRANICS ANALYSIS SDG# W2666 RFW# 9302S098, 9302S111	ADMIN RECORD	IOG	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . . FROM . SIGNATURE . . . TO . . . . . . TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. Site . . . . . .Location . . . . .
M00681 000729 DATA 0549	05/16/94 03/01/93 00166 02.2	WESTON MANAGERS MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLTON CLP AND NON-CLP\ SEMIVOLATILE ANALYSIS SDG# W2684 RFW# 9302S112, 9302S133	ADMIN RECORD	SOLVENTS	
M00681 002353 DATA 0000000000000000 0015	07/21/94 03/01/93 00166 02.2	CH2M NILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: CHLORINATED HERBICIDES SDG: 35251	ADMIN RECORD	WATER HERBICIDE	
M00681 000297 DATA 0000000000000000 0110	05/11/94 03/03/93 00166 02.2	WESTON MANAGERS ROY F. WESTON IT CORPORATION	LABORATORY REPORT FOR IT CORP. CLP\ORGANOCHLORINE PESTICIDES ANALYSIS SDG# W2700 RFW# 9302S205, 9302S215 9303S237, 9303S245	ADMIN RECORD	PESTICIDES	SOUTHWEST DIVISION
M00681 000621 DATA 0401	05/13/94 03/03/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP AND NONCLP\INORGANICS ANALYSIS SDG# 2684 RFW# 9302S112, 9302S133	ADMIN RECORD	IOG	
M00681 000622 DATA 0146	05/13/94 03/03/93 00166 02.2	WESTON MANAGERS IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON SEMIVOLATILES BY GC\MS LAB ID: 9302S098-001	ADMIN RECORD	SOLVENTS	
M00681 000550 DATA 01F166S920066 0005	05/12/94 03/04/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON G29380 MATRIX: SOIL PARAMETER: PCDDs AND PCDFs LAB: ROY F. WESTON SDG# NA	ADMIN RECORD	DATA	
M00681 002305 DATA 0000000000000000 0006	07/20/94 03/04/93 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: SOIL PARAMETERS: VOLATILES SDG: W2700	ADMIN RECORD	VOLATILES	
M00681 002306 DATA 0000000000000000 0006	07/20/94 03/04/93 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: SOIL PARAMETERS: VOLATILES SDG: W2700	ADMIN RECORD	VOLATILES	
M00681 002464 DATA 0006	07/22/94 03/04/93 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: SOIL PARAMETERS: ORGANOCHLORINE PESTICIDES/PCBs SDG: W2700	ADMIN RECORD	PESTICIDES PCB	
M00681 00538 DATA 01F166S920066 0020	05/12/94 03/05/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON G29380 MATRIX: WATER & SOIL PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 33142	ADMIN RECORD	WATER PESTICIDES PCB	`

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . . FROM . SIGNATURE . . . TO . . . . . . TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . .Location . . . . .
M00681 000539 DATA 01F166S920066 0002	05/12/93 03/05/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON G29380 MATRIX: WATER PARAMETER: CHLORINATED HERBICIDE LAB: CH2M HILL SDG# 32946	ADMIN RECORD	WATER HERBICIDE	
M00681 000540 DATA 01F166S920066 0032	05/12/94 03/05/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON G29380 MATRIX: WATER PARAMETER: SEMIVOLATILE LAB: CH2M HILL SDG# 33559	ADMIN RECORD	WATER SOLVENTS	
M00681 000541 DATA 01F166S920066 0018	05/12/94 03/05/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON G29380 MATRIX: WATER PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 33673	ADMIN RECORD	WATER PESTICIDES PCB	
M00681 000542 DATA 01F166S920066 0018	05/12/94 03/05/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON G29380 MATRIX: WATER PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 33682	ADMIN RECORD	WATER PESTICIDES PCB	
M00681 000543 DATA 01F166S920066 0014	05/12/94 03/05/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON G29380 MATRIX: WATER PARAMETER: CHLORINATED HERBICIDES LAB: CH2M HILL SDG# 33682	ADMIN RECORD	WATER HERBICIDE	
M00681 000544 DATA 01F166S920066 0018	05/12/94 03/05/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON G29380 MATRIX: WATER PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 33718	ADMIN RECORD	WATER PESTICIDES PCB	
M00681 000545 DATA 01F166S920066 0015	05/12/94 03/05/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON G29380 MATRIX: WATER PARAMETER: CHLORINATED HERBICIDES LAB: CH2M HILL SDG# 33718	ADMIN RECORD	WATER HERBICIDES	
M00681 000546 DATA 01F166S920066 0020	05/12/94 03/05/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON G29380 MATRIX: SOIL PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 32452	ADMIN RECORD	PESTICIDES PCB	
M00681 000547 DATA 01F166S920066 0019	05/12/94 03/05/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON G29380 MATRIX: WATER PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 33719	ADMIN RECORD	WATER PESTICIDES PCB	
M00681 000548 DATA 01F166S920066 0019	05/12/94 03/05/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON G29380 MATRIX: WATER PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 33733	ADMIN RECORD `	WATER PESTICIDES PCB	`

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . . FROM . SIGNATURE . . TO . . . . . . TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. . Site . . . . . .Location . . . . .
M00681 000549 DATA 01F166S920066 0014	05/12/94 03/05/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON G29380 MATRIX: WATER PARAMETER: CHLORINATED HERBICIDE LAB: CH2M HILL SDG# 32946	ADMIN RECORD	WATER HERBICIDE	
M00681 000628 DATA 01F166S920066 0018	05/13/94 03/05/93 00166` 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 34118	ADMIN RECORD	WATER PESTICIDES PCB	
M00681 000629 DATA 01F166S920066 0018	05/13/94 03/05/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 34348	ADMIN RECORD	WATER PESTICIDES PCB	
M00681 000630 DATA 01F166S920066 0019	05/13/94 03/05/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 34349	ADMIN RECORD	WATER PESTICIDES PCB	
M00681 000631 DATA 01F166S920066 0013	05/13/94 03/05/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: GENERAL CHEMISTRY LAB: CH2M HILL SDG# 34297	ADMIN RECORD	WATER	
M00681 000632 DATA 01F166S920066 0013	05/13/94 03/05/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 33820	ADMIN RECORD	WATER TPH	
M00681 000633 DATA 01F166S920066 0013	05/13/94 03/05/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 34314	ADMIN RECORD	WATER TPH	
M00681 000634 DATA 01F166S920066 0013	05/13/94 03/05/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 34296	ADMIN RECORD	WATER TPH	
M00681 000635 DATA 01F166S920066 0013	05/13/94 03/05/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 33820	ADMIN RECORD	WATER TPH	
M00681 000636 DATA 01F166S920066 0012	05/13/94 03/05/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 34314	ADMIN RECORD	WATER TPH	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . . FROM . SIGNATURE . . TO . . . . . . TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS . . . . . Site . . . . . Location
M00681 000637 DATA 01F166S920066 0013	05/13/94 03/05/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 34296	ADMIN REPORT	WATER TPH
M00681 002345 DATA 0000000000000000 0025	07/21/94 03/05/93 00166 02.2	ESE MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: VOLATILES CASE NUMBER: NACPW6D SDG: G35793 AND G36496	ADMIN REPORT	WATER VOLATILES
M00681 002395 DATA 0000000000000000 0016	07/22/94 03/05/93 00166 02.2	ESE MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH-GASOLINE AND TPH-DIESEL SDG: G35812 AND G36494	ADMIN REPORT	WATER FUEL
M00681 002398 DATA 0000000000000000 0045	07/22/94 03/05/93 00166 02.2	ESE MCB CAMP PENDLETON	MATRIX: WATER CASE NUMBER: NACPW6D PARAMETERS: TCL METALS WITH BORON, CYANIDE, MOLYBDENUN SDG: G36251, G36110, G36361, G36331, G36246, G36245, G36224	ADMIN RECORD	WATER METALS CYANIDE
M00681 002440 DATA 0000000000000000 0020	07/22/94 03/05/93 00166 02.2	ESE MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: GENERAL CHEMISTRY CASE: NACPW6D SDG: G35881, G26526, G36442, G36234, G36446, G35961, G36031	ADMIN RECORD	WATER SOUTHWEST DIVISION
M00681 001258 DATA 0450	05/27/94 03/06/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON SOIL RFW# 9303S245	ADMIN RECORD	DATA
M00681 000325 DATA 01F166S920066 0013	05/11/94 03/08/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 33806	ADMIN RECORD	WATER TPH
M00681 000326 DATA 01F166S920066 0014	05/11/94 03/08/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 33806	ADMIN RECORD	WATER TPH
M00681 000327 DATA 01F166S920066 0027	05/11/94 03/08/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: SEMIVOLATILES LAB: CH2M HILL SDG# 34325	ADMIN RECORD	WATER SOLVENTS
M00681 000328 DATA 01F166S920066 0024	05/11/94 03/08/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: SEMIVOLATILES LAB: CH2M HILL SDG# 34364	ADMIN RECORD	WATER SOLVENTS `

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS . . . . . Site . . . . . Location
M00681 000329 DATA 01F166S920066 0027	05/11/94 03/08/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATAVALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: SEMIVOLATILES LAB: CH2M HILL SDG# 34314	ADMIN RECORD	WATER SOLVENTS
M00681 000330 DATA 01F166S920066 0028	05/11/94 03/08/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: SEMIVOLATILES LAB: CH2M HILL SDG# 34402	ADMIN RECORD	WATER SOLVENTS
M00681 000331 DATA 01F166S920066 0019	05/11/94 03/08/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILE LAB: CH2M HILL SDG# 33806	ADMIN RECORD	WATER VOC
M00681 000332 DATA 01F166S920066 0020	05/11/94 03/08/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2M HILL SDG# 34364	ADMIN RECORD	WATER VOC
M00681 000333 DATA 01F1066S920066 0021	05/11/94 03/08/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2M HILL SDG# 34314	ADMIN RECORD	WATER
M00681 000334 DATA 01F1066S920066 0023	05/11/94 03/08/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2M HILL SDG# 34402	ADMIN RECORD	WATER
M00681 000335 DATA 01F166S920066 0025	05/11/94 03/08/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WAER PARAMETER: VOLATILES LAB: CH2M HILL SDG# 34563	ADMIN RECORD	WATER
M00681 000496 DATA 01F166S920066 0012	05/12/94 03/08/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 33733	ADMIN RECORD	WATER TPH
M00681 000497 DATA 01F166S920066 0013	05/12/94 03/08/93 00166 02.2	QUANTALEX MCB CAMP PENLETON	DATA VALIDATION REORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 33733	ADMIN RECORD	WATER TPH
M00681 000498 DATA 01F166S920066 0013	05/12/94 03/08/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 33673	ADMIN RECORD	WATER TPH

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681 000499 DATA 01F166S920066 0013	05/12/94 03/08/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 33673	ADMIN RECORD	WATER TPH	
M00681 000500 DATA 01F166S920066 0024	05/12/94 03/08/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: SEMIVOLATIES LAB: CH2M HILL SDG# 32452	ADMIN RECORD	SOLVENTS	
M00681 000501 DATA 01F166S92066 0018	05/12/94 03/08/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: VOLATIES LAB: CH2M HILL SDG# 32452	ADMIN RECORD	VOC	
M00681 000502 DATA 01F166S920066 0014	05/12/94 03/08/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: SOIL & WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 32948	ADMIN RECORD	WATER TPH	
M00681 000503 DATA 01F166S920066 0031	05/12/94 03/08/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: SOIL & WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 32948	ADMIN RECORD	WATER TPH	
M00681 000504 DATA 01F166S920066 0013	05/12/94 03/08/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 33718	ADMIN RECORD	WATER TPH	
M00681 000505 DATA 01F1665920066 0013	05/12/94 03/08/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 33718	ADMIN RECORD	WATER TPH	
M00681 000506 DATA 01F166S920066 0020	05/12/94 03/08/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2M HILL SDG# 33696	ADMIN RECORD	WATER VOC	
M00681 000507 DATA 01F166S920066 0013	05/12/94 03/08/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 33683	ADMIN RECORD	WATER TPH	
M00681 000508 DATA 01F166S920066 0013	05/12/94 03/08/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 33683	ADMIN RECORD	WATER TPH	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . . FROM . SIGNATURE . . . . TO . . . . . . TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS . . . . . .Site . . . . . Location
M00681 000509 DATA 01F166S920066 0033	05/12/94 03/08/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATAVALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2M HILL SDG# 32520	ADMIN RECORD	WATER
M00681 000510 DATA 01F166S920066 0047	05/12/94 03/08/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATAVALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: SEMIVOLATILES LAB: CH2M HILL SDG# 32520	ADMIN RECORD	SOLVENTS
M00681 000511 DATA 01F166S920066 0031	05/12/94 03/08/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATAVALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: SEMIVOLATILES LAB: CH2M HILL SDG# 33042	ADMIN RECORD	SOLVENTS
M00681 000512 DATA 01F166S920066 0053	05/12/94 03/08/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATAVALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL & WATER PARAMETER: VOLATILES LAB: CH2M HILL SDG# 33024	ADMIN RECORD	WATER VOC
M00681 000324 DATA 0102	05/11/94 03/10/93 00166 02.2	ESE JEFF THOMAS IT CORPORATION DAVID MARK	SAMPLE DATA PACKAGE FOR MCB CAMP PENDLETON ROLLOFF SOILS QC DATA	ADMIN RECORD	DATA QC
M00681 001232 DATA 0015	05/27/94 03/10/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANICS SDG# W2684 RFW# 9302S112	ADMIN RECORD	IOG
M00681 002390 DATA 000000000000000 0020	07/21/94 03/10/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: PESTICIDES/PCBs SDG# G36519 CASE: NACPW6D	ADMIN RECORD	WATER PESTICIDES PCB
M00681 002391 DATA 000000000000000 0023	07/22/94 03/10/93 00166 02.2	ESE MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: PESTICIDES/PCBs SDG# G36519 CASE: NACPW5E	ADMIN RECORD	WATER PESTICIDES PCB
M00681 002443 DATA 000000000000000 0015	07/22/94 03/10/93 00166 02.2	ESE MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: CHLORINATED HERBICIDES CASE: NACPW6D SDG: G36167	ADMIN RECORD	WATER HERBICIDE SOUTHWEST DIVISION
M00681 002444 DATA 000000000000000 0019	07/22/94 03/10/93 00166 02.2	ESE MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: CHLORINATED HERBICIDES CASE: NACPW6D SDG: G36167	ADMIN RECORD	WATER HERBICIDE SOUTHWEST DIVISION

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . . FROM . SIGNATURE . . . . TO . . . . . . TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS . . . . . .Site . . . . . Location
M00681 002330 DATA 000000000000000 0022	07/21/94 03/11/93 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR CTO #166, LRD LAB REFERENCE NO. 34364.	ADMIN RECORD	DATA LAB
M00681 002336 DATA 000000000000000 0020	07/21/94 3/11/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: SEMIVOLATILES SDG: 35326	ADMIN RECORD	WATER SEMIVOLATILES
M00681 000336 DATA 01F166S920066 0027	05/11/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: SEMIVOLATILES LAB: CH2M HILL SDG# 34633	ADMIN RECORD	WATER SOLVENTS
M00681 000337 DATA 01F166S920066 0022	05/11/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VAILDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2M HILL SDG# 34633	ADMIN RECORD	WATER
M00681 000338 DATA 01F166S920066 0002	05/11/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER & SOIL PARAMETER: SEMIVOLATILES LAB: CH2M HILL SDG# 33062	ADMIN RECORD	WATER
M00681 000339 DATA 01F166S920066 0013	05/11/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 32520	ADMIN RECORD	TPH
M00681 000340 DATA 01F166S920066 0016	05/11/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL & WATER PARAMETER: CHLORINATED HERBICIDES LAB: CH2M HILL SDG# 32953	ADMIN RECORD	WATER HERBICIDES
M00681 000341 DATA 01F166S920066 0053	05/11/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL & WATER PARAMETER: SEMIVOLATILES LAB: CH2M HILL SDG# 33062	ADMIN RECORD	WATER SOLVENTS
M00681 000342 DATA 01F166S920066 0014	05/11/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CHLORINATED HERBICIDES LAB: CH2M HILL SDG# 33611	ADMIN RECORD	WATER HERBICIDES
M00681 000343 DATA 01F166S92006 0015	05/11/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CHLORINATED HERBICIDES LAB: CH2M HILL SDG# 33683	ADMIN RECORD	WATER HERBICIDES

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . . / TO . . . . . / TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS . . . . . .Site . . . . . Location
M00681 000344 DATA 01F166S920066 0013	05/11/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 32520	ADMIN RECORD	TPH
M00681 000345 DATA 01F166S920066 0014	05/11/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETERS: CHLORINATED HERBICIDES LAB: CH2M HILL SDG# 33141	ADMIN RECORD	HERBICIDES
M00681 000346 DATA 01F166S920066 0014	05/11/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 33007	ADMIN RECORD	WATER TPH
M00681 000347 DATA 01F166S920066 0026	05/11/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VAILDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 33740	ADMIN RECORD	WATER TPH
M00681 000348 DATA 01F166S920066 0012	05/11/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 33740	ADMIN RECORD	WATER TPH
M00681 000349 DATA 01F166S920066 0014	05/11/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CHLORINATED HERBICIDES LAB: CH2M HILL SDG# 33733	ADMIN RECORD	WATER HERBICIDES
M00681 000350 DATA 01F166S920066 0018	05/11/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CHLORINATED HERBICIDES LAB: CH2M HILL SDG# 33719	ADMIN RECORD	WATER HERBICIDES
M00681 000351 DATA 01F166S920066 0013	05/11/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 33719	ADMIN RECORD	WATER TPH
M00681 000352 DATA 01F166S920066 0015	05/11/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CHLORINATED HERBICIDES LAB: CH2M HILL SDG# 33740	ADMIN RECORD	WATER HERBICIDES
M00681 000353 DATA 01F166S920066 0015	05/11/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CHLORINATED HERBICIDES LAB: CH2M HILL SDG# 33942	ADMIN RECORD	HERBICIDES

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . . FROM . SIGNATURE . . . . TO . . . . . . TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS . . . Site . . . . . Location . . . . .
M00681 000354 DATA 01F166S920066 0015	05/11/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CHLORINATED HERBICIDES LAB: CH2M HILL SDG# 33643	ADMIN RECORD	WATER HERBICIDES
M00681 000355 DATA 01F166S920066 0016	05/11/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETERS: CHLORINATED HERBICIDES LAB: CH2M HILL SDG# 33624	ADMIN RECORD	WATER HERBICIDES
M00681 000356 DATA 01F166S920066 0013	05/11/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CHLORINATED HERBICIDES LAB: CH2M HILL SDG# 33673	ADMIN RECORD	WATER HERBICIDES
M00681 000357 DATA 01F166S920066 0019	05/11/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VAILDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CHLORINATED HERBICIDES LAB: CH2M HILL SDG# 34689	ADMIN RECORD	WATER HERBICIDES
M00681 000358 DATA 01F166S920066 0019	05/11/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER & SOIL PARAMETER: CHLORINATED HERBICIDES LAB: CH2M HILL SDG# 32948	ADMIN RECORD	WATER HERBICIDES
M00681 000359 DATA 01F166S920066 0013	05/11/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 32452	ADMIN RECORD	TPH
M00681 000360 DATA 01F166S920066 0012	05/11/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 32452	ADMIN RECORD	TPH
M00681 000361 DATA 01F166S920066 0016	05/11/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL & WATER PARAMETER: CHLORINATED HERBICIDES LAB: CH2M HILL SDG# 32936	ADMIN RECORD	WATER HERBICIDES
M00681 000362 DATA 01F166S920066 0018	05/11/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: CHLORINATED HERBICIDES LAB: CH2M HILL SDG# 32943	ADMIN RECORD	HERBICIDES
M00681 000431 DATA 01F166S920066 0021	05/11/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2M HILL SDG# 34325	ADMIN RECORD	WATER VOC

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE / TO . . . . . / TO . SIGNATURE . . .	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS . . Site . . . . . Location . . . . .
M00681 000432 DATA 01F166S920066 0017	05/12/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2MHILL SDG# 34365	ADMIN RECORD	WATER VOC
M00681 000433 DATA 01F166S920066 0021	05/12/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2MHILL SDG# 34376	ADMIN RECPRD	WATER VOC
M00681 000434 DATA 01F166S920066 0033	05/12/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2MHILL SDG# 34376	ADMIN RECORD	WATER VOC
M00681 000435 DATA 01F166S920066 0026	05/12/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2MHILL SDG# 34414	ADMIN RECORD	WATER VOC
M00681 000436 DATA 01F166S920066 0020	05/12/94 3/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2M HILL SDG# 34583	ADMIN RECORD	WATER VOC
M00681 000437 DATA 01F166S920066 0023	05/12/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2MHILL SDG# 34429	ADMIN RECORD	WATER VOC
M00681 000438 DATA 01F166S920066 0016	05/12/94 03/12/93 00166 02.2.	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CHLORINATED HERBICIDE LAB: CH2MHILL SDG# 34118	ADMIN RECORD	WATER HERBICIDE
M00681 000439 DATA 01F166S920066 0013	05/12/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: GENERAL CHEMISTRY LAB: CH2MHILL SDG# 34348	ADMIN RECORD	WATER
M00681 000440 DATA 01F166S920066 0029	05/12/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TCL METALS W\MOLYBDENUM BORON LAB:CH2MHILL SDG# 34314	ADMIN RECORD	WATER
M00681 000441 DATA 01F166S920066 0022	05/12/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: SEMIVOLATILES LAB: CH2MHILL SDG# 34365	ADMIN RECORD	WATER SOLVENTS

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . . FROM . SIGNATURE TO . . . . . . TO . SIGNATURE . . .	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS . . . Site . . . . . .Location . . . . .
M00681 000442 DATA 01F166S920066 0027	05/12/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: SEMIVOLATILES LAB: CH2MHILL SDG# 34237	ADMIN RECORD ADMIN RECORD	WATER SOLVENTS
M0681 000443 DATA 01F166S920066 0024	05/12/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MARTIX: WATER PARAMETER: SEMIVOLATILES LAB: CH2MHILL SDG# 34376	ADMIN RECORD	WATER SOLVENTS
M00681 000444 DATA 01F166S920066 0060	05/12/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: SEMIVOLATILES LAB: CH2MHILL SDG# 34376	ADMIN RECORD	WATER
M00681 000445 DATA 01F166S920066 0032	05/12/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: SEMIVOLATILES LAB: CH2M HILL SDG# 34414	ADMIN RECORD	WATER SOLVENTS
M00681 000446 DATA 01F166S920066 0029	05/12/94 03/12/93 00166 02.2	QUANTALEX MCN CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: SEMIVOLATILES LAB: CH2M HILL SDG# 34429	ADMIN RECORD	WATER SOLVENTS
M00681 000447 DATA 01F166S920066 0025	05/12/94 03/12/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: SEMIVOLATILES LAB: CH2M HILL SDG# 34583	ADMIN RECORD	WATER SOLVENTS
M00681 000323 DATA 0436	05/11/94 03/15/93 00166 02.2	WESTION MANAGERS ROY F. WESTON IT CORPORATION	LABORATORY REPORT FOR IT CORP. MCB CAMP PENDELTON CLP/GC/MS VOLATILE ANALYSIS SDG# W2700 RFW# 93024S205, 9302S215, 9303S237, 9303S245	ADMIN RECORD	VOC
M00681 002334 DATA 000000000000000 0025	07/21/94 03/17/93 00166 02.2	CN2M HILL MCB CAMP PENDLETON	MARTIX: WATER PARAMETERS: SEMIVOLATILES SDG: 35377	ADMIN RECIRD	WATER SEMIVOLATILES
M00681 002434 DATA 0030	07/22/94 03/17/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TLC METALS WITH BORON, CYANIDE, AND MOLYBDENUM SDG: 35377	ADMIN RECORD	WATER METALS CYANIDE
M0681 000316 DATA 35104 1837	05/11/94 03/18/93 00166 02.2	CH2M HILL PEGGY A. NORTON MCB CAMP PENDLETON	ANALYTICAL DATA BIO ACCUMULATION, PESTICIDES\PCBs ORGNAICS, INORGANICS SDG# 35104	ADMIN RECORD	PESTICIDES PCB IOG

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . . FROM . SIGNATURE TO . . . . . . TO . SIGNATURE . . .	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS . . . Site . . . . . Location . . . . .
M00681 000315 DATA 01F166S920066 0017	05/11/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 34365	ADMIN RECORD	WATER PESTICIDES PCB
M0681 000320 DATA 0083	05/11/94 03/19/93 00166 02.2	WESTION MANAGERS ROY P. WESTON IT CORPORATION	LABORATORY REPORT FOR IT CORP. VOLATILE PURGEABLE PETROLEUM HYDROCARBONS ANALYSIS SDG# W2700 RFW# 9302S205, 9303S245	ADMIN RECORD	TPH
M00681 000387 DATA 01F166S920066 0012	05/11/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 33624	ADMIN RECORD	WATER TPH
M00681 000388 DATA 01F166S920066 0018	05/11/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 33642	ADMIN RECORD	WATER PESTICIDES PCB
M00681 000389 DATA 01F166S920066 0020	05/11/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 34689	ADMIN RECORD	WATER PESTICIDES PCB
M00681 000390 DATA 01F166S920066 0018	05/11/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SEDIMENT PARAMETER: CHLORAINATED HERBICIDE LAB: CH2M HILL SDG# 32452	ADMIN RECORD	HERBICIDE
M00681 000391 DATA 01F166S920066 0020	05/11/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2M HILL SDG# 34688	ADMIN RECORD	WATER VOC
M00681 000392 DATA 01F166S920066 0012	05/11/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MARTIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 34688	ADMIN RECIRD	WATER TPH
M00681 000393 DATA 01F166S920066 0012	05/11/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 34688	ADMIN RECORD	WATER TPH
M0681 000394 DATA 01F166S920066 0017	05/11/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CHLORINATED HERBICIDE LAB: CH2M HILL SDG# 34688	ADMIN RECORD	WATER HERBICIDE

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . . FROM . SIGNATURE TO . . . . . . TO . SIGNATURE . . .	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS . . Site . . . Location . . . . .
M00681 000395 DATA 01F166S920066 0024	05/11/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: SEMIVOLATILES LAB: CH2M HILL SDG# 34688	ADMIN RECORD	WATER SOLVENTS
M00681 000396 DATA 01F166S920066 0019	05/11/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MARTIX: WATER PARAMETER: CHLORINATED HERBICIDE LAB: CH2M HILL SDG# 34640	ADMIN RECORD	WATER HERBICIDE
M00681 000397 DATA 01F166S920066 0012	05/11/94 03/19/93 00166 01.1	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 34640	ADMIN RECORD	WATER
M00681 000398 DATA 01F166S920066 0012	05/11/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 34640	ADMIN RECORD	WATER TPH
M00681 000399 DATA 01F166S920066 0030	05/11/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: SEMIVOLATILES LAB: CH2M HILL SDG# 34640	ADMIN RECORD	WATER SOLVENTS
M00681 000400 DATA 01F166S920066 0022	05/11/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILE LAB: CH2M HILL SDG# 32640	ADMIN RECORD	WATER VOC
M00681 000401 DATA 01F166S920066 0019	05/11/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CHLORINATED HERBICIDE LAB: CH2M HILL SDG# 34633	ADMIN RECORD	WATER HERBICIDE
M00681 000402 DATA 01F166S920066 0031	05/11/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MARTIX: WATER PARAMETER: TCL METALS W\BORON MOLYBDENUM & CYANIDE LAB: CH2M HILL SDG# 34633	ADMIN RECORD	WATER CYANIDE
M00681 000403 DATA 01F166S920066 0020	05/11/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 34633	ADMIN RECORD	WATER PESTICIDES PCB
M0681 000404 DATA 01F166S920066 0013	05/11/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 34633	ADMIN RECORD	WATER TPH

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE / TO . . . . . / TO . SIGNATURE . . .	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS . . . . Site . . . . . Location . . . . .
M00681 000405 DATA 01F166S920066 0013	05/11/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 34633	ADMIN RECORD	WATER TPH
M0681 000406 DATA 01F166S920066 0016	05/11/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MARTIX: WATER & SOIL PARAMETER: CHLORINATED HERBICIDE LAB: CH2M HILL SDG# 32904	ADMIN RECORD	WATER HERBICIDE
M00681 000407 DATA 01F166S920066 0023	05/11/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER & SOIL PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 32904	ADMIN RECORD	WATER PESTICIDES PCB
M00681 000408 DATA 01F166S920066 0016	05/11/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 33683	ADMIN RECORD	WATER PESTICIDES PCB
M00681 000409 DATA 01F166S920066 0018	05/11/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: CHLORINATED HERBICIDE LAB: CH2M HILL SDG# 32520	ADMIN RECORD	HERBICIDE
M00681 000410 DATA 01F166S920066 0043	05/11/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: 14\SOIL 1\WATER PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 33007	ADMIN RECORD	WATER PESTICIDES PCB
M00681 000411 DATA 01F166S920066 0019	05/11/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CHLORINATED HERBICIDE LAB: CH2M HILL SDG# 33696	ADMIN RECORD	WATER HERBICIDE
M00681 000448 DATA 01F166S920066 0018	05/12/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MARTIX: WATER PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 34376	ADMIN RECORD	WATER PESTICIDES PCB
M00681 000449 DATA 01F166S920066 0022	05/12/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 34563	ADMIN RECORD	WATER PESTICIDES PCB
M0681 000450 DATA 01F166S920066 0019	05/12/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 34583	ADMIN RECORD	WATER PESTICIDES PCB

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . . FROM . SIGNATURE TO . . . . . . TO . SIGNATURE . . .	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS . . . Site . . . . . .Location . . . . .
M00681 000451 DATA 01F166S920066 0022	05/12/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 34414	ADMIN RECORD	WATER PESTICIDES PCB
M00681 000452 DATA 01F166S920066 0021	05/12/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MARTIX: WATER PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 34402	ADMIN RECORD	WATER PESTICIDES PCB
M00681 000453 DATA 01F166S920066 0028	05/12/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TCL METALS W\BORON, MOLYBDENUM & CYANIDE LAB: CH2M HILL SDG# 34376	ADMIN RECORD	WATER CYANIDE
M00681 000454 DATA 01F166S920066 0027	05/12/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TCL METALS W\BORON, MOLYBDENUM & CYANIDE LAB: CH2M HILL SDG# 34583	ADMIN RECORD	WATER CYANIDE
M00681 000455 DATA 01F166S920066 0031	05/12/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TCL METALS W\BORON, MOLYBDENUM & CYANIDE LAB: CH2M HILL SDG# 34563	ADMIN RECORD	WATER CYANIDE
M00681 000456 DATA 01F166S920066 0029	05/12/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TCL METALS W\BORON, MOLYBDENUM LAB: CH2M HILL SDG# 34429	ADMIN RECORD	WATER
M00681 000457 DATA 01F166S920066 0013	05/12/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH DIESEL MOLYBDENUM LAB: CH2M HILL SDG# 34429	ADMIN RECORD	WATER TPH
M00681 000458 DATA 01F166S920066 0013	05/12/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MARTIX: WATER PARAMETER: TPH GASOLINE MOLYBDENUM LAB: CH2M HILL SDG# 34429	ADMIN RECORD	WATER TPH
M00681 000459 DATA 01F166S920066 0020	05/12/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CHLORINATED HERBICIDE MOLYBDENUM LAB: CH2M HILL SDG# 34402	ADMIN RECORD	WATER HERBICIDE
M0681 000460 DATA 01F166S920066 0020	05/12/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CHLORINATED HERBICIDE MOLYBDENUM LAB: CH2M HILL SDG# 34429	ADMIN RECORD	WATER HERBICIDE

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . . FROM . SIGNATURE . . . TO . . . . . . TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS . . . . Site . . . . . Location . . . . .
M00681 000461 DATA 01F166S920066 0016	05/12/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CHLORINATED HERBICIDE MOLYBDENUM LAB: CH2M HILL SDG# 34117	ADMIN RECORD	WATER HERBICIDE
M00681 000462 DATA 01F166S920066 0020	05/12/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CHLORINATED HERBICIDE MOLYBDENUM LAB: CH2M HILL SDG# 33820	ADMIN RECORD	WATER HERBICIDE
M00681 000463 DATA 01F166S920066 0017	05/12/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CHLORINATED HERBICIDE MOLYBDENUM LAB: CH2M HILL SDG# 33806	ADMIN RECORD	WATER HERBICIDE
M00681 000464 DATA 01F166S920066 0018	05/12/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CHLORINATED HERBICIDE MOLYBDENUM LAB: CH2M HILL SDG# 34364	ADMIN RECORD	WATER HERBICIDE
M00681 000465 DATA 01F166S920066 0018	05/12/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CHLORINATED HERBICIDE MOLYBDENUM LAB: CH2M HILL SDG# 34349	ADMIN RECORD	WATER HERBICIDE
M00681 000466 DATA 01F166S920066 0018	05/12/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB PENDLETON MATRIX: WATER PARAMETER: CHLORINATED HERBICIDE MOLYBDENUM LAB: CH2M HILL SDG# 34376	ADMIN RECORD	WATER HERBCIDE
M00681 000467 DATA 01F166S920066 0017	05/12/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB PENDLETON MATRIX: WATER PARAMETER CHLORINATED HERBICIDE MOLYBDENUM LAB: CH2M HILL SDG# 34365	ADMIN RECORD	WATER HERBICIDE
M00681 000468 DATA 01F166S920066 0022	05/12/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB PENDLETON MATRIX: WATER PARAMETER: CHLORINATED HERBICIDE MOLYBDENUM LAB: CH2M HILL SDG# 34563	ADMIN RECORD	WATER HERBICIDE
M00681 000469 DATA 01F166S920066 0016	05/12/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB PENDLETON MATRIX: WATER PARAMETER: CHLORINATED HERBICIDE LAB: CH2M HILL SDG# 34583	ADIMIN RECORD	WATER HERBICIDE
M00681 000470 DATA 01F166S920066 0016	05/12/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB PENDLETON MATRIX: WATER PARAMETER: CHLORINATED HERBICIDE LAB: CH2M HILL SDG# 34348	ADMIN RECORD	WATER HERBICIDE

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . . FROM . SIGNATURE . . . TO . . . . . . TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS . . Site . . . . . Location . . . . .
M00681 000471 DATA 01F166S920066 0020	05/12/94 03/19/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CHORINATED HERBICIDE LAB: CH2M HILL SDG# 34414	ADMIN RECORD	WATER HERBICIDE
M00681 000298 DATA 000000000000000 0488	05/11/94 03/22/93 00166 02.2	WESTON MANAGERS ROY F. WESTON IT CORPORATION	LABORATORY REPORT FOR IT CORP. CLP\GC\MS SEMIVOLATILE ANALYSIS SDG# W2700 RFW# 9302S205, 9302S215 9303S237, 9303S245	ADMIN RECORD	SOLVENTS SOUTHWEST DIVISION
M00681 002337 DATA 000000000000000 0012	07/21/94 03/22/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH-GASOLINE SDG: 35427	ADMIN RECORD	WATER FUEL
M00681 002421 DATA 0030	07/22/94 03/22/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TCL METALS WITH BORON, CYANIDE, AND MOLYBDENUM SDG: 35549	ADMIN RECORD	WATER METALS CYANIDE
M00681 000253 DATA 35235 0336	05/10/94 03/23/93 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCLB BARSTOW VOLATILES, PCB's SEMIVOLATILES, PESTICIDES, DIESEL & GASOLINE TOTAL FUEL HYDROCARBONS	ADMIN RECORD	PESTICIDES DIESEL FUEL SOUTHWEST DIVISION
M00681 000291 DATA 35218 0402	05/11/94 03/23/93 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA SELECTED ORGANIC AND INORGANIC PARAMETERS MCB CAMP PENDLETON	ADMIN RECORD	IOG SOUTHWEST DIVISION
M00681 000293 DATA 35223 0289	05/11/94 03/23/93 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA SELECTED ORGANIC AND INORGANIC PARAMETERS PESTICIDES, PCB's, TPH, HERBICIDES CAMP PENDLETON	ADMIN RECORD	PESTICIDES PCB TPH HERBICIDES SOUTHWEST DIVISION
M00681 002333 DATA 000000000000000 0019	07/21/94 03/23/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: SEMIVOLATILES SDG: 35441	ADMIN RECORD	WATER SEMIVOLATILES
M00681 002424 DATA 0020	07/22/94 03/23/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TCL METALS WITH BORON, CYANIDE, AND MOLYBDENUM SDG: 35441	ADMIN RECORD	WATER METALS CYANIDE
M00681 000292 DATA 35251 0371	05/11/94 03/24/93 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCLB BARSTOW SELECTED ORGANIC AND INORGANIC PARAMETERS	ADMIN RECORD	IOG SOUTHWEST DIVISION

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . . FROM . SIGNATURE . . . TO . . . . . . TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS . . . . . Site . . . . . Location . . . . .
M00681 00296 DATA 000000000000000 0110	05/11/94 03/24/93 00166 02.2	WESTON MANAGERS ROY F. WESTON IT CORPORTATION	LABORATORY REPORT FOR IT CORP. TOTAL EXTRACTABLE HYDROCARBONS ANALYSIS SDG# W2700 RFW# 9302S205, 9303S245	ADMIN RECORD	TEH SOUTHWEST DIVISION
M00681 001257 DATA 0018	05/27/94 03/24/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANIC RFW# 9303S345	ADMIN RECORD	IOG
M00681 002506 DATA 01F166S920066 0012	08/24/94 03/25/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG: 35471	ADMIN RECORD	DATA WATER TPH SOUTHWEST DIVISION
M00681 000254 DATA 01F166S920066 0020	05/10/93 03/26/93 00166 02.2	QUANTALEN CH2M HILL	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES SDG# 34689	ADMIN RECORD	WATER VOC SOUTHWEST DIVISION
M00681 000255 DATA 01F166S920066 0020	05/10/94 03/26/93 00166 02.2	QUANTALEN CH2M HILL	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: SEMIVOLATILES SDG# 34689	ADMIN RECORD	WATER SOUTHWEST DIVISION
M00681 000256 DATA 01F166S920066 0020	05/10/94 03/26/93 00166 02.2	QUANTALEN CH2M HILL	DATA VALIDATON REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH-DIESEL SDG# 34689	ADMIN RECORD	TPH SOUTHWEST DIVISION
M00681 000257 DATA 01F166S920066 0020	05/10/94 03/26/93 00166 02.2	QUANTALEN CH2M HILL	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CYANIDE (FOR SDG# SEE ADDL INFO)	ADMIN RECORD	WATER SOUTHWEST DIVISION
M00681 000258 DATA 01F166S920066 0015	05/11/94 03/26/93 00166 02.2	QUANTALEN JACOBS	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CHLORINATED HERBICIDE LAB: CH2M HILL SDG # 34729	ADMIN RECORD	WATER HERBICIDE SOUTHWEST DIVISION
M00681 000259 DATA 01F166S920066 0015	05/11/94 03/26/93 00166 02.2	QUANTALEN JACOBS	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH-DIESEL LAB: CH2M HILL SDG # 34728	ADMIN RECORD	TPH WATER SOUTHWEST DIVISION
M00681 000260 DATA 01F166S920066 0015	05/11/94 03/26/93 00166 02.2	QUANTALEN JACOBS	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CHLORINATED HERBICIDE LAB: CH2M HILL SDG# 34728	ADMIN RECORD	WATER HERBICIDE SOUTHWEST DIVISION

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS . . . . . Site . . . . . Location . . . . .
M00681 000261 DATA 01F166S920066 0015	05/11/94 03/26/93 00166 02.2	QUANTALEX JACOBS	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG # 34689	ADMIN RECORD	WATER TPH SOUTHWEST DIVISION
M00681 000262 DATA 01F166S920066 0015	05/11/94 03/26/93 00166 02.2	QUANTALEX JACOBS	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CHLORINATED HERBICIDE LAB: CH2M HILL SDG # 34681	ADMIN RECORD	WATER HERBICIDE SOUTHWEST DIVISION
M00681 000263 DATA 01F166S920066 0015	05/11/94 03/26/93 00166 02.2	QUANTALEX JACOBS	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TCL METALS W\BORAON, MOLYBDENUM & CYANIDE LAB: CH2M HILL SDG # 34688	ADMIN RECORD	WATER CYANIDE SOUTHWEST DIVISION
M00681 000264 DATA 01F166S920066 0020	05/11/93 03/26/93 00166 02.2	QUANTALEX JACOBS	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG # 34681	ADMIN RECORD	WATER PESTICIDES PCB SOUTHWEST DIVISION
M00681 000265 DATA 01F166S920066 0012	05/11/94 03/26/93 00166 02.2	QUANTALEX JACOBS	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG # 34652	ADMIN RECORD	WATER TPH SOUTHWEST DIVISION
M00681 000266 DATA 01F166S920066 0012	05/11/94 03/26/93 00166 02.2	QUANTALEX JACOBS	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG # 34652	ADMIN RECORD	WATER TPH SOUTHWEST DIVISION
M00681 000267 DATA 01F166S920066 0028	05/11/94 03/26/93 00166 02.2	QUANTALEX JACOBS	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TCL METALS W\BORON, MLYBDENUM & CYANIDE LAB: CH2M HILL SDG # 34640	ADMIN RECORD	WATER CYANIDE SOUTHWEST DIVISION
M00681 000268 DATA 01F166S920066 0012	05/11/94 03/26/93 00166 02.2	QUANTALEX JACOBS	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG # 34728	ADMIN RECORD	WATER TPH SOUTHWEST DIVISION
M00681 000269 DATA 01F166S920066 0012	05/11/94 03/26/93 00166 02.2	QUANTALEX JACOBS	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG # 34728	ADMIN RECORD	WATER TPH SOUTHWEST DIVISION
M00681 000270 DATA 01F166S920066 0026	05/11/94 03/26/93 00166 02.2	QUANTALEX JACOBS	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CYANIDE LAB: CH2M HILL	ADMIN RECORD	WATER CYANIDE SOUTHWEST DIVISION

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . . FROM . SIGNATURE . . . TO . . . . . . TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. . . . . Site . . . . . .Location
M00681 000271 DATA 01F166S920066 0012	05/11/94 03/26/93 00166 02.2	QUANTALEX JACOBS	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL & WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG # 32904	ADMIN RECORD	WATER TPH	SOUTHWEST DIVISION
M00681 000272 DATA 01F166S920066 0012	05/11/94 03/26/93 00166 02.2	QUANTALEX JACOBS	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL & WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG # 32904	ADMIN RECORD	WATER TPH	SOUTHWEST DIVISION
M00681 000294 DATA 35262 0279	05/11/94 03/26/93 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA SELECTED ORGANIC AND INORGANIC PARAMETERS PESTICIDES, PCBs, TPH, HERBICIDES CAMP PENDLETON	ADMIN RECORD	PESTICIDES PCB TPH HERBICIDES	SOUTHWEST DIVISION
M00681 000295 DATA 35262 0279	05/11/93 03/26/93 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA SELECTED ORGANIC AND INORGANIC PARAMETERS PESTICIDES, PCBs, TPH, HERBICIDES CAMP PENDLETON	ADMIN RECORD	PESTICIDES IOG PCB TPH HERBICIDES	SOUTHWEST DIVISION
M00681 000303 DATA 01F166S920066 0025	05/11/94 03/26/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TCL METALS W\BORON, ILL MOLYBDENUM & CYANIDE LAB: CH2M HILL SDG# 34118	ADMIN RECORD	WATER CYANIDE	
M00681 000304 DATA 01F166S920066 0019	05/11/94 03/26/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 34117	ADMIN RECORD	WATER PESTICIDES PCB	
M00681 000305 DATA 01F166S920066 0019	05/11/94 03/26/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 34365	ADMIN RECORD	WATER TPH	
M00681 000306 DATA 01F166S920066 0012	05/11/94 03/26/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 34365	ADMIN RECORD	WATER TPH	
M00681 000307 DATA 01F166920066 0013	05/11/94 03/26/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 34563	ADMIN RECORD	WATER TPH	
M00681 000308 DATA 01F166S920066 0013	05/11/94 03/26/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 34563	ADMIN RECORD	WATER TPH	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . . FROM . SIGNATURE . . . TO . . . . . . TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. . . . . Site . . . . . .Location
M00681 000309 DATA 01F166S920066 0025	05/11/94 03/26/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TCL METALS W\BORON, MOLYBDENUM & CYANIDE LAB: CH2M HILL SDG# 34365	ADMIN RECORD	WATER CYANIDE	
M00681 000310 DATA 01F166S920066 0026	05/11/94 03/26/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TCL METALS W\BORON, MOLYBDENUM & CYANIDE LAB: CH2M HILL SDG# 342966	ADMIN RECORD	WATER CYANIDE	
M00681 000311 DATA 01F166S920066 0012	05/11/94 03/26/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 34376	ADMIN RECORD	WATER TPH	
M00681 000312 DATA 01F166S920066 0012	05/11/93 03/26/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 34583	ADMIN RECORD	WATER TPH	
M00681 000313 DATA 01F166S920066 0013	05/11/94 03/26/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 34376	ADMIN RECORD	WATER TPH	
M00681 000314 DATA 01F166S920066 0012	05/11/94 03/26/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 34583	ADMIN RECORD	WATER TPH	
M00681 001256 DATA 0013	05/27/94 03/27/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON DIOXION RFW# 9303L019	ADMIN RECORD	DATA	
M00681 000301 DATA 000000000000000 0378	05/11/94 03/29/93 00166 02.2	WESTON MANAGERS ROY F. WESTON IT CORPORATION	LABORATORY REPORT FOR IT CORP. CLP\INORGANICS & NON-CLP INORGANICS ANALYSIS SDG# W2700 RFW# 9302S205, 9302S215, 9303S237, 9303S245 MCB CAMP PENDLETON	ADMIN RECORD	IOG	SOUTHWEST DIVISION
M00681 002430 DATA 0025	07/22/94 03/29/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TCL METALS WITH BORON, CYANIDE, AND MOLYBDENUM SDG: 35491	ADMIN RECORD	WATER METALS CYANIDE	
M00681 002433 DATA 0030	07/22/94 03/30/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TCL METALS WITH BORON, CYANIDE, ANDMOLYBDENUM SDG: 35502	ADMIN RECORD	WATER METALS CYANIDE	

UIC No. / DOCUMENT . TYPE. . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO. . . / .DOC . DATE / CTO . NO . . / EPA . CAT#	PRC . DATE	FROM . . . . . / FROM . SIGNATURE . . . . / TO . . . . . / TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . .Location
M00681 DATA 000000000000000 0012	002338	07/21/94 03/31/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH-GASOLINE SDG: 35518	ADMIN RECORD	WATER FUEL	
M00681 DATA 0030	002422	07/22/94 03/31/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TCL METALS WITH BORON, CYANIDE, AND MOLYBDENUM SDG: 35518	ADMIN RECORD	WATER METALS CYANIDE	
M00681 DATA 0025	002426	07/22/94 03/31/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TCL METALS WITH BORON, CYANIDE, AND MOLYBDENUM SDG: 35531	ADMIN RECORD	WATER METALS CYANIDE	
M00681 DATA 0029	002435	07/22/94 03/31/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TCL METALS WITH BORON, CYANIDE, AND MOLYBDNUM SDG: 35520	ADMIN RECORD	WATER METALS CYANIDE	
M00681 DATA 000000000000000 0010	002450	07/22/94 03/31/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: GENERAL CHEMISTRY SDG: 35520	ADMIN RECORD	WATER	SOUTHWEST DIVISION
M00681 DATA 000000000000000 0010	002451	07/22/94 03/31/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: GENERAL CHEMISTRY SDG: 35518	ADMIN RECORD	WATER	SOUTHERN DIVISION
M00681 DATA 000000000000000 0010	002454	07/22/94 03/31/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: GENERAL CHEMISTRY SDG: 35531	ADMIN RECORD	WATER	SOUTHERN DIVISION
M00681 DATA 000000000000000 0010	002339	07/21/94 04/01/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH-GASOLINE SDG: 35533	ADMIN RECORD	WATER FUEL	
M00681 DATA 0025	002427	07/22/94 04/01/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TCL METALS WITH BORON, CYANIDE, AND MOLYBDENUM SDG: 35533	ADMIN RECORD	WATER CYANIDE METALS	
M00681 DATA 000000000000000 0015	002453	07/22/94 04/01/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: GENERAL CHEMISTRY SDG: 35533	ADMIN RECORD	WATER	SOUTHWEST DIVISION

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE. . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO. . . / .DOC . DATE / CTO . NO . . / EPA . CAT#	PRC . DATE	FROM . . . . . / FROM . SIGNATURE . . . . / TO . . . . . / TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . .Location
M00681 DATA 0027	002425	07/22/94 04/02/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TCL METALS WITH BORON, CYANIDE, AND MOLYBDENUM SDG: 35539	ADMIN RECORD	WATER METALS CYANIDE	
M00681 DATA 0025	002432	07/22/94 04/02/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TCL METALS WITH BORON, CYANIDE, AND MOLYBDENUM SDG: 35540	ADMIN RECORD	WATER METALS CYANIDE	
M00681 DATA 000000000000000 0013	002452	06/22/94 04/02/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: GENERAL CHEMISTRY SDG: 35539	ADMIN RECORD	WATER	SOUTHWEST DIVISION
M00681 DATA 000000000000000 0013	002460	07/22/94 04/02/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: GENERAL CHEMISTRY SDG: 35540	ADMIN RECORD	WATER	SOUTHWEST DIVISION
M00681 DATA 0289	000954	05/18/94 04/05/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP/GC/MS VOLATILE ANALYSIS SDG# W2714 RFW# 9303S312, 9303S321	ADMIN RECORD	VOLATILES	
M00681 DATA 35268 0351	001128	05/25/94 04/05/93 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARX	ANALYTICAL REPORT FOR MCB CAMP PENDLETON INORGANIC METALS	ADMIN RECORD	IOG METALS	
M00681 DATA 000000000000000 0015	002373	07/21/94 04/05/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: CHLORINATED HERBICIDES SDG: 35548	ADMIN RECORD	WATER HERBICIDE	
M00681 DATA 000000000000000 0010	002376	07/21/94 04/05/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: PESTICIDES/PCBs SDG: 35549	ADMIN RECORD	WATER PESTICIDES PCB	
M00681 DATA 000000000000000 0018	002384	07/21/94 04/05/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: VOLATILES SDG: 35549	ADMIN RECORD	WATER VOLATILES	
M00681 DATA 000000000000000 0010	002389	07/21/94 04/05/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: CHLORINATED HERBICIDES SDG: 35549	ADMIN RECORD	WATER HERBICIDE	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE. . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO. . . / EPA . CAT#	PRC . DATE / .DOC . DATE / CTO . NO . .	FROM . . . . . / FROM . SIGNATURE . . . . / TO . . . . . / TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . .Location
M00681 DATA 0010	002401	07/22/94 04/05/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH-GASOLINE SDG: 35548	ADMIN RECORD	WATER FUEL	
M00681 DATA 0012	002405	07/22/94 04/05/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH-DIESEL SDG: 35549	ADMIN RECORD	WATER FUEL	
M00681 DATA 0022	002416	07/22/94 04/05/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: SEMIVOLATILES SDG: 35548	ADMIN RECORD	WATER SEMIVOLATILES	
M00681 DATA 0015	002420	07/22/94 04/05/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: SEMIVOLATILES SDG: 35549	ADMIN RECORD	WATER SEMIVOLATILES	
M00681 DATA 0025	002429	07/22/94 04/05/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TCL METALS WITH BORON, CYANIDE, AND MOLLYBDENUM SDG: 35548	ADMIN RECORD	WATER METALS CYANIDE	
M00681 DATA 0019	002437	07/22/94 04/05/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: VOLATILES SDG: 35548	ADMIN RECORD	WATER VOLATILES	
M00681 DATA 000000000000000 0010	002449	07/22/94 04/05/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: GENERAL CHEMISTRY SDG: 35549	ADMIN RECORD	WATER	SOUTHWEST DIVISION
M00681 DATA 000000000000000 0010	002457	07/22/94 04/05/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: GENERAL CHEMISTRY SDG: 35548	ADMIN RECORD	WATER	SOUTHWEST DIVISION
M00681 DATA 000000000000000 0010	002463	07/22/94 04/05/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH-DIESEL SDG: 35548	ADMIN RECORD	WATER FUEL	SOUTHWEST DIVISION
M00681 DATA 0010	002467	07/22/94 04/05/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH-GASOLINE SDG: 35548	ADMIN RECORD	WATER FUEL	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE. . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO. . . /	PRC . DATE / .DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . . / TO . . . . . / TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . .Location
M00681 DATA 0012	002472	07/22/94 04/05/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH-GASOLINE SDG: 35549	ADMIN RECORD	WATER FUEL	
M00681 DATA 0559	001252	05/27/94 04/06/93 166 02.2	WESTON MANGAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP GCMS SEMIVOLATILES ANALYSIS SDG# W2714 RFW# 9303S312, 9303S321	ADMIN RECORD	SEMIVOLATILES	
M00681 DATA 35352 0219	000979	05/18/94 04/07/93 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH, METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES TFH METALS	
M00681 DATA 35337 0325	000981	05/18/94 04/07/93 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH, METALS, PESTICIDES, PCB HERBICIDES	ADMIN RECORD	VOLATILES SEMIVOLATILES TFH METALS PESTICIDES PCB HERBICIDES	
M00681 DATA 35326 0387	001133	05/25/94 04/07/93 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH, METALS, PESTICIDES, PCB, HERBICIDES	ADMIN RECORD	VOLATILES SEMIVOLATILES TFH METALS PESTICIDES PCB HERBICIDE	
M00681 DATA 000000000000000 0013	002370	07/21/94 04/07/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: CHLORINATED HERBICIDES SDG: 35565	ADMIN RECORD	WATER HERBICIDE	
M00681 DATA 000000000000000 0015	002372	07/21/94 04/07/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: CHLORINATED HERBICIDES SDG: 35569	ADMIN RECORD	WATER HERBICIDE	
M00681 DATA 000000000000000 0020	002375	07/21/94 04/07/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: PESTICIDES/PCBs SDG: 35565	ADMIN RECORD	WATER PESTICIDEES PCB	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE. . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO. . . / .DOC . DATE / CTO . NO . . / EPA . CAT#	PRC . DATE	FROM . . . . . / FROM . SIGNATURE . . . . / TO . . . . . / TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . .Location
M00681 DATA 00000000000000 0020	002379	07/21/94 04/07/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: VOLATILES SDG: 35565	ADMIN RECORD	WATER VOLATILES	
M00681 DATA 00000000000000 0013	002380	07/21/94 04/07/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: VOLATILES SDG: 35569	ADMIN RECORD	WATER VOLATILES	
M00681 DATA 0013	002403	07/22/94 04/07/93 166 02.2	CH2M HILL MCB CAM PENDLETON	MATRIX: WATER PARAMETERS: TPH-DIESEL SDG: 35569	ADMIN RECORD	WATER FUEL	
M00681 DATA 0010	002409	07/22/94 04/07/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH-DIESEL SDG: 35565	ADMIN RECORD	WATER FUEL	
M00681 DATA 0025	002413	07/22/94 04/07/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: SEMIVOLATILES SDG: 35565	ADMIN RECORD	WATER SEMIVOLATILES	
M00681 DATA 0020	002415	07/22/94 04/07/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: SEMIVOLATILES SDG: 35569	ADMIN RECORD	WATER SEMIVOLATILES	
M00681 DATA 0025	002423	07/22/94 04/07/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TCL METALS WITH BORON, CYANIDE, AND MOLYBDENUM SDG: 35569	ADMIN RECORD	WATER METALS CYANIDE	
M00681 DATA 00000000000000 0013	002448	07/22/94 04/07/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: GENERAL CHEMISTRY SDG: 35565	ADMIN RECORD	WATER	SOUTHWEST DIVISION
M00681 DATA 000000000000000 0013	002461	07/22/94 04/07/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: GENERAL CHEMISTRY SDG: 35569	ADMIN RECORD	WATER	SOUTHWEST DIVISION
M00681 DATA 0010	002470	07/22/94 04/07/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH-GASOLINE SDG: 35569	ADMIN RECORD	WATER FUEL	

UIC No. / DOCUMENT . TYPE. . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO. . . / .DOC . DATE / CTO . NO . . / EPA . CAT#	PRC . DATE	FROM . . . . . / FROM . SIGNATURE . . . . / TO . . . . . / TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . .Location
M00681 DATA 0010	002473	07/22/94 04/07/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH-GASOLINE SDG: 35565	ADMIN RECORD	WATER FUEL	
M00681 DATA 00000000000000 0020	002368	07/21/94 04/08/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: CHLORINATED HERBICIDES SDG: 35576	ADMIN RECORD	WATER HERBICIDE	
M00681 DATA 000000000000000 0013	002377	07/21/94 04/08/93 00166 02.2	CH2M HILL MCB CAM PENDLETON	MATRIX: WATER PARAMETERS: PESTICIDES/PCBs SDG: 35576	ADMIN RECORD	WATER PESTICIDES PCB	
M00681 DATA 0032	002417	07/22/94 04/08/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: SEMIVOLATILES SDG: 35576	ADMIN RECORD	WATER SEMIVOLATILES	
M00681 DATA 0035	002428	07/22/94 04/08/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TCL METALS WITH BORON, CYANIDE, AND MOLYBDENUM SDG: 35576	ADMIN RECORD	WATER METALS CYANIDE	
M00681 DATA 0020	002436	07/22/94 04/08/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: VOLATILES SDG: 35520	ADMIN RECORD	WATER VOLATILES	
M00681 DATA 000000000000000 0015	002458	07/22/94 04/08/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: GENERAL CHEMISTRY SDG: 35576	ADMIN RECORD	WATER	SOUTHWEST DIVISION
M00681 DATA 0010	002471	07/22/94 04/08/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH-GASOLINE SDG: 35576	ADMIN RECORD	WATER FUEL	
M00681 DATA 000000000000000 0015	002371	07/21/94 04/09/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: CHLORINATED HERBICIDES SDG: 35583	ADMIN RECORD	WATER HERBICIDES	
M00681 DATA 000000000000000 0018	002378	07/21/94 04/09/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: PESTICIDES/PCBs SDG: 35583	ADMIN RECORD	WATER PESTICIDES PCB	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE / CONTR/GUID . . NO / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO / EPA . CAT#	FROM / FROM . SIGNATURE / TO / TO . SIGNATURE	SUBJECT	CLASSIFICATION	KEY WORDS	Site / Location
M00681 DATA 000000000000000 0020	002382	07/21/94 04/09/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: VOLATILES SDG: 35583	ADMIN RECORD	WATER VOLATILES	
M00681 DATA 0010	002410	07/22/94 04/09/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH-DIESEL SDG: 35583	ADMIN RECORD	WATER FUEL	
M00681 DATA 0025	002419	07/22/94 04/09/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: SEMIVOLATILES SDG: 35583	ADMIN RECORD	WATER SEMIVOLATILES	
M00681 DATA 000000000000000 0010	002447	07/22/94 04/09/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: GENERAL CHEMISTRY SDG: 35583	ADMIN RECORD	WATER	SOUTHWEST DIVISION
M00681 DATA 0012	002465	07/22/94 04/09/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH-GASOLINE SDG: 35583	ADMIN RECORD	WATER FUEL	
M00681 DATA 2020	002478	07/22/94 04/09/93 02.2	ENVIRON & SCI ENG. MCB CAMP PENDLETON	ESE FIELD GROUP SAMPLES. CASE: NACPW8D1-4	ADMIN RECORD	QC GC/MS VOLATILES SEMIVOLATILES	
M00681 DATA 35335 0281	001135	05/25/94 04/12/93 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON METALS	ADMIN RECORD	METALS	
M00681 DATA 0100	001286	05/27/94 04/12/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON VOLATILE PURGEABLE PETROLEUM HYDROCARBONS ANALYSIS SDG# W2763 RFW# 9304S448	ADMIN RECORD	VOLATILES	
M00681 DATA 000000000000000 0013	002369	07/21/94 04/13/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: CHLORINATED HERBICIDES SDG: 35601	ADMIN RECORD	WATER HERBICIDE	
M00681 DATA 0013	002407	07/22/94 04/13/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH-DIESEL SDG: 35601	ADMIN RECORD	WATER FUEL	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE / CONTR/GUID . . NO / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO / EPA . CAT#	FROM / FROM . SIGNATURE / TO / TO . SIGNATURE	SUBJECT	CLASSIFICATION	KEY WORDS	Site / Location
M00681 DATA 000000000000000 0013	002456	07/2294 04/13/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: GENERAL CHEMISTRY SDG: 35601	ADMIN RECORD	WATER	SOUTHWEST DIVISION
M00681 DATA 0013	002474	07/22/94 04/13/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH-GASOLINE SDG: 35601	ADMIN RECORD	WATER FUEL	
M00681 DATA 35377 0332	001134	05/25/94 04/14/93 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH, METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES TFH METALS	
M00681 DATA 000000000000000 0027	002381	07/21/94 04/14/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: VOLATILES SDG: 35623	ADMIN RECORD	WATER VOLATILES	
M00681 DATA 000000000000000 0020	002387	07/21/94 04/14/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: CHLORINATED HERBICIDES SDG: 35623	ADMIN RECORD	WATER HERBICIDE	
M00681 DATA 0030	002418	07/22/94 04/14/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: SEMIVOLATILES SDG: 35623	ADMIN RECORD	WATER SEMIVOLATILES	
M00681 DATA 000000000000000 0010	002462	07/22/94 04/14/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH-DIESEL SDG: 35623	ADMIN RECORD	WATER FUEL	SOUTHWEST DIVISION
M00681 DATA 0010	002468	07/22/94 04/14/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MARTIX: WATER PARAMETERS: TPH-GASOLINE SDG: 35623	ADMIN RECORD	WATER FUEL	
M00681 DATA 0205	000926	05/18/94 04/15/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP/GC/MS VOLATILE ANALYSIS SDG# W2763 RFW# 9304S448 9304S462	ADMIN RECORD	VOLATILES	
M00681 DATA 35441 0184	001131	05/25/94 04/15/93 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH, METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES TFH	

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location
M00681 DATA 35427 0196	001132	05/25/94 04/15/93 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH, METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES TFH METALS	
M00681 DATA 35379 0224	001136	05/25/94 04/15/93 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH, METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES TFH METALS	
M00681 DATA 35407 0173	001138	05/25/94 04/15/93 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH, METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES TFH METALS	
M00681 DATA 0048	001287	05/27/94 04/15/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON VOLATILES RFW# 9303S383	ADMIN RECORD	VOLATILES	
M00681 DATA 0071	001288	05/27/94 04/15/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON VOLATILES RFW# 9303S390	ADMIN RECORD	VOLATILES	
M00681 DATA 000000000000000 0020	002383	07/21/94 04/15/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: VOLATILES SDG: 35633	ADMIN RECORD	WATER VOLATILES	
M00681 DATA 000000000000000 0018	002388	07/21/94 04/15/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: CHLORINATED HERBICIDES SDG: 35633	ADMIN RECORD	WATER HERBICIDE	
M00681 0010	002402	07/22/94 04/15/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH-DIESEL SDG: 35633	ADMIN RECORD	WATER FUEL	
M00681 DATA 0023	002412	07/22/94 04/15/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: SEMIVOLATILES SDG: 35633	ADMIN RECORD	WATER SEMIVOLATILES	
M00681 DATA 0029	002431	07/22/94 04/15/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TLC METALS WITH BORON, CYANIDE, AND MOLYBDENUM SDG: 35633	ADMIN RECORD	WATER METALS CYANIDE	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location
M00681 DATA 000000000000000 0010	002455	07/22/94 04/15/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: GENERAL CHEMISTRY SDG: 35633	ADMIN RECORD	WATER	SOUTHWEST DIVISION
M00681 DATA 0010	002469	07/22/94 04/15/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH-GASOLINE SDG: 35633	ADMIN RECORD	WATER FUEL	
M00681 DATA 000000000000000 0018	002385	07/21/94 04/16/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: VOLATILES SDG: 35637	ADMIN RECORD	WATER VOLATILES	
M00681 DATA 000000000000000 0016	002386	07/21/94 04/16/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: CHLORINATED HERBICIDES SDG: 35637	ADMIN RECORD	WATER HERBICIDE	
M00681 DATA 0013	002408	07/22/94 04/16/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH-DIESEL SDG: 35637	ADMIN RECORD	WATER FUEL	
M00681 DATA 0015	002414	07/22/94 04/16/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: SEMIVOLATILES SDG: 35637	ADMIN RECORD	WATER SEMIVOLATILES	
M00681 DATA 000000000000000 0010	002459	07/22/94 04/16/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: GENERAL CHEMISTRY SDG: 35637	ADMIN RECORD	WATER	SOUTHWEST DIVISION
M00681 DATA 0008	002466	07/22/94 04/16/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH-GASOLINE SDG: 35637	ADMIN RECORD	WATER FUEL	
M00681 DATA 35091 0067	000976	05/18/94 04/19/93 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON DIESEL FUEL	ADMIN RECORD	DIESEL FUEL	
M00681 DATA 000000000000000 0005	002285	07/20/94 04/19/93 00000 02.2	ROY F. WESTON MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: CYANIDE SDG: S1284	ADMIN RECORD	WATER CYANIDE	SOUTHWEST DIVISION

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location
M00681 DATA 35235 0074	000977	05/18/94 04/20/93 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON PESTICIDES PCBs	ADMIN RECORD	PESTICIDES PCB	
M00681 DATA 35223 0064	000978	05/18/94 04/20/93 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON PESTICIDES PCBs	ADMIN RECORD	PESTICIDES PCB	
M00681 DATA 0068	002235	07/19/94 04/20/93 166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR CTO #166, LRD LAB REFERENCE NO. 35218	ADMIN RECORD	DATA LAB	
M00681 DATA 0041	000958	05/18/94 04/21/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON VOA RFW# 9303S407	ADMIN RECORD	VOA	
M00681 DATA 35458 0719	000971	05/18/94 04/21/93 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON TFH	ADMIN RECORD	TFH	
M00681 DATA 35471 0210	000973	05/18/94 04/21/93 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON TFH, VOLATILES, SEMIVOLATILES METALS	ADMIN RECORD	TFH VOLATILES SEMIVOLATILES METALS	
M00681 DATA 35502 0240	000974	05/18/94 04/21/93 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON TFH, VOLATILES, SEMIVOLATILES METALS	ADMIN RECORD	TFH VOLATILES SEMIVOLATILES METALS	
M00681 DATA 35479 0245	000980	05/18/94 04/21/93 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH, METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES TFH METALS	
M00681 DATA 35470 0623	000991	05/18/94 04/21/93 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES	ADMIN RECORD	VOLATILES	
M00681 DATA 35491 0282	000992	05/18/94 04/21/93 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH, METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES TFH METALS	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location
M00681 DATA 35532 0244	000970	05/18/94 04/23/93 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, PESTICIDES, PCB, TFH METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES PESTICIDES PCB TFH METALS	
M00681 DATA 35520 0315	000987	05/18/94 04/23/93 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, PESTICIDES, PCB, TFH, METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES PESTICIDES PCB TFH METALS	
M00681 DATA 35531 0754	000989	05/18/94 04/23/93 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON PESTICIDES, PCB, SEMIVOLATILES	ADMIN RECORD	PESTICIDES PCB SEMIVOLATILES	
M00681 DATA 0421	002479	07/22/94 04/23/93 02.2	ENVIRON & SCI ENG. MCB CAMP PENDLETON	ESE FIELD GROUP SAMPLES. CASE: NACPW5E*3-34	ADMIN RECORD	QC GC/MS METALS TPF PESTICIDES PCB	
M00681 DATA 35518 0270	000983	05/18/94 04/26/93 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH, METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES TFH METALS	
M00681 DATA 35533 0774	000984	05/18/94 04/26/93 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON GC/MS SEMIVOLATILES	ADMIN RECORD	SEMIVOLATILES	
M00681 DATA 35540 0241	000985	05/18/94 04/26/93 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, PESTICIDES, PCB, TFH, METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES PESTICIDES PCB TFH METALS	
M00681 DATA 0145	000730	05/16/94 04/27/93 00166 02.2	 MCB CAMP PENDLETON	LABORATORY REPORT FOR MCB CAMP PENDLETON	ADMIN RECORD	DATA	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . . . / TO . . . . . / TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. . . . . Site . . . . . .Location . . . . .
M00681 DATA 35539 0815	000731	05/16/94 04/28/93 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLTON ORGANIC AND INORGANIC PARAMETERS	ADMIN RECORD	10G	
M00681 DATA 0091	000860	05/18/94 04/28/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP/GC/MS VOLATILE ANALYSIS SDG# W2763 RFW# 9304S569	ADMIN RECORD	VOLATILE	
M00681 DATA 1073	000719	05/16/94 04/29/93 00166 02.2	MCB CAMP PENDLETON	ANALYSIS DATA FOR MCB CAMP PENDLETON	ADMIN RECORD	PESTICIDES PCB VOC	
M00681 DATA 1018	000720	05/16/94 04/29/93 00166 02.2	MCB CAMP PENDLETON	ANALYSIS DATA FOR MCB CAMP PENDLETON	ADMIN RECORD	PESTICIDES PCB VOC	
M00681 DATA 35091 0125	000732	05/16/94 04/29/93 00166 02.2	CH2M HILL PEGGY A. NORTON CH2M HILL EARL HILL	ANALYTICAL DATA FOR MCB CAMP PENDLTON PESTICIDES/PCBs	ADMIN RECORD	PESTICIDES PCB	
M00681 DATA 01F166S920066 0015	000520	05/12/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: TPH GASOLINE TPH DIESEL LAB: CH2M HILL SDG# G28558	ADMIN RECORD		
M00681 DATA 01F166S920066 0037	000521	05/12/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: SEMIVOLATILES CASE# NACPBI LAB: ESE SDG# G29064,G28950,G28341,G28342	ADMIN RECORD	WATER SOLVENTS	
M00681 DATA 01F166S920066 0021	00052	05/12/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE TPH DIESEL CASE# NACPB1 LAB: ESE SDG# G28572,G28726,G29172,G29354	ADMIN RECORD	WATER TPH	
M00681 DATA 01F166S920066 0025	000523	05/12/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON G28371 MATRIX: WATER PARAMETER: CHLORINATED HERBICIDES CASE# NACPB1 LAB: SDG# G29116,G28115,G28458,G28994	ADMIN RECORD	WATER HERBICIDE	
M00681 DATA 01F166S920066 0062	000524	05/12/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON G29380 MATRIX: WATER PARAMETER: TRIAZINE, PESTICIDES CASE# NACPB1 LAB: ESE SDG# G29289, G29015,G28626,G27029	ADMIN RECORD	WATER PESTICIDES	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . . FROM . SIGNATURE . . . . . . TO . . . . . . TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS . . . . . Site . . . . . .Location . . . . .
M00681 000525 DATA 01F166S920066 0096	05/12/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON G29380 MATRIX: SOIL PARAMETER: PESTICIDES/PCBs CASE# NACPB1 LAB: ESE SDG# G29292,G28783,G29104	ADMIN RECORD	PESTICIIDES PCB
M00681 000526 DATA 01F166S920066 0026	05/12/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON G29380 MATRIX: SOIL PARAMETER: SEMIVOLATILES CASE# NACPB1 LAB: ESE SDG# G26992	ADMIN RECORD	SOLVENTS
M00681 000530 DATA 01F166S920066 0106	05/12/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON G29380 MATRIX: SOIL PARAMETER: TCL METALS W/MOLYBDENUM LAB: ESE SDG# G28859 (SEE ADDL INFO)	ADMIN RECORD	METALS
M00681 000531 DATA 01F166S92066 0045	05/12/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON G29380 MATRIX: WATER PARAMETER: TCL METALS W/MOLYBDENUM LAB: ESE SDG# 228728 (SEE DOCUMENT FOR MORE SDG#'S)	ADMIN RECORD	WATER METALS
M00681 000532 DATA 01F166S920066 0024	05/12/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON G29380 MATRIX: SOIL PARAMETER: PESTICIDES/PCBs LAB: ESE SDG# G29554 & G28757	ADMIN RECORD	PESTICIDES PCB
M00681 000533 DATA 01F166S920066 0033	05/12/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON G29380 MATRIX: SOIL PARAMETER: PESTICIDES, TRIAZINE LAB: ESE SDG# G29565 & G28910	ADMIN RECORD	PESTICICIDES
M00681 000620 DATA 0379	05/13/94 04/30/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP/GC/SEMIVOLATILE ANALYSIS SDG# W2763 RFW# 9304S448, 9304S462, 9304S569	ADMIN RECORD	SOLVENTS
M00681 000736 DATA 01F166S920066 0014	05/16/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: TPH GASLINE TPH DIESEL LAB: ESE SDG# G29107	ADMIN RECORD	TPH
M00681 000737 DATA 01F166S920066 0020	05/16/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: VOLATILES LAB: ESE SDG# G28751	ADMIN RECORD	VOLATILES
M00681 000738 DATA 01F166S920066 0024	05/16/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: SEMIVOLATILES LAB: ESE SDG# G28609	ADMIN RECORD	SEMIVOLATIL ES

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . . FROM . SIGNATURE . . . . . . TO . . . . . . TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS . . . . . Site . . . . . .Location . . . . .
M00681 000739 DATA 01F166S920066 0015	05/16/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CARBAMATE/UREA PESTICIDES LAB: ESE SDG# G32675	ADMIN RECORD	PESTICIIDES WATER
M00681 000740 DATA 01F166S920066 0027	05/16/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: TRIAZINE, PESTICIDES LAB: ESE SDG# G32752	ADMIN RECORD	WATER PESTICIDES
M00681 000741 DATA 01F166S920066 0017	05/16/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CHLORINATED HERBICIDES LAB: ESE SDG# G33069	ADMIN RECORD	WATER HERBICIDE
M00681 000742 DATA 01F166S92066 0026	05/16/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CARBAMATE/UREA PESTICIDES LAB: ESE SDG# G28540, G29189	ADMIN RECORD	WATER PESTICIDES
M00681 000743 DATA 01F166S920066 0022	05/16/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: CHLORINATED HERBICIDES LAB: ESE SDG# G28841, G29573	ADMIN RECORD	HERBICIDE
M00681 000744 DATA 01F166S920066 0050	05/16/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CHLORINATED HERBICIDES LAB: ESE SDG# G31087, G30577, G30271	ADMIN RECORD	WATER HERBICIDE
M00681 000745 DATA 01F166S920066 0082	05/16/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: SEMIVOLATILES LAB: ESE SDG# G30674	ADMIN RECORD	WATER
M00681 000746 DATA 01F166S920066 0041	05/16/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TCL METALS W/BORON CYANIDE & MOLYBDENUM LAB: ESE SDG# G30457, G30624, G30428	ADMIN RECORD	WATER METALS CYANIDE
M00681 000747 DATA 01F166S920066 0066	05/16/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: TCL METALS W/MOLYBDENUM LAB: ESE SDG# G29147, G28759, G29521, ETC.	ADMIN RECORD	METALS
M00681 000748 DATA 01F166S920066 0014	05/16/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: GENERAL CHEMISTRY LAB: ESE SDG# 34681	ADMIN RECORD	WATER

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . . FROM . SIGNATURE . . . . . . TO . . . . . . TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. . . . . Site . . . . . .Location . . . . .
M00681 000749 DATA 01F166S920066 0019	05/16/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: GENERAL CHEMISTRY LAB: ESE SDG# G30417, ETC.	ADMIN RECORD	WATER	
M00681 000750 DATA 01F166S920066 0016	05/16/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: GENERAL CHEMISTRY LAB: ESE SDG# G33072, G32534, G32782, G32965	ADMIN RECORD	WATER	
M00681 000751 DATA 01F166S920066 0023	05/16/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CHLORINATED HERBICIDES LAB: ESE SDG# G33071	ADMIN RECORD	WATER HERBICIDE	
M00681 000752 DATA 01F166S92066 0040	05/16/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: ESE SDG# G32437, G32487	ADMIN RECORD	WATER VOLATILES	
M00681 000753 DATA 01F166S920066 0072	05/16/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TCL METALS W/BORON, CYNAIDE MOLYBDENUM LAB: ESE SDG# G33335, G33133, ETC.	ADMIN RECORD	WATER METALS CYNAIDE	
M00681 000754 DATA 01F166S920066 0026	05/16/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TCL METALS W/BORON, CYNAIDE MOLYBDENUM LAB: CH2MHILL SDG# 33643	ADMIN RECORD	WATER METALS CYNAIDE	
M00681 000755 DATA 01F166S920066 0057	05/16/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: SEMIVOLATILES LAB: ESE SDG# G30479, G30706	ADMIN RECORD	WATER SEMIVOLATIL ES	
M00681 000756 DATA 01F166S920066 0084	05/17/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TCL METALS W/CYNAIDE MOLYBDENUM LAB: ESE SDG# G30306, etc.	ADMIN RECORD ADMIN RECORD	METALS CYNAIDE	
M00681 000757 DATA 01F166S920066 0040	05/17/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: ORGANOPHOSPHORUS PESTICIDES LAB: ESE SDG# G32924, G33527	ADMIN RECORD	PESTICIDES WATER	
M00681 000758 DATA 01F166S920066 0037	05/17/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: ORGANONITROGEN PESTICIDES LAB: ESE SDG# G32924, G33527	ADMIN RECORD	WATER PESTICIDES	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . . . / TO . . . . . / TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. . . . . Site . . . . . .Location . . . . .
M00681 DATA 01F166S920066 0031	000759	05/17/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: GENERAL CHEMISTRY LAB: ESE SDG# G30076, ETC.	ADMIN RECORD	WATER	
M00681 DATA 01F166S920066 0096	000760	05/17/94 04/30/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: CARBAMATE/UREA PESTICIDES LAB: ESE SDG# G26905, ETC.	ADMIN RECORD	PESTICIDES	
M00681 DATA 0174	000725	05/16/94 05/04/93 00166 02.2	WESTON MANAGERS MCB CAMP PENDLETON	LOBORATORY REPORT FOR MCB CAMP PENDLTON TOTAL EXTRACTABLE HYDROCARBONS ANALYSIS SDG# W2763 RFW# 9304S448	ADMIN RECORD	TEH	
M00681 DATA 35549 0225	000733	05/16/94 05/04/93 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORTATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLTON ORGANIC AND INORGANIC PARAMETERS	ADMIN RECORD	IOG PESTICIDES PCB TFH HERBICIDE METALS	
M00681 DATA 35583 0293	000615	05/13/94 05/05/93 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORTATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLTON METALS, PESTICIDES, PCB, TFH, HERBICIDES	ADMIN RECORD	METALS PESTICIDES PCB TFH HERBICIDE	
M00681 DATA 35601 0336	000616	05/13/94 05/05/93 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA MCB CAMP PENDLETON METALS, PESTICIDES, PCB, TFH, HERBICIDES	ADMIN RECORD	METALS PESTICIDES PCB TFH HERBICIDE	
M00681 DATA 35565 0333	000617	05/13/94 05/05/93 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA MCB CAMP PENDLETON METALS, PESTICIDES, PCB, TFH, HERBICIDES	ADMIN RECORD	METALS PESTICIDES PCB TFH HERBICIDE	
M00681 DATA 35576 0426	000618	05/13/94 05/05/93 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA MCB CAMP PENDLETON METALS, PESTICIDES, PCB, TFH, HERBICIDES	ADMIN RECORD	METALS PESTICIDES PCB TFH HERBICIDE	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . . FROM . SIGNATURE . . . . . . TO . . . . . . TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. . . . . Site . . . . . .Location . . . . .
M00681 000614 DATA 35558 0275	05/13/94 05/06/93 00166 02.2	CH2M HILL PEGGY A. NORTON CH2M HILL EARL BYRON	ANALYTICAL DATA MCB CAMP PENDLETON BIO ACCUMULATION METALS, INORGANICS	ADMIN RECORD	IOG METALS	
M00681 002340 DATA 000000000000000 0030	07/21/94 05/06/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TCL METALS WITH BORON, CYANIDE, AND MOLYBDENUM SDG: 35533	ADMIN RECORD	WATER METALS CYANIDE	
M00681 002344 DATA 000000000000000 0021	07/21/94 05/06/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: VOLATILES SDG: 35781	ADMIN RECORD	WATER VOLATILES	
M00681 002346 DATA 000000000000000 0025	07/21/94 05/06/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: SEMIVOLATILES CASE NUMBER: NACPW6D SDG: 35781	ADMIN RECORD	WATER SEMIVOLATILE S	
M00681 002362 DATA 000000000000000 0013	07/21/94 05/06/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH-DIESEL SDG: 35781	ADMIN RECORD	WATER FUEL	
M00681 002400 DATA 000000000000000 0013	07/22/94 05/06/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH-GASOLINE SDG: 35781	ADMIN RECORD	WATER FUEL	
M00681 002439 DATA 000000000000000 0015	07/22/94 05/06/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: GENERAL CHEMISTRY SDG: 35781	ADMIN RECORD	WATER	SOUTHWEST DIVISION
M00681 002445 DATA 000000000000000 0015	07/22/94 05/06/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: CHLORINATED HERBICIDES SDG: 35781	ADMIN RECORD	WATER HERBICIDE	SOUTHWEST DIVISION
M00681 002446 DATA 000000000000000 0020	07/22/94 05/06/93 00166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: PESTICIDES/PCBs SDG: 35781	ADMIN RECORD	WATER PESTICIDES PCB	SOUTHWEST DIVISION
M00681 000317 DATA 000000000000000 0353	05/11/94 05/07/93 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON PCBs/PESTICIDES VOLATILES, TFH GASOLINE AND DIESEL, HERBICIDES	ADMIN RECORD	PCB PESTICIDES VOC TFH HERBICIDES	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . Site . . . . . Location . . . . .
M00681 DATA 35623 0369	000318	05/11/94 05/07/93 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON PCBs\PESTICIDES VOLATILES, TFH GASOLINE AND DIESEL, HERBICIDES	ADMIN RECORD	PCB PESTICIDES VOC TFH HERBICIDES	
M00681 DATA 35637 0309	000319	05/11/94 05/07/93 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON PCBs\PESTICIDES VOLATILES, TFH GASOLINE AND DIESEL, HERBICIDES	ADMIN RECORD	PCB PESTICIDES VOC TFH HERBICIDES	
M00681 DATA 01F166S920066 0024	000534	05/12/94 05/07/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON G29380 MATRIX: WATER PARAMETER: SEMIVOLATILES LAB: CH2M HILL SDG# 35427	ADMIN RECORD	WATER SOLVENTS	
M00681 DATA 01F166S920066 0026	000535	05/12/94 05/07/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON G29380 MATRIX: WATER PARAMETER: SEMIVOLATILES LAB: CH2M HILL SDG# 35379	ADMIN RECORD	WATER SOLVENTS	
M00681 DATA 01F166S920066 0024	000536	05/12/94 05/07/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON G29380 MATRIX: WATER PARAMETER: SEMIVOLATILES LAB: CH2M HILL SDG# 35352	ADMIN RECORD	WATER SOLVENTS	
M00681 DATA 01F166S920066 0022	000537	05/12/94 05/07/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON G29380 MATRIX: WATER PARAMETER: SEMIVOLATILES LAB: CH2M HILL SDG# 35407	ADMIN RECORD	WATER SOLVENTS	
M00681 DATA 01F166S920066 0026	000623	05/13/94 05/07/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: SEMIVOLATILES LAB: CH2M HILL SDG# 35337	ADMIN RECORD	WATER SOLVENTS	
M00681 DATA 01F166S920066 0022	000624	05/13/94 05/07/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2M HILL SDG# 35379	ADMIN RECORD	WATER	
M00681 DATA 01F166S920066 0021	000625	05/13/94 05/07/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2M HILL SDG# 35337	ADMIN RECORD	WATER	

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . Site . . . . . Location . . . . .
M00681 DATA 01F166S920066 0019	000626	05/13/94 05/07/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2M HILL SDG# 35407	ADMIN RECORD	WATER	
M00681 DATA 01F166S920066 0020	000627	05/13/94 05/07/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2M HILL SDG# 35352	ADMIN RECORD	WATER	
M00681 DATA 0166	000322	05/11/94 05/10/93 00166 02.2	WESTION MANAGERS ROY F. WESTON IT CORPORATION	LABORATORY REPORT FOR IT CORP. MCB CAMP PENDLETON CLP\ORGANOCHLORINE PESTICIDES ANALYSIS SDG# W2763 RFW# 9304S569	ADMIN RECORD	PESTICIDES	
M00681 DATA 0331	000321	05/11/94 05/11/93 00166 02.2	WESTION MANAGERS ROY F. WESTON IT CORPORATION	LABORATORY REPORT FOR IT CORP. MCB CAMP PENDLETON CLP\INORGANIC METALS ANALYSIS SDG# W2763 RFW# 9304S448, 9304S569	ADMIN RECORD	IOG	
M00681 DATA 01F166S920066 0014	000420	05/11/94 05/14/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: GENERAL CHEMISTRY LAB: CH2M HILL SDG# 35377	ADMIN RECORD	WATER	
M00681 DATA 01F166S920066 0013	000421	05/11/94 05/14/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: GENERAL CHEMISTRY LAB: CH2M HILL SDG# 35352	ADMIN RECORD	WATER	
M00681 DATA 01F166S920066 0013	000422	05/11/94 05/14/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: GENERAL CHEMISTRY LAB: CH2M HILL SDG# 35337	ADMIN RECORD	WATER	
M00681 DATA 01F166S920066 0013	000423	05/11/94 05/14/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: GENERAL CHEMISTRY LAB: CH2M HILL SDG# 35326	ADMIN RECORD	WATER	
M00681 DATA 01F166S920066 0017	000424	05/11/94 05/14/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CHLORINATED HERBICIDES LAB: CH2M HILL SDG# 35326	ADMIN RECORD	WATER HERBICIDES	
M00681 DATA 01F166S920066 0019	000425	05/11/94 05/14/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CHLORINATED HERBICIDES LAB: CH2M HILL SDG# 35337	ADMIN RECORD	WATER HERBICIDES	

UIC No. DOC. NO. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . Site . . . . . Location . . . . .
M00681 000426 DATA 01F166S920066 0013	05/12/94 05/14/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2MHILL SDG# 35441	ADMIN RECORD	WATER TPH	
M00681 000427 DATA 01F166S920066 0013	05/12/94 05/14/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2MHILL SDG# 35441	ADMIN RECORD	WATER TPH	
M00681 000428 DATA 01F166S920066 0026	05/12/94 05/14/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: TCL METALS W\MOLYBDENUM LAB: CH2MHILL SDG# 35073	ADMIN RECORD	DATA	
M00681 000429 DATA 01F166S920066 0025	05/12/94 05/14/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TCL METALS W\MOLYBDENUM LAB: CH2MHILL SDG# 35078	ADMIN RECORD	WATER	
M00681 000430 DATA 01F166S920066 0032	05/12/94 05/14/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER:TCL METALS W\BORON MOLYBDENUM & CYANIDE LAB: CH2MHILL SDG# 34414	ADMIN RECORD	WATER CYANIDE	
M00681 000513 DATA 01F166S920066 0015	05/12/94 05/14/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: GENERAL CHEMISTRY LAB: CH2M HILL SDG# 35471	ADMIN RECORD	WATER	
M00681 000514 DATA 01F166S920066 0013	05/12/94 05/14/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: GENERAL CHEMISTRY LAB: CH2M HILL SDG# 35407	ADMIN RECORD	WATER	
M00681 000515 DATA 01F166S920066 0013	05/12/94 05/14/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: GENERAL CHEMISTRY LAB: CH2M HILL SDG# 35427	ADMIN RECORD	WATER	
M00681 000516 DATA 01F166S920066 0013	05/12/94 05/14/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: GENERAL CHEMISTRY LAB: CH2M HILL SDG# 35441	ADMIN RECORD	WATER	
M00681 000517 DATA 01F166S920066 0009	05/12/94 05/14/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: GENERAL CHEMISTRY LAB: CH2M HILL SDG# 35470	ADMIN RECORD	WATER	

UIC No. DOC. NO. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . Site . . . . . Location . . . . .
M00681 000518 DATA 01F166S920066 0013	05/12/94 05/14/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: GENERAL CHEMISTRY LAB: CH2M HILL SDG# 35379	ADMIN RECORD	WATER	
M00681 000519 DATA 01F166S920066 0013	05/12/94 05/14/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: GENERAL CHEMISTRY LAB: CH2M HILL SDG# 35479	ADMIN RECORD	WATER	
M00681 000527 DATA 01F166S920066 0014	05/12/94 05/14/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON G29380 MATRIX: WATER PARAMETER: GENERAL CHEMISTRY LAB: CH2M HILL SDG# 35502	ADMIN RECORD	WATER	
M00681 000528 DATA 01F166S920066 0013	05/12/94 05/14/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON G29380 MATRIX: WATER PARAMETER: GENERAL CHEMISTRY LAB: CH2M HILL SDG# 35491	ADMIN RECORD	WATER	
M00681 000529 DATA 01F166S920066 0013	05/12/94 05/14/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON G29380 MATRIX: WATER PARAMETER: GENERAL CHEMISTRY LAB: CH2M HILL SDG# 35458	ADMIN RECORD	WATER	
M00681 000486 DATA 01F166S920066 0010	05/12/94 05/17/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: CPL METALS & MOLYBDEUM LAB: ROY F. WESTON SDG# W2700	ADMIN RECORD	METALS	
M00681 000273 DATA 01F166S920066 0022	05/11/94 05/21/93 00166 02.2	QUANTALEX JACOBS	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: SEMIVOLATILES LAB: CH2M HILL SDG# 35539	ADMIN RECORD	WATER SOLVENTS	SOUTHWEST DIVISION
M00681 000274 DATA 01F166S920066 0017	05/11/94 05/21/93 00166 02.2	QUANTALEX JACOBS	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 35540	ADMIN RECORD	WATER PESTICIDES PCB	SOUTHWEST DIVISION
M00681 000275 DATA 01F166S920066 0022	05/11/94 05/21/93 00166 02.2	QUANTALEX JACOBS	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 35218	ADMIN RECORD	WATER PESTICIDES PCB	SOUTHWEST DIVISION
M00681 000276 DATA 01F166S920066 0020	05/11/94 05/21/93 00166 02.2	QUANTALEX JACOBS	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 35223	ADMIN RECORD	WATER PESTICIDES PCB	SOUTHWEST DIVISION

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . Site . . . . . Location . . . . .
M00681 DATA 01F166S920066 0022	000277	05/11/94 05/21/93 00166 02.2	QUANTALEX JACOBS	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 35235	ADMIN RECORD	WATER PESTICIDES PCB	SOUTHWEST DIVISION
M00681 DATA 01F166S920066 0020	000278	05/11/94 05/21/93 00166 02.2	QUANTALEX JACOBS	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 35251	ADMIN RECORD	WATER PESTICIDES PCB	SOUTHWEST DIVISION
M00681 DATA 01F166S920066 0018	000279	05/11/94 05/21/93 00166 02.2	QUANTALEX JACOBS	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 35520	ADMIN RECORD	WATER PESTICIDES PCB	SOUTHWEST DIVISION
M00681 DATA 01F166S920066 0016	000280	05/11/94 05/21/93 00166 02.2	QUANTALEX JACOBS	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 35078	ADMIN RECORD	WATER PESTICIDES PCB	SOUTHWEST DIVISION
M00681 DATA 01F166S920066 0016	000281	05/11/94 05/21/93 00166 02.2	QUANTALEX JACOBS	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 35533	ADMIN RECORD	WATER PESTICIDES PCB	SOUTHWEST DIVISION
M00681 DATA 01F166S920066 0016	000282	05/11/94 05/21/93 00166 02.2	QUANTALEX JACOBS	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 35531	ADMIN RECORD	WATER PESTICIDES PCB	SOUTHWEST DIVISION
M00681 DATA 01F166S920066 0017	000283	05/11/94 05/21/93 00166 02.2	QUANTALEX JACOBS	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 35539	ADMIN RECORD	WATER PESTICIDES PCB	SOUTHWEST DIVISION
M00681 DATA 01F166S920066 0023	000284	05/11/94 05/21/93 00166 02.2	QUANTALEX JACOBS	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: VOLATILES LAB: CH2M HILL SDG# 35091	ADMIN RECORD	VOC	SOUTHWEST DIVISION
M00681 DATA 01F166S920066 0020	000285	05/11/94 05/21/93 00166 02.2	QUANTALEX JACOBS	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 35073	ADMIN RECORD	PESTICIDES PCB	SOUTHWEST DIVISION
M00681 DATA 01F166S920066 0021	000286	05/11/94 05/21/93 00166 02.2	QUANTALEX JACOBS	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: PESTICIDES\PCBs LAB: CH2M HILL SDG# 35091	ADMIN RECORD	PESTICIDES PCB	SOUTHWEST DIVISION

UIC No. DOC. NO. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . Site . . . . . Location . . . . .
M00681 000287 DATA 01F166S920066 0023	05/11/94 05/21/93 00166 02.2	QUANTALEX JACOBS	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: CYANIDE LAB: CH2M HILL SDG# 33683	ADMIN RECORD	WATER CYANIDE	SOUTHWEST DIVISION
M00681 000288 DATA 01F166S920066 0013	05/11/94 05/21/93 00166 02.2	QUANTALEX JACOBS	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 35104	ADMIN RECORD	WATER TPH	SOUTHWEST DIVISION
M00681 000289 DATA 01F166S920066 0026	05/11/94 05/21/93 00166 02.2	QUANTALEX JACOBS	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER & SOIL PARAMETER: PESTICIDES\PCBs LAB: CH2MHILL SDG# 35104	ADMIN RECORD	WATER PESTICIDES PCB	SOUTHWEST DIVISION
M00681 000290 DATA 01F166S920066 0027	05/11/94 05/21/93 00166 02.2	QUANTALEX JACOBS	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: TCL METALS W\MOLYBDENUM LAB: CH2MHILL SDG# 35091	ADMIN RECORD	DATA METALS	SOUTHWEST DIVISION
M00681 000363 DATA 01F166S920066 0029	05/11/94 05/21/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: SEMIVOLATILES LAB: CH2M HILL SDG# 35502	ADMIN RECORD	WATER SOLVENTS	
M00681 000364 DATA 01F166S920066 0012	05/11/94 05/21/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 35379	ADMIN RECORD	WATER TPH	
M00681 000365 DATA 01F166S920066 0013	05/11/94 05/21/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 34681	ADMIN RECORD	WATER TPH	
M00681 000366 DATA 01F166S920066 0012	05/11/94 05/21/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 35520	ADMIN RECORD	WATER TPH	
M00681 000367 DATA 01F166S920066 0013	05/11/94 05/21/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 35531	ADMIN RECORD	WATER TPH	
M00681 000368 DATA 01F166S920066 0019	05/11/94 05/21/93 00166 02.2	QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: SOIL PARAMETER: VOLATILES LAB: CH2M HILL SDG# 35073	ADMIN RECORD	VOC	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	PRC . DATE FROM . . . . . / DOC . DATE FROM . SIGNATURE . . . . . / CTO . NO . . TO . . . . . / EPA . CAT# TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . . . Site . . . . . Location . . . . .
M00681 000369 DATA 01F166S920066 0022	05/11/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2M HILL SDG# 35502	ADMIN RECORD	WATER VOC	
M00681 000370 DATA 01F166S920066 0020	05/11/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2M HILL SDG# 35502	ADMIN RECORD	WATER VOC	
M00681 000371 DATA 01F166S920066 0021	05/11/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2M HILL SDG# 35518	ADMIN RECORD	WATER VOC	
M00681 000372 DATA 01F166S920066 0021	05/11/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2M HILL SDG# 35491	ADMIN RECORD	WATER VOC	
M00681 000373 DATA 01F166S920066 0021	05/11/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2M HILL SDG# 35479	ADMIN RECORD	WATER VOC	
M00681 000374 DATA 01F166S920066 0019	05/11/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2M HILL SDG# 35471	ADMIN RECORD	WATER VOC	
M00681 000375 DATA 01F166S920066 0019	05/11/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2M HILL SDG# 35470	ADMIN RECORD	WATER VOC	
M00681 000376 DATA 01F166S920066 0017	05/11/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2M HILL SDG# 34117	ADMIN RECORD	WATER VOC	
M00681 000377 DATA 01F166S920066 0022	05/11/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2M HILL SDG# 35326	ADMIN RECORD	WATER VOC	
M00681 000378 DATA 01F166S920066 0023	05/11/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2M HILL SDG# 35377	ADMIN RECORD	WATER VOC	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	PRC . DATE FROM . . . . . / DOC . DATE FROM . SIGNATURE . . . . . / CTO . NO . . TO . . . . . / EPA . CAT# TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. . . . . Site . . . . . Location . . . . .
M00681 000379 DATA 01F166S920066 0019	05/11/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2M HILL SDG# 35441	ADMIN RECORD	WATER VOC	
M00681 000380 DATA 01F166S920066 0020	05/11/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2M HILL SDG# 35458	ADMIN RECORD	WATER VOC	
M00681 000381 DATA 01F166S920066 0018	05/11/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2M HILL SDG# 35531	ADMIN RECORD	WATER VOC	
M00681 000382 DATA 01F166S920066 0019	05/11/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2M HILL SDG# 35078	ADMIN RECORD	WATER VOC	
M00681 000383 DATA 01F166S920066 0026	05/11/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER & SOIL PARAMETER: VOLATILES LAB: CH2M HILL SDG# 35104	ADMIN RECORD	WATER VOC	
M00681 000384 DATA 01F166S920066 0018	05/11/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2M HILL SDG# 35533	ADMIN RECORD	WATER VOC	
M00681 000385 DATA 01F166S920066 0019	05/11/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2M HILL SDG# 35540	ADMIN RECORD	WATER VOC	
M00681 000386 DATA 01F166S920066 0012	05/11/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 35491	ADMIN RECORD	WATER TPH	
M00681 000412 DATA 01F166S920066 0023	05/11/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: SEMIVOLATILES LAB: CH2M HILL SDG# 35520	ADMIN RECORD	WATER SOLVENTS	
M00681 000413 DATA 01F166S920066 0029	05/11/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: SEMIVOLATILES LAB: CH2M HILL SDG# 35518	ADMIN RECORD	WATER SOLVENTS	

UIC No. DOC. NO. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	PRC . DATE FROM . . . . . / DOC . DATE FROM . SIGNATURE . . . . . / CTO . NO . . TO . . . . . / EPA . CAT# TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. . . . . Site . . . . . Location . . . . .
M00681 000414 DATA 01F166S920066 0028	05/11/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: SEMIVOLATILES LAB: CH2M HILL SDG# 35479	ADMIN RECORD	WATER SOLVENTS	
M00681 000415 DATA 01F166S920066 0022	05/11/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: SEMIVOLATILES LAB: CH2M HILL SDG# 35471	ADMIN RECORD	WATER SOLVENTS	
M00681 000416 DATA 01F166S920066 0022	05/11/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: SEMIVOLATILES LAB: CH2M HILL SDG# 35470	ADMIN RECORD	WATER SOLVENTS	
M00681 000417 DATA 01F166S920066 0023	05/11/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: SEMIVOLATILES LAB: CH2M HILL SDG# 35458	ADMIN RECORD	WATER SOLVENTS	
M00681 000418 DATA 01F166S920066 0020	05/11/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: SEMIVOLATILES LAB: CH2M HILL SDG# 35533	ADMIN RECORD	WATER SOLVENTS	
M00681 000419 DATA 01F166S920066 0022	05/11/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: SEMIVOLATILES LAB: CH2M HILL SDG# 35540	ADMIN RECORD	WATER SOLVENTS	
M00681 000472 DATA 01F166S920066 0012	05/12/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 35502	ADMIN RECORD	WATER TPH	
M00681 000473 DATA 01F166S920066 0014	05/12/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER &SOIL PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 35104	ADMIN RECORD	WATER TPH	
M00681 000474 DATA 01F166S920066 0013	05/12/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 35326	ADMIN RECORD	WATER TPH	
M00681 000475 DATA 01F166S920066 0013	05/12/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 35337	ADMIN RECORD	WATER TPH	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	PRC . DATE FROM . . . . . / DOC . DATE FROM . SIGNATURE . . . . . / CTO . NO . . TO . . . . . / EPA . CAT# TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. . . . . Site . . . . . Location . . . . .
M00681 000476 DATA 01F166S920066 0013	05/12/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 35377	ADMIN RECORD	WATER TPH	
M00681 000477 DATA 01F166S920066 0012	05/12/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 35379	ADMIN RECORD	WATER TPH	
M00681 000478 DATA 01F166S920066 0012	05/12/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 34681	ADMIN RECORD	WATER TPH	
M00681 000479 DATA 01F166S920066 0012	05/12/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 35520	ADMIN RECORD	WATER TPH	
M00681 000480 DATA 01F166S920066 0013	05/12/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 35531	ADMIN RECORD	WATER TPH	
M00681 000481 DATA 01F166S920066 0012	05/12/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: GASOLINE LAB: CH2M HILL SDG# 35502	ADMIN RECORD	WATER TPH	
M00681 000482 DATA 01F166S920066 0012	05/12/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 35491	ADMIN RECORD	WATER TPH	
M00681 000483 DATA 01F166S920066 0012	05/12/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 35326	ADMIN RECORD	WATER TPH	
M00681 000484 DATA 01F166S920066 0013	05/12/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 35337	ADMIN RECORD	WATER TPH	
M00681 000485 DATA 01F166S920066 0013	05/12/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 35377	ADMIN RECORD	WATER TPH	

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE FROM . . . . . . DOC . DATE FROM . SIGNATURE . . . . . CTO . NO . . TO . . . . . . EPA . CAT# TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. . . . . Site . . . . . Location . . . . .
M00681 000487 DATA 01F166S920066 0029	05/12/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TCL METALS W\BORON, CYANAIDE & MOLYBDENUM LAB: CH2M HILL SDG# 34237	ADMIN RECORD	WATER METALS	
M00681 000488 DATA 01F166S920066 0030	05/12/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TCL METALS W\BORON, CYANAIDE & MOLYBDENUM LAB: CH2M HILL SDG# 35379	ADMIN RECORD	WATER METALS	
M00681 000489 DATA 01F166S920066 0027	05/12/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TCL METALS W\BORON, CYANAIDE & MOLYBDENUM LAB: CH2M HILL SDG# 35407	ADMIN RECORD	WATER METALS	
M00681 000490 DATA 01F166S920066 0034	05/12/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TCL METALS W\BORON, CYANAIDE & MOLYBDENUM LAB: CH2M HILL SDG# 35218	ADMIN RECORD	WATER METALS CYANIDE	
M00681 000491 DATA 01F166S920066 0032	05/12/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TCL METALS W\BORON, CYANIDE & MOLYBDENUM LAB: CH2M HILL SDG# 35235	ADMIN RECORD	WATER METALS CYANIDE	
M00681 000492 DATA 01F166S920066 0029	05/12/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TCL METALS W\BORON, CYANIDE & MOLYBDENUM LAB: CH2M HILL SDG# 35251	ADMIN RECORD	WATER METALS CYANIDE	
M00681 000493 DATA 01F166S920066 0030	05/12/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TCL METALS W\BORON, CYANIDE & MOLYBDENUM LAB: CH2M HILL SDG# 35326	ADMIN RECORD	WATER METALS CYANIDE	
M00681 000494 DATA 01F166S920066 0031	05/12/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT MCB CAMP PENDLETON MATRIX: WATER PARAMETER:TCL METALS W\BORON, CYANIDE & MOLYBDENUM LAB: CH2M HILL SDG# 35337	ADMIN RECORD	WATER METALS CYANIDE	
M00681 000495 DATA 01F166S920066 0028	05/12/94 05/21/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TCL METALS W\BORON, CYANIDE & MOLYBDENUM LAB: CH2M HILL SDG# 35352	ADMIN RECORD	WATER METALS CYANIDE	
M00681 000299 DATA 000000000000000 0677	05/11/94 05/26/93 00166 02.2 WESTON MANAGERS ROY F. WESTON IT CORPORATION	LABORATORY REPORT FOR IT CORP. CLP\SEMIVOLATILES ANALYSIS SDG# W2773 RFW# 9304S687, 9305S700	ADMIN RECORD	SOLVENTS	SOUTHWEST DIVISION

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	PRC . DATE FROM . . . . . / DOC . DATE FROM . SIGNATURE . . . . . / CTO . NO . . TO . . . . . / EPA . CAT# TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. . . . . Site . . . . . Location . . . . .
M00681 000300 DATA 000000000000000 0237	05/11/94 05/27/93 00166 02.2 WESTON MANAGERS ROY F. WESTON IT CORPORATION	LABORATORY REPORT FOR IT CORP. DIOXION EED RFW# 9305S763	ADMIN RECORD	HPCDD	SOUTHWEST DIVISION
M00681 000302 DATA 01F166S920066 0019	05/11/94 05/28/93 00166 02.2 QUANTALEX MCB CAMP PENDLETON	DATA VALIDATION REPORT FOR MCB CAMP PENDLETON MATRIX: WATER PARAMETER: VOLATILES LAB: CH2M HILL SDG# 35539	ADMIN RECORD	WATER VOC	SOUTHWEST DIVISION
M00681 001224 DATA 0059	05/27/94 06/01/93 00166 02.2 WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON VOLATILES RFW# 9305S741	ADMIN RECORD	VOALTILES	
M00681 001289 DATA 0213	05/27/94 06/02/93 00166 02.2 WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON PURGEABLE PETROLEUM HYDROCARBONS ANALYSES SDG# W2818 RFW# 9305S775, 9305S787, 9305S798, 935S804, 9305S812	ADMIN RECORD	TPH	
M00681 001290 DATA 0213	05/27/94 06/02/93 00166 02.2 WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE HYDROCARBONS ANALYSIS SDG# W2773 RFW# 9304S687, 9305S700	ADMIN RECORD	TPH	
M00681 001291 DATA 0196	05/27/94 06/02/93 00166 02.2 WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON PURGEABLE HALOCARBONS ANALYSIS SDG# W2773 RFW# 9304S687, 9305S700	ADMIN RECORD	DATA	
M00681 002332 DATA 000000000000000 0019	07/21/94 06/02/93 00166 02.2 CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: SEMIVOLATILES SDG: 35531	ADMIN RECORD	WATER SEMIVOLATILES	
M00681 002481 DATA 01F166S920066 0013	08/09/94 06/02/93 00166 02.2 QUANTLEX MCB CAMP PENDLETON	MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG: 35539	ADMIN RECORD	WATER TPH	SOUTHWEST DIVISION
M00681 002487 DATA 01F166S920066 0012	08/10/94 06/02/93 00166 02.2 QUANTLEX MCB CAMP PENDLETON	MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 35540	ADMIN RECORD	WATER TPH	SOUTHWEST DIVISION
M00681 002488 DATA 01F166S920066 0012	08/10/94 06/02/93 00166 02.2 QUANTLEX MCB CAMP PENDLETON	MCB CAMP PENDLETON MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 35407	ADMIN RECORD	WATER TPH	SOUTHWEST DIVISION

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681 002489 DATA 01F166S920066 0012	08/10/94 06/02/93 00166 02.2	QUANTLEX MCB CAMP PENDLETON	MCB CAMP PENLETON DATA VALIDATION REPORT MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 35352	ADMIN RECORD	WATER TPH DATA	SOUTHWEST DIVISION
M00681 002490 DATA 01F166S920066 0012	08/10/94 06/02/93 00166 02.2	QUANTLEX MCB CAMP PENDLETON	MCB CAMP PENLETON DATA VALIDATION REPORT MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 35078	ADMIN RECORD	WATER TPH DATA	SOUTHWEST DIVISION
M00681 002491 DATA 01F166S920066 0012	08/10/94 06/02/93 00166 02.2	QUANTLEX MCB CAMP PENDLETON	MCB CAMP PENDLETON DATA VALIDATION REPORT MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 35479	ADMIN RECORD	WATER TPH DATA	SOUTHWEST DIVISION
M00681 002492 DATA 01F166S920066 0012	08/10/94 06/02/93 00166 02.2	QUANTLEX MCB CAMP PENDLETON	MCB CAMP PENDLETON DATA VALIDATION REPORT MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 35471	ADMIN RECORD	WATER TPH DATA	SOUTHWEST DIVISION
M00681 002493 DATA 01F166S920066 0013	08/10/94 06/02/93 00166 02.2	QUANTLEX MCB CAMP PENDLETON	MCB CAMP PENDLETON DATA VALIDATION REPORT MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 35470	ADMIN RECORD	WATER TPH DATA	SOUTHWEST DIVISION
M00681 002494 DATA 01F166S920066 0013	08/10/94 06/02/93 00166 02.2	QUANTLEX MCB CAMP PENDLETON	MCB CAMP PENDLETON DATA VALIDATION REPORT MATRIX: WATER PARAMETER: TPH GASOLINE LAB: CH2M HILL SDG# 35458	ADMIN RECORD	WATER TPH DATA	SOUTHWEST DIVISION
M00681 002495 DATA 01F166S920066 0041	08/10/94 06/02/93 00166 02.2	QUANTLEX MCB CAMP PENDLETON	MCB CAMP PENDLETON DATA VALIDATION REPORT PARAMETER: ORGANOINTROGEN PESTICIDE LAB: ESE SDG# G27557, G27581, G27664, G27718	ADMIN RECORD	PESTICIDES WATER DATA	SOUTHWEST DIVISION
M00681 002496 DATA 01F166S920066 0044	08/10/94 06/02/93 00166 02.2	QUANTLEX MCB CAMP PENDLETON	MCB CAMP PENDLETON DATA VALIDATION REPORT PARAMETER: CARBAMATE/UREA PESTICIDE LAB: ESE SDG# G27393, G27423, G27468, G27593	ADMIN RECORD	PESTICIDES DATA	SOUTHWEST DIVISION
M00681 002497 DATA 01F166S920066 0013	08/10/94 06/02/93 00166 02.2	QUANTLEX MCB CAMP PENDLETON	MCB CAMP PENDLETON DATA VALIDATION REPORT MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 35533	ADMIN RECORD	WATER DATA TPH	SOUTHWEST DIVISION
M00681 002498 DATA 01F166S920066 0012	08/10/94 06/02/93 00166 02.2	QUANTLEX MCB CAMP PENDLETON	MCB CAMP PENDLETON DATA VALIDATION REPORT MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 35352	ADMIN RECORD	WATER DATA TPH	SOUTHWEST DIVISION

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681 002499 DATA 01F166S920066 0012	08/10/94 06/02/93 00166 02.2	QUANTLEX MCB CAMP PENDLETON	MCB CAMP PENDLETON DATA VALIDATION REPORT MATIRX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 35518	ADMIN RECORD	WATER DATA TPH	SOUTHWEST DIVISION
M00681 002500 DATA 01F166S920066 0012	08/10/94 06/02/93 00166 02.2	QUANTLEX MCB CAMP PENDLETON	MCB CAMP PENDLETON DATA VALIDATION REPORT MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 35479	ADMIN RECORD	WATER TPH DATA	SOUTHWEST DIVISION
M00681 002501 DATA 01F166S920066 0013	08/10/94 06/02/93 00166 02.2	QUANTLEX MCB CAMP PENDLETON	MCB CAMP PENDLETON DATA VALIDATION REPORT MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 35539	ADMIN RECORD	WATER DATA TPH	SOUTHWEST DIVISION
M00681 002502 DATA 01F166S9220066 0012	08/10/94 06/02/93 00166 02.2	QUANTLEX MCB CAMP PENDLETON	MCB CAMP PENDLETON DATA VALIDATION REPORT MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 35540	ADMIN RECORD	WATER DATA TPH	SOUTHWEST DIVISION
M00681 002503 DATA 01F166S920066 0013	08/10/94 06/02/93 00166 02.2	QUANTLEX MCB CAMP PENDLETON	MCB CAMP PENDLETON DATA VALIDATION REPORT MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 35427	ADMIN RECORD	WATER TPH DATA	SOUTHWEST DIVISION
M00681 002504 DATA 01F166S920066 0012	08/10/94 06/02/93 00166 02.2	QUANTLEX MCB CAMP PENDLETON	MCB CAMP PENDLETON DATA VALIDATION REPORT MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 35078	ADMIN RECORD	WATER TPH DATA	SOUTHWEST DIVISION
M00681 002505 DATA 01F166S920066 0013	08/10/94 06/02/93 00166 02.2	QUANTLEX MCB CAMP PENDLETON	MCB CAMP PENDLETON DATA VALIDATION REPORT MATRIX: WATER PARAMETER: TPH DIESEL LAB: CH2M HILL SDG# 35470	ADMIN RECORD	WATER TPH DATA	SOUTHWEST DIVISION
M00681 001293 DATA 0634	05/27/94 06/03/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP GCMS SEMIVOLATILE ANALYSIS SDG# W2792 RFW# 9305S701, 9305S725, 9305S763	ADMIN RECORD	SEMIVOLATILES	
M00681 001297 DATA 0252	05/27/94 06/07/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE HYDROCARBONS ANALYSIS SDG# W2792 RFW# 9305S701, 935S725, 9305S763	ADMIN RECORD	TEH	
M00681 001298 DATA 0520	05/27/94 06/07/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP GCMS SEMIVOLATILE ANALYSIS SDG# W2818 RFW# 9305S775, 9305S787, 9305S798, 9305S804, 9305S812	ADMIN RECORD	SEMIVOLATILE	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681 DATA 0502	001300	05/27/94 06/07/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP GCMS VOLATILES ANALYSIS SDG# W2773 RFW# 9304S687, 9305S700	ADMIN RECORD	VOLATILES	
M00681 DATA 0453	001294	05/27/94 06/08/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP GCMS VOLATILE ANALYSIS SDG# W2836 RFW# 9305S820, 9305S828, 9305S842. 9305S851, 9305S858, 9305S866	ADMIN RECORD	VOLATILES	
M00681 DATA 0430	001295	05/27/94 06/08/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP GCMS VOLATILE ANALYSIS SDG# W2818 RFW# 9305S775, 9305S787, 9305S798, 9305S804, 9305S812	ADMIN RECORD	VOLATILES	
M00681 DATA 0150	001296	05/27/94 06/08/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON HERBICIDES ANALYSIS SDG# W2792 RFW# 9305S763	ADMIN RECORD	HERBICIDE	
M00681 DATA 0216	001299	05/27/94 06/08/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE HYDROCARBONS ANALYSIS SDG# W2818 RFW# 9305S775, 9305S787, 9305S798, 9305S804, 9305S812	ADMIN RECORD	TEH	
M00681 DATA 35781 0408	001125	05/25/94 06/10/93 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, PESTICIDES, PCB, TFH HERBICIDES, METALS	ADMIN RECORD	PESTICIDES PCB TFH HERBICIDES METALS VOLATILES SEMIVOLATILES	
M00681 DATA 35848 0216	001126	05/25/94 06/10/93 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, PESTICIDES, PCB, METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES PESTICIDES PCB METALS	
M00681 DATA 0821	001231	05/27/94 06/10/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP SEMIVOLATILES ANALYSIS SDG# W2858 RFW# 9305S843 9305S852, 9305S857	ADMIN RECORD	SEMIVOLATILES	
M00681 DATA 0364	001248	05/27/94 06/10/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP ORGANOCHLORINE PESTICIDES ANALYSIS SDG# W2773 RFW# 9304S687, 9304S700	ADMIN RECORD	PESTICIDES	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681 DATA 0492	001274	05/27/94 06/10/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP GCMS VOLATILES ANALYSIS SDG# W2858 RFW# 9305S843, 9305S852, 9305S857	ADMIN RECORD	VOLATILES	
M00681 DATA 0337	001234	05/27/94 6/11/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON HERBICIDES ANALYSIS SDG# W2818 RFW# 9305S775, 9305S787, 9305S798 9305S804, 9305S812	ADMIN RECORD	HERBICIDE	
M00681 DATA 0357	001236	05/27/94 06/11/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP ORGANOCHLORINE PESTICIDES ANALYSIS SDG# W2792 RFW# 9305S701, 9305S763	ADMIN RECORD	PESTICIDES	
M00681 DATA 0321	001237	05/27/94 06/11/93 00166 02.2	WESTON MANGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP ORGANOCHLORINE PESTICIDES ANALYSIS SDG# W2818 RFW# 9305S775, 9305S787, 9305S798, 9305S804, 9305S812	ADMIN RECORD	PESTICIDES	
M00681 DATA 0505	001249	05/27/94 06/11/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP GCMS VOLATILE ANALYSIS SDG# W2890 RFW# 9305S877, 9305S878, 9305S891	ADMIN RECORD	VOLATILES	
M00681 DATA 0252	001233	05/27/94 06/15/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON VOLATILE PURGEABLE PETROLEUM HYDROCARBONS ANALYSIS SDG# W2792 RFW# 9305S701, 9305S725, 9305S763	ADMIN RECORD	TPH VOLATILES	
M00681 DATA 0563	001235	05/27/94 06/16/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP INORGANIC METALS AND CYANIDE ANALYSIS SDG# W2792 RFW# 9305S701, 9305S725, 9305S763	ADMIN RECORD	IOG METALS CYANIDE	
M00681 DATA 0249	001238	05/27/94 06/16/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE HYDROCARBONS ANALYSIS SDG# W2858 RFW# 9305S843, 9305S852, 9305S857	ADMIN RECORD	TEH	
M00681 DATA 0160	001239	05/27/94 06/16/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANICS ANALYSIS SDG# W2792 RFW# 9305S701, 9305S725, 9305S763	ADMIN RECORD	IOG	
M00681 DATA 0356	001263	05/27/94 06/17/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP ORGANICHLORINE PESTICIDES ANALYSIS SDG# W2836 RFW# 9305S820, 9305S828, 9305S842, 9305S851, 9305S858	ADMIN RECORD	PESTICIDES	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681 DATA 0010	002404	07/22/94 06/17/93 166 02.2	CH2M HILL MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: TPH-DIESEL SDG: 35576	ADMIN RECORD	WATER FUEL	
M00681 DATA 0371	001241	05/27/94 06/18/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP INORGANIC METALS ANALYSIS SDG# W2773 RFW# 9304S687 9304S700	ADMIN RECORD	IOG METALS	
M00681 DATA 0187	001240	05/27/94 06/19/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE HYDROCARBONS ANALYSIS SDG# W2890 RFW# 9305S877, 9305S878, 9305S891	ADMIN RECORD	THE	
M00681 DATA 0258	001242	05/27/94 06/19/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE HYDROCARBONS ANALYSIS SDG# W2836 RFW# 9305S820, 9305S828, 9305S842, 9305S851, 9305S858	ADMIN RECORD	TEH	
M00681 DATA 0271	001243	05/27/94 06/19/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON VOLATILE PURGEABLE PETROLEUM HYDROCARBONS ANALYSIS SDG# W2836 RFW# 9305S820, 9305S828, 9305S842, 9305S851	ADMIN RECORD	VOLATILES TPH	
M00681 DATA 0385	001244	05/27/94 06/19/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON HERBICIDES ANALYSIS SDG# W2836 RFW# 9305S820, 9305S828, 9305S842, 9305S851, 9305S858, 9305S866	ADMIN RECORD	HERBICIDE	
M00681 DATA 0763	001246	05/27/94 06/19/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP GCMS SEMIVOLATILE ANALYSIS SDG# W2836 RFW# 9305S820, 9305S828, 9305S842, 9305S851, 9305S858	ADMIN RECORD	SEMIVOLATILE	
M00681 DATA 0230	001245	05/27/94 06/21/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE HYDROCARBONS ANALYSIS SDG# W2905 RFW# 9305S879, 9305S889, 9305S902, 9305S904	ADMIN RECORD	TEH	
M00681 DATA 0449	001247	05/27/94 06/21/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP GCMS VOLATILE ANALYSIS SDG# W2905 RFW# 9305S879, 9305S889, 9305S904	ADMIN RECORD	VOLATILE	
M00681 DATA 0263	001250	05/27/94 06/21/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP ORGANOCHLORINE PESTICIDES ANALYSIS SDG# W2905 RFW# 9305S879, 9305S889, 9305S902	ADMIN RECORD	PESTICIDES	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681 DATA 0101	001251	05/27/94 06/21/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON VOLATILE PETROLEUM HRDOCARBONS ANALYSIS SDG# W2858 RFW# 9305S843, 9305S852, 9305S857	ADMIN RECORD	TPH VOLATILES	
M00681 DATA 0273	001253	05/27/94 06/21/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON HERBICIDES ANALYSIS SDG# W2905 RFW# 9305S879, 9305S889, 9305S902	ADMIN RECORD	HERBICIDE	
M00681 DATA 0391	001254	05/27/94 06/21/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP GCMS VOLATILE ANALYSIS SDG# W2926 RFW# 9306S011, 9306S024, 9306S030, 9036S037, 9306S044, 9306S050	ADMIN RECORD ADMIN RECORD	VOLATILES VOLATILES	
M00681 DATA 0332	001262	05/27/94 06/22/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP INORGANIC METALS ANALYSIS SDG# W2818 RFW# 9305S775, 9305S787, 9305S798, 9305S804, 9305S812	ADMIN RECORD	IOG METALS	
M00681 DATA 0198	001264	05/27/94 06/22/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANIC WET CHEMISTRY ANALYSIS SDG# W2818 RFW# 9305S775, 9305S787, 9305S798, 9305S804, 9305S812	ADMIN RECORD	IOG	
M00681 DATA 0608	000920	05/18/94 06/23/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP/GC/MS SEMIVOLATILE ANALYSIS SDG# W2890 RFW# 9305S877, 9305S878, 9305S891	ADMIN RECORD	SEMIVOLATILES	
M00681 DATA 0464	000921	05/18/94 06/23/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP/GC/MS SEMIVOLATILE ANALYSIS SDG# W2945 RFW# 9306S051, 9306S058, 9306S059, 9306S060, 9306S068	ADMIN RECORD	SEMIVOLATILES	
M00681 DATA 0522	000927	05/18/94 06/23/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP/GC/MS SEMIVOLATILE ANALYSIS SDG# W2905 RFW# 9305S879, 9305S889, 9305S902, 9305S904	ADMIN RECORD	SEMIVOLATILES	
M00681 DATA 0269	001261	05/27/94 06/23/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON VOLATILE PETROLEUM HYDROCARBONS ANALYSIS SDG# W2890 RFW# 9305S877, 9305S878, 9305S891	ADMIN RECORD	VOLATILES TPH	
M00681 DATA 0395	001272	05/27/94 06/23/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP GCMS VOLATILE ANALYSIS SDG# W2945 RFW# 9306S051, 9306S058, 9306S059, 9306S060, 9306S068	ADMIN RECORD	VOLATILES	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location
M00681 DATA 0337	000913	05/18/94 06/25/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP INORGANIC METALS ANALYSIS SDG# W2836 RFW# 9305S820, 9305S828, 9305S842, 9305S851, 9305S858	ADMIN RECORD	METALS IOG	
M00681 DATA 0350	000916	05/18/94 06/25/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANIC WET CHEMISTRY ANALYSIS SDG# W2836 RFW# 9305S820, 9305S828, 9305S842, 9305S851	ADMIN RECORD	IOG	
M00681 DATA 0330	000917	05/18/94 06/25/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON VOLATILE PETROLEUM HYDROCARBONS ANALYSIS SDG# W2905 RFW# 9305S879, 9305S889, 9305S902, 9305S904	ADMIN RECORD	VOLATILE	
M00681 DATA 0517	000907	05/18/94 06/28/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP/GC/MS SEMIVOLATILES ANALYSIS SDG# W2926 RFW# 9306S011, 9306S024, 9306S030, 9306S037	ADMIN RECORD	SEMIVOLATILES	
M00681 DATA 0234	000914	05/18/94 06/28/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON VOA RFW# 9306S224	ADMIN RECORD	VOA	
M00681 DATA 0360	000915	05/18/94 06/28/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON SEMIVOLATILES RFW# 9306S224	ADMIN RECORD	SEMIVOLATILES	
M00681 DATA 0084	000918	05/18/94 06/28/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON VOLATILES RFW# 9306S224	ADMIN RECORD	VOLATILES	
M00681 DATA 0112	000919	05/18/94 06/28/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON DIESEL FUEL RFW# 9306S224	ADMIN RECORD	DIESEL FUEL	
M00681 DATA 0224	000928	05/18/94 06/28/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON PESTICIDES PCBs RFW# 9306S224	ADMIN RECORD	PESTICIDES PCB	
M00681 DATA 0223	000929	05/18/94 06/28/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON WATER RFW# 9306S224	ADMIN RECORD	WATER	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location
M00681 DATA 00255	000910	05/18/94 06/29/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON VOLATILE PETROLEUM HYDROCARBONS ANALYSIS SDG# W2926 RFW# 9306S011, 9306S024, 9306S030, 9306S037, 93065044	ADMIN RECORD	VOLATILES	
M00681 DATA 00352	000933	05/18/94 06/29/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP INORGANIC METALS ANALYSIS SDG# W2890 RFW# 9305S877 905S878, 9305S891	ADMIN RECORD	IOG METALS	
M00681 DATA 0229	000937	05/18/94 06/29/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE HYDROCARBONS ANALYSIS SDG# W2926 RFW# 9306S011, 9306S024, 9306S030, 9306S037, 9306S044	ADMIN RECORD	TEH	
M00681 DATA 0383	000938	05/18/94 06/29/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON HERBICIDES ANALYSIS SDG# W2926 RFW# 9306S011, 9306S024 9306S030, 9306S037, 9306S044, 9306S050	ADMIN RECORD	HERBICIDE	
M00681 DATA 0320	000932	05/18/94 06/30/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP INORGANIC METALS ANALYSIS SDG# W2926 RFW# 9306S011 9306S024, 9306S030, 9306S037, 9306S044, 9306S050	ADMIN RECORD	IOG METALS	
M00681 DATA 0256	000934	05/18/94 06/30/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANIC WET CHEMISTRY ANALYSIS SDG# W2890 RFW# 9606S051, 9306S058, 9306S059, 9306S060, 9306S068	ADMIN RECORD	IOG	
M00681 DATA 0151	000935	05/18/94 06/30/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INOGRANIC ANALYSIS SDG# W2905 RFW# 9305S879, 9305S889, 9305S902, 9305S904	ADMIN RECORD	IOG	
M00681 DATA 0255	000955	05/18/94 06/30/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANIC WET CHEMISTRY SDG# W2926 RFW# 9306S011, 9306S024, 9306S030, 9306S037, 9306S044	ADMIN RECORD	IOG	
M00681 DATA 0077	000908	05/18/94 07/01/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON DIESEL FUEL W2926 RFW# 99306S258	ADMIN RECORD	DIESEL FUEL	
M00681 DATA 0061	000909	05/18/94 07/01/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON VOLATILES RFW# 9306S258	ADMIN RECORD	VOLATILES	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . . . / TO . . . . . / TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location
M00681 DATA 0160	000911	05/18/94 07/01/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANICS RFW# 9306S258	ADMIN RECORD	IOG	
M00681 DATA 0161	000912	05/18/94 07/01/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON PESTICIDES\PCBs RFW# 9306S258	ADMIN RECORD	PESTICIDES PCB	
M00681 DATA 0203	000930	05/18/94 07/01/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON SEMIVOLATILES RFW# 9306S258	ADMIN RECORD	SEMIVOLATILES	
M00681 DATA 0093	000931	05/18/94 07/01/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON HERBICIDES RFW# 9306S258	ADMIN RECORD	HERBICIDE	
M00681 DATA 0430	000939	05/18/94 07/01/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP/INORGANICS METALS ANALYSIS SDG# W2905 RFW# 9305S879, 9305S889, 9305S902, 9305S904	ADMIN RECORD	IOG METALS	
M00681 DATA 0387	000940	05/18/94 07/01/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP/INORGANICS METALS ANALYSIS SDG# W2858 RFW# 9305S843, 9305S852, 9305S857	ADMIN RECORD	IOG METALS	
M00681 DATA 0351	000941	05/18/94 07/01/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP/ORGANOCHORINE PESTICIDES ANALYSIS SDG# W2926 RFW# 9306S011, 9306S024, 9306S030, 9306S037, 9306S044	ADMIN RECORD	PESTICIDES	
M00681 DATA 0504	000925	05/18/94 07/02/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP/GC/MS VOLATILE ANALYSIS SDG# W2960 RFW# 9306S067 RFW# 9306S070, 9306S078, 9306S079, 9306S080, 9306S091	ADMIN RECORD	VOLATILES	
M00681 DATA 0526	000936	05/18/94 07/02/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP/GC/MS SEMIVOLATILES ANALYSIS SDG# W2960 RFW# 9306S067, 9306S070, 9306S078, 9306S079, 9306S080	ADMIN RECORD	SEMIVOLATILES	
M00681 DATA 35908 0244	000975	05/18/94 07/02/93 00166 02.2	WESTON MANAGERS IT CORPORATION	ANALYTICAL DATA FOR MCB CAMP PENDLETON TFH, VOLATILES, SEMIVOLATILES, PESTICIDES, PCB HERBICIDES	ADMIN RECORD	TFH VOLATILES SEMIVOLATILES PESTICIDES PCB HERBICIDE	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location
M00681 DATA 0227	000922	05/18/94 07/06/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL PURGEABLE PETROLEUM ANALYSIS SDG# W2945 RFW# 9306S501, 9306S058, 9306S059, 9306S060, 9306S068	ADMIN RECORD	TPH	
M00681 DATA 0189	000923	05/18/94 07/06/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE HYDROCARBONS ANALYSIS SDG# W2945 RFW# 9306S501, 9306S058, 9306S059, 9306S060, 9306S068	ADMIN RECORD	TEH	
M00681 DATA 0428	000924	05/18/94 07/06/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GCMS VOLATILES ANALYSIS SDG# W2984 RFW# 9306S103 RFW# 9306S119, 9306S120, 9306S135, 9306S136, 9306S137	ADMIN RECORD	VOLATILES	
M00681 DATA 0389	001192	05/26/94 07/06/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON HERBICIDES ANALYSIS SDG# W2945, RFW# 9306S051, 9306S058 9306S059	ADMIN RECORD	HERBICIDE	
M00681 DATA 0252	001196	05/27/94 07/06/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON ORGANOCHLORINE PESTICIDES ANALYSIS SDG# 2945 RFW# 9306S051, 9306S058, 9306S059	ADMIN RECORD	PESTICIDES	
M00681 DATA 0224	001197	05/27/94 07/06/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL PURGEABLE PETROLEUM ANALYSIS SDG# 2960 RFW# 9306S067, 9306S070, 9306S078, 9306S079, 9306S080	ADMIN RECORD	TPH	
M00681 DATA 0311	001198	05/27/94 07/06/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON METALS ANALYSIS SDG# 2945 RFW# 9306S051, 9306S058 9306S059, 9306S060, 9306S068	ADMIN RECORD	METALS	
M00681 DATA 000000000000000 0409	001199	05/27/94 07/06/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GCMS VOLATILES ANALYSIS SDG# W3004 RFW# 9306S163, 9306S164, 9306S180, 9306S181, 9306S182, 9306S192, 9306S205	ADMIN RECORD	VOLATILES	SOUTHWEST DIVISION
M00681 DATA 0506	001191	05/26/94 07/07/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GCMS SEMIVOLATILES ANALYSIS SDG# W2984, RFW# 9306S103, 9306S119, 9306S120, 9306S135, 9306S136, 9306S137	ADMIN RECORD	SEMIVOLATILES	
M00681 DATA 0327	001195	05/27/94 07/07/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON HERBICIDES ANALYSIS SDG# W2960 RFW# 9306S067, 9306S070, 9306S078, 9306S078, 9306S079, 9306S91, 9306S102	ADMIN RECORD	HERBICIDE	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location
M00681 DATA 0265	001202	05/27/94 07/08/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANICS WET CHEMISTRY SDG# W2960 RFW# 9306S067, 9306S070, 9306S078, 9306S079,9306S080, 9306S091, 9306S102	ADMIN RECORD	IOG	
M00681 DATA 000000000000000 0249	001200	05/27/94 07/12/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON HERBICIDES ANALYSIS SDG# W2984 RFW# 9306S103, 9306S135	ADMIN RECORD		SOUTHWEST DIVISION
M00681 DATA 0073	001204	05/27/94 07/12/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON INORGANIC RFW# 9306S147	ADMIN RECORD	IOG	
M00681 DATA 0203	001205	05/27/94 07/12/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON VOLATILE PETROLEUM HYDROCARBONS ANALYSIS SDG# W2984 RFW# 9306S103, 9306S119, 9306S120, 9306S135, 9306S136	ADMIN RECORD	TPH VOLATILES	
M00681 DATA 0156	001207	05/27/94 07/12/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP ORGANOCHLORINE PESTICIDES ANALYSIS SDG# 2984 RFW# 9306S103	ADMIN RECORD	PESTICIDES	
M00681 DATA 35967 0232	001151	05/25/94 07/13/93 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	LABORATORY REPORT FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, PESTICIDES, PCBs, TFH, METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES PESTICIDES PCB TFH METALS	
M00681 DATA 35926 0242	001154	05/25/94 07/13/93 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH, PESTICIDES, PCBs, METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES TFH PESTICIDES PCB METALS	
M00681 DATA 35914 0316	001157	05/25/94 07/13/93 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH, PESTICIDES, PCBS, METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES TFH PESTICIDES PCB HERBICIDE	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location
M00681 DATA 35945 0273	001158	05/25/94 07/13/93 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH, PESTICIDES, PCBs, METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES TFH PESTICIDES PCB METALS	
M00681 DATA 35901 0297	001159	05/25/94 07/13/93 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH, PESTICIDES, PCBs, METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES TFH PESTICIDES PCB METALS	
M00681 DATA 35934 0380	001160	05/25/94 07/13/93 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH, PESTICIDES, PCBs, METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES TFH PESTICIDES PCB METALS	
M00681 DATA 35966 0960	001176	05/25/94 07/13/93 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH, PESTICIDES, PCBs,	ADMIN RECORD	VOLATILES SEMIVOLATILES PESTICIDES PCB	
M00681 DATA 0097	001201	05/25/94 07/13/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP/GCMS VOLATILE ANALYSIS SWG# W3030 RFW# 9306S258	ADMIN RECORD	VOLATILES	
M00681 DATA 0202	001203	05/27/94 07/13/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP GCMS VOLATILES ANALYSIS SDG# W3020 RFW# 9306S193, 99306S194, 9306S225	ADMIN RECORD	VOLATILES	
M00681 DATA 0252	001206	05/27/94 07/13/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE HYDROCARBONS ANALYSIS SDG# W2960 RFW# 9306S067, 9306S070, 9306S078, 9306S079, 9306S080	ADMIN RECORD	TEH	
M00681 DATA 0239	001209	05/27/94 07/13/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE HYDROCARBONS ANALYSIS SDG# W2984 RFW# 9306S103, 9306S119, 9306S120, 9306S135, 9306S136	ADMIN RECORD	TEH	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681 DATA 35984 0966	001177	05/25/94 07/14/93 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, PESTICIDES, PCBs	ADMIN RECORD	VOLATILES SEMIVOLATILES PESTICIDES PCB	
M00681 DATA 35985 0280	001178	05/25/94 07/14/93 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, PESTICIDES, PCBs TFH, METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES PESTICIDES PCB TFH METALS	
M00681 DATA 0412	001225	05/27/94 07/14/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP INORGANICS METALS ANALYSIS SDG# W2960 RFW# 9306S067, 9306S070, 9306S078, 9306S079, 9306S080	ADMIN RECORD	IOG METALS	
M00681 DATA 0272	001226	05/27/94 07/15/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP INORGANICS METALS ANALYSIS SDG# W2984 RFW# 9305S103, 9305S119, 9306S120, 9306S135, 9306S136	ADMIN RECORD	IOG METALS	
M00681 DATA 0210	001228	05/27/94 07/15/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON GC/MS SEMIVOLATILE ANALYSIS SDG# W3020 RFW# 9306S193 9306S194, 9306S225	ADMIN RECORD	SEMIVOLATILES	
M00681 DATA 0328	001229	05/27/94 07/15/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP INORGANICS WET CHEMISTRY ANALYSIS SDG# W 2984 RFW# 9306S103, 9306S119, 9306S120, 9306S135, 9306S136	ADMIN RECORD	IOG	
M00681 DATA 0471	001265	05/27/94 07/15/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP GCMS SEMIVOLATILE ANALYSIS SDG# W3004 RFW# 9306S163, 9306S164, 9306S180, 9306S181, 9306S182	ADMIN RECORD	SEMIVOLATILES	
M00681 DATA 36008 0303	001127	05/25/94 07/16/93 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, TFH, METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES TPH METALS	
M00681 DATA 0294	001266	05/27/94 07/19/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP ORGANOCHLORINE PESTICIDES ANALYSIS SDG# W2960 RFW# 9306S067, 9306S070, 9306S078, 9306S079, 9306S091	ADMIN RECORD	PESTICIDES	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . / TO . . . . . / TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . .Location . . . . .
M00681 001267 DATA 0231	05/27/94 07/20/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON VOLATILE PETROLEUM HYDROCARBONS ANALYSIS SDG #W3004RFW# 9306S163, 9306S164, 9306S181, 9306S182	ADMIN RECORD	VOLATILES TPH	
M00681 001269 DATA 0397	05/27/94 07/20/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP INORGANIC METALS ANALYSIS SDG# W3004 RFW# 9306S163, 9305S164, 9306S180, 9306S181, 9306S182	ADMIN RECORD	IOG METALS	
M00681 001268 DATA 0318	05/27/94 07/21/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON WET CHEMISTRY ANALYSIS SDG# W3004 RFW# 9306S163, 9306S164, 9306S180, 9306S181, 9306S182	ADMIN RECORD	DATA	
M00681 001270 DATA 0205	05/27/94 07/21/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON HERBICIDES ANALYSIS SDG# W3004 RFW# 9306S164, 9305S180, 9305S182	ADMIN RECORD	HERBICIDE	
M00681 001271 DATA 0194	05/27/94 07/21/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE HYDROCARBONS ANALYSIS SDG# W3004 RFW# 9306S163, 9306S164, 9306S180, 9306S181, 9306S182	ADMIN RECORD	THE	
M00681 001259 DATA 0122	05/27/94 07/22/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON VOLATILE PETROLEUM HYDROCARBONS ANALYSIS SDG# W3020 RFW# 9306S193, 9306S194, 9306S225	ADMIN RECORD	TPH VOLATILES	
M00681 001260 DATA 0189	05/27/94 07/22/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP ORGANOCHLORINE PESTICIDES ANALYSIS SDG# W3004 RFW# 9306S164, 9306S180, 9306S182	ADMIN RECORD	PESTICIDES	
M00681 002363 DATA 0000000000000000 0026	05/25/94 07/23/93 00166 02.2	ESE MCB CAMP PENDLETON	MATRIX: WATER PARAMETERS: GENERAL CHEMISTRY CASE: NACPW7G G35714, G36446, G36029, G35103, G35334, G35715, G36442,	ADMIN RECORD	WATER	
M00681 001273 DATA 0113	05/27/94 07/27/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE HYDROCARBONS ANALYSIS SDG# W30201, RFW# 9306S193, 9306S194, 9306S225	ADMIN RECORD	TEH	
M00681 001275 DATA 0269	05/27/94 07/27/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP INORGANICS METALS ANALYSIS SDG# W3020 RFW# 9306S193, 9306S194, 9306S206, 9306S225, 9306S259	ADMIN RECORD	IOG METALS	

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . . FROM . SIGNATURE . . . TO . . . . . . TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . .Location . . . . .
M00681 001276 DATA 0153	05/27/94 07/27/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON HERBICIDES ANALYSIS SDG# W3020 RFW# 9306S225	ADMIN RECORD	HERBICIDE	
M00681 001277 DATA 0193	05/27/94 07/27/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP ORGANOCHLORINE PESTICIDES ANALYSIS SDG# W2984 RFW# 9307S405, 9306S135	ADMIN RECORD	PESTICIDES	
M00681 001278 DATA 0161	05/27/94 07/27/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP ORGANOCHLORINE PESTICIDES ANALYSIS SDG# W3020 RFW# 9306S225	ADMIN RECORD	PESTICIDES	
M00681 001279 DATA 0230	05/27/94 07/28/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON WET CHEMISTRY SDG# W3020 RFW# 9306S193, 9306S194, 9306S205, S9306S225, S9306S259	ADMIN RECORD	DATA	
M00681 002482 DATA 01F166S920066 0032	08/09/94 07/28/93 00166 02.2	QUANTLEX MCB CAMP PENDLETON	MCB CAMP PENLETON MATRIX: WATER PARAMETER: VOLATILES LAB: ESE SDG: G35398, G36497	ADMIN RECORD	WATER VOLATILES	SOUTHWEST DIVISION
M00681 002483 DATA 01F166S920066 0050	08/09/94 07/28/93 00166 02.2	QUANTLEX MCB CAMP PENDLETON	MCB CAMP PENLETON MATRIX: WATER PARAMETER: VOLATILES LAB: ESE SDG: G359397,G35398, G35399, G36496	ADMIN RECORD	WATER	SOUTHWEST DIVISION
M00681 002484 DATA 01F166S920066 0063	08/09/94 07/28/93 00166 02.2	QUANTLEX MCB CAMP PENDLETON	MCB CAMP PENLETON MATRIX: WATER PARAMETER: TCL METALS WITH BORON, CYANIDE, AND MOLYBDENUM SDG: G35338, G36107, G35740, G36332, G35751, G36374, G36336	ADMIN RECORD	WATER	SOUTHWEST DIVISION
M00681 002485 DATA 01F166S920066 0051	08/10/94 07/28/93 00166 02.2	QUAMTLEX MCB CAMP PENDLETON	MCB CAMP PENLETON MATRIX: WATER PARAMETER: TCL METALS WITH BORON, CTANIDE, AND MOLYBDENUM LAB: ESE SDG# G36251, G35621	ADMIN RECORD	WATER METALS CYANIDE	SOUTHWEST DIVISION
M00681 002486 DATA 01F166S920066 0014	08/10/94 07/28/93 00166 02.2	QUANTLEX MCB CAMP PENDLETON	MCB CAMP PENLETON MATRIX: WATER PARAMETER: TPH GASOLINE & TPH DIESEL LAB: ESE CASE# NACPW8DSDG# G35462	ADMIN RECORD	WATER TPH	SOUTHWEST DIVISION
M00681 001129 DATA 36209 0233	05/25/94 07/30/93 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, PESTICIDES, PCB, TFH, METALS	ADMIN RECORD	VOLATILES SEMIVOLATILES PESTICIDES PCB TFH METALS	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681 DATA 36198 0258	001130	05/25/94 07/30/93 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, PESTICIDES, PCB, TFH, METALS	ADMIN RECORD	VOLATILES SEMIVOALITILES PESTICIDES PCB TFH METALS	
M00681 DATA 36235 0912	001137	05/25/94 08/06/93 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, RISK ASSESSMENT	ADMIN RECORD	VOLATILES SEMIVOLATILES RA	
M00681 DATA 36234 0332	001139	05/25/94 08/06/93 02.2	CH2M HILL PEGGAY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON VOLATILES, SEMIVOLATILES, RFH, METALS, PESTICIDES, PCB RISK ASSESSMENT	ADMIN RECORD	VOALTILES SEMIVOLATILES TFH METALS PESTICIDES PCB RA	
M00681 DATA 0112	001280	05/27/94 08/11/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP GCMS SEMIVOLATILE ANALYSIS SDG# S3060 RFW# 9307S468	ADMIN RECORD	SEMIVOLATILES	
M00681 DATA 0096	001285	05/27/94 08/11/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP GCMS VOLATILE ANALYSIS SDG# S3060 FRW# 92\307S468	ADMIN RECORD	VOLATILES	
M00681 DATA 0070	001284	05/27/94 08/16/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL PURGEABLE PETROLEUM HYDROCARBONS ANALYSIS SDG# S3060 RFW# 9307S468	ADMIN RECORD	TPH	
M00681 DATA 0145	001283	05/27/94 08/19/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON HERBICIDES ANALYSIS SDG# S3060 RFW# 9307S468	ADMIN RECORD	HERBICIDE	
M00681 DATA 0065	001282	05/27/94 08/26/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON TOTAL EXTRACTABLE HYDROCARBONS ANALYSIS SDG# S3060 RFW#9307S468	ADMIN RECORD	TEH	
M00681 DATA 0159	001281	05/27/94 08/31/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP ORGANOCHLORINE PESTICIDES ANALYSIS SDG# S3060 RFW# 9307S468	ADMIN RECORD	PESTICIDES	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681 DATA 0163	001292	05/27/94 09/08/93 00166 02.2	WESTON MANAGERS IT CORPORATION	LABORATORY REPORT FOR MCB CAMP PENDLETON CLP INORGANIC METALS ANALYSIS SDG# S3060 RFW# 9307S468	ADMIN RECORD	IOG METALS	
M00681 DATA 0295	001108	05/25/94 09/10/93 0166 02.2	IT CORPORATION	ANALYSIS DATA FOR MCB CAMP PENDLETON SDG# CP002 HERBICIDE	ADMIN RECORD	HERBICIDE	
M00681 DATA 36562 0322	001140	05/25/94 09/17/93 02.2	CH2M HILL PEGGAY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON METALS, RISK ASSESSMENT	ADMIN RECORD	METALS RA	
M00681 DATA 36563 0327	001150	05/25/94 09/17/93 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON METALS, RISK ASSESSMENT	ADMIN RECORD	METALS RA	
M00681 DATA 0000000000000000 1385	001091	05/25/94 09/22/93 00000 02.2	IT CORPORATION	INORGANIC ANALYSIS DATA SHEET FOR MCB CAMP PENDLETON SDG# CP006 MATRIX: SOIL AND WATER	ADMIN RECORD	WATER IOG	
M00681 DATA 36561 0235	001149	05/25/94 09/24/93 00166 02.2	CH2M HILL PEGGY A. NORTON IT CORPORATION DAVE MARK	ANALYTICAL DATA FOR MCB CAMP PENDLETON RISK ASSESSMENT, PESTICIDES, PCBs	ADMIN RECORD	RA PESTICIDES PCB	
M00681 DATA 0460	001071	05/24/94 10/11/93 00166 02.2	IT CORPORATION	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP003 - A TAL METALS, CYANIDE AND MOLYBDENUM	ADMIN RECORD	METALS CYANIDE	
M00681 DATA 0269	001074	05/24/94 10/11/93 00166 02.2	IT CORPORATION	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP003 - B VOLATILE ORGANICS	ADMIN RECORD	VOC	
M00681 DATA 0120	001106	05/25/94 10/11/93 00166 02.2	IT CORPORATION	ANALYSIS DATA FOR MCB CAMP PENDLETON SDG# CP002 - D GASOLINE FUEL HYDROCARBONS	ADMIN RECORD	TFH	
M00681 DATA 0281	001107	05/25/94 10/11/93 0166 02.2	IT CORPORATION	ANALYSIS DATA FOR MCB CAMP PENDLETON SDG# CP002 - F PESTICIDES AND PCBs	ADMIN RECORD	PESTICIDES PCB	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO. / DOC . DATE / CTO . NO . . / EPA . CAT#	PRC . DATE	FROM . . . . . / FROM . SIGNATURE . . . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . . . . .
M00681 DATA 0142	001109	05/25/94 10/11/93 0166 02.2	IT CORPORATION	ANALYSIS DATA FOR MCB CAMP PENDLETON SDG# CP002 - C DIESEL FUEL HYDROCARBONS	ADMIN RECORD	TFH	
M00681 DATA 0360	001110	05/25/94 10/11/93 0166 02.2	IT CORPORATION	ANALYSIS DATA FOR MCB CAMP PENDLETON SDG# CP002 - N VOLATILE ORGANICS	ADMIN RECORD	VOC	
M00681 DATA 0696	001111	05/25/94 10/11/93 0166 02.2	IT CORPORATION	ANALYSIS DATA FOR MCB CAMP PENDLETON SDG# CP002 - C SEMIVOLATILES ORGANICS	ADMIN RECORD	SEMIVOLATILES	
M00681 DATA 0709	001112	05/25/94 10/11/93 00166 02.2	IT CORPORATION	ANALYSIS DATA FOR MCB CAMP PENDLETON SDG# CP002 - A METALS, BORON, CYANIDE AND MOLYBDENUM	ADMIN RECORD	METALS CYANIDE	
M00681 DATA 0838	001069	05/24/94 10/12/93 00166 02.2	IT CORPORATION	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON ODG# CP003 - C SEMIVOLATILE ORGANICS	ADMIN RECORD	SEMIVOLATILES	
M00681 DATA 0118	001070	05/24/94 10/12/93 00166 02.2	IT CORPORATION	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP003 - D GASOLINE FUEL HYDROCARBONS	ADMIN RECORD	TFH	
M00681 DATA 0122	001072	05/24/94 10/12/93 00166 02.2	IT CORPORATION	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP003 - E DIESEL FUEL HYDROCARBONS	ADMIN RECORD	TFH	
M00681 DATA 0286	001073	05/24/94 10/12/93 00166 02.2	IT CORPORATION	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP003 - F PESTICIDES AND PCBs	ADMIN RECORD	PESTICIDES PCB	
M00681 DATA 0870	001119	05/25/94 10/14/93 00166 02.2	IT CORPORATION	ANALYSIS DATA FOR MCB CAMP PENDLETON SDG# CP001 - C SEMIVOLATILE ORGANICS	ADMIN RECORD	SEMIVOLATILES	
M00681 DATA 0477	001120	05/25/94 10/14/93 00166 02.2	IT CORPORATION	ANALYSIS DATA FOR MCB CAMP PENDLETON SDG# CP001 - O WATER	ADMIN RECORD	WATER	

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . .
M00681 DATA 0477	001121	05/25/94 10/14/93 00166 02.2	IT CORPORATION	ANALYSIS DATA FOR MCB CAMP PENDLETON SDG# CP001 METALS, TFH, PESTICIDES, PCBs	ADMIN RECORD	METALS TFH PESTICIDES PCB	
M00681 DATA 0147	001122	05/25/94 10/14/93 00166 02.2	IT CORPORATION	ANALYSIS DATA FOR MCB CAMP PENDLETON SDG# CP001-D GASOLINE FUEL HYDROCARBONS	ADMIN RECPRD	TFH	
M00681 DATA 0219	001123	05/25/94 10/14/93 00166 02.2	IT CORPORATION	ANALYSIS DATA FOR MCB CAMP PENDLETON SDG# CP001-E DIESEL FUEL HYDROCARBONS	ADMIN RECORD	TFH	
M00681 DATA 0850	001124	05/25/94 10/14/93 00166 02.2	IT CORPORATION	ANALYSIS DATA FOR MCB CAMP PENDLETON SDG# CP001-A METALS, BORON, CYANIDE AND MOLYBDENUM	ADMIN RECORD	METALS CYANIDE	
M00681 DATA 1068	001113	05/25/94 10/15/93 00166 02.2	IT CORPORATION	ANALYSIS DATA FOR MCB CAMP PENDLETON SDG# CP004-O WATER	ADMIN RECORD	WATER	
M00681 DATA 0675	001114	05/25/94 10/15/93 00166 02.2	IT CORPORATION	ANALYSIS DATA FOR MCB CAMP PENDLETON SDG# CP004-A METALS, BORON, CYANIDE AND MOLYBDENUM	ADMIN RECORD	METALS CYANIDE	
M00681 DATA 0877	001115	05/25/94 10/15/93 00166 02.2.	IT CORPORATION	ANALYSIS DATA FOR MCB CAMP PENDLETON SDG# CP004-C SEMIVOLATILE ORGANICS	ADMIN RECORD	SEMIVOLATILES	
M00681 DATA 0410	001116	05/25/94 10/15/93 0166 02.2	IT CORPORATION	ANALYSIS DATA FOR MCB CAMP PENDLETON SDG# CP004-N VOLATILE ORGANICS	ADMIN RECORD	VOLATILES	
M00681 DATA 0148	001117	05/25/94 10/15/93 00166 02.2	IT CORPORATION	ANALYSIS DATA FOR MCB CAMP PENDLETON SDG# CP004-E DIESEL FUEL HYDROCARBONS	ADMIN RECORD	TFH	
M00681 DATA 0187	001118	05/25/94 10/15/93 00166 02.2	IT CORPORATION	ANALYSIS DATA FOR MCB CAMP PENDLETON SDG# CP004-D GASOLINE FUEL HYDROCARBONS	ADMIN RECORD	TFH	

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . .
M00681 DATA 0369	01085	05/24/94 10/21/93 00166 02.2	IT CORPORATION	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP007-H HERBICIDES WATER	ADMIN RECORD	HERBICIDE WATER	
M00681 DATA 0195	001095	05/25/94 10/21/93 00166 02.2	IT CORPORATION	ANALYSIS DATA FOR MCB CAMP PENDLETON SDG# CP006-H HERBICIDES WATER	ADMIN RECORD	HERBICIDE WATER	
M00681 DATA 1243	001099	05/25/94 10/21/93 00166 02.2	IT CORPORATION	ANALYSIS DATA FOR MCB CAMP PENDLETON SDG# CP005-O WATER	ADMIN RECORD	WATER	
M00681 DATA 0480	001100	05/25/94 10/21/93 00166 02.2	IT CORPORATION	ANALYSIS DATA FOR MCB CAMP PENDLETON SDG# CP005-N VOLATILE ORGANICS	ADMIN RECORD	VOC	
M00681 DATA 0793	001101	05/25/94 10/21/93 00166 02.2	IT CORPORATION	ANALYSIS DATA FOR MCB CAMP PENDLETON SDG# CP005-C SEMIVOLATILES	ADMIN RECORD	SEMIVOLATILES	
M00681 DATA 0742	001102	05/25/94 10/21/93 0166 02.2	IT CORPORATION	ANALYSIS DATA FOR MCB CAMP PENDLETON SDG# CP005-A METALS, BORON, CYANIDE AND MOLYBDENUM	ADMIN RECORD	METALS CYANIDE	
M00681 DATA 0749	001105	05/25/94 10/21/93 00166 02.2	IT CORPORATION	ANALYSIS DATA FOR MCB CAMP PENDLETON SDG# CP002-O CARBONATE\BICARBONATE	ADMIN RECORD	DATA	
M00681 DATA 0162	001093	05/25/94 10/28/93 00166 02.2.	IT CORPORATION	ANALYSIS DATA FOR MCB CAMP PENDLETON SDG# CP006-D GASOLINE FUEL HYDROCARBONS	ADMIN RECORD	TFH	
M00681 DATA 0200	001094	05/25/94 10/28/93 0166 02.2	IT CORPORATION	ANALYSIS DATA FOR MCB CAMP PENDLETON SDG# CP006-E DIESEL FUEL HYDROCARBONS	ADMIN RECORD	TFH	
M00681 DATA 0446	001096	05/25/94 10/28/93 00166 02.2	IT CORPORATION	ANALYSIS DATA FOR MCB CAMP PENDLETON SDG# CP006-N VOLATILES ORGANICS	ADMIN RECORD	VOC	

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . .
M00681 DATA 0471	001097	05/25/94 10/28/93 00166 02.2	IT CORPORATION	ANALYSIS DATA FOR MCB CAMP PENDLETON SDG# CP006-C SEMIVOLATILES	ADMIN RECORD	SEMIVOLATILES	
M00681 DATA 0943	001083	05/24/94 10/29/93 00166 02.2	IT CORPORATION	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP007-C SEMIVOLATILE ORGANICS	ADMIN RECORD	SEMIVOLATILES	
M00681 DATA 1056	001084	05/24/94 10/29/93 00166 02.2	IT CORPORATION	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP007-O WATER	ADMIN RECORD	WATER	
M00681 DATA 0552	001086	05/24/94 10/29/93 00166 02.2	IT CORPORATION	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP07-A METALS, BORON, CYANIDE AND MOLYBDNUM	ADMIN RECORD	METALS CYANIDE	
M00681 DATA 0215	001087	05/24/94 10/29/93 00166 02.2	IT CORPORATION	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP007-E DIESEL FUEL HYDROCARBONS	ADMIN RECORD	TFH	
M00681 DATA 0530	001088	05/24/94 10/29/93 0166 02.2	IT CORPORATION	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP007-F PESTICIDE AND PCBs	ADMIN RECORD	PESTICIDES PCB	
M00681 DATA 0507	001089	05/24/94 10/29/93 00166 02.2	IT CORPORATION	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP007-N VOLATILE ORGANICS	ADMIN RECORD	VOLATILES	
M00681 DATA 0199	001090	05/24/94 10/29/93 00166 02.2.	IT CORPORATION	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP007-D GASOLINE FUEL HYDROCARBONS	ADMIN RECORD	TFH	
M00681 DATA 0235	001092	05/25/94 10/29/93 0166 02.2	IT CORPORATION	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP006-F PESTICIDES AND PCBs	ADMIN RECORD	PESTICIDES PCB	
M00681 DATA 0142	001103	05/25/94 10/29/93 00166 02.2	IT CORPORATION	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP005-D GASOLINE FUEL HYDROCARBONS	ADMIN RECORD	TFH	

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . FROM . SIGNATURE . TO . . . . . TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . .
M00681 001104 DATA 0186	05/25/94 10/29/93 00166 02.2	IT CORPORATION	ANALYSIS DATA FOR MCB CAMP PENDLETON SDG# CP005-E DIESEL FUEL HYDROCARBONS	ADMIN RECORD	TFH	
M00681 001066 DATA 0170	05/24/94 11/03/93 00166 02.2	IT CORPORATION	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP009-H HERBICIDES	ADMIN RECORD	HERBICIDE	
M00681 001076 DATA 0199	05/24/94 11/03/93 00166 02.2	IT CORPORATION	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP008-H HERBICIDES WATER	ADMIN RECORD	WATER HERBICIDES	
M00681 001075 DATA 1180	05/24/94 11/05/93 00166 02.2	IT CORPORATION	CERFITICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP008-O WATER	ADMIN RECORD	WATER	
M00681 001077 DATA 0798	05/24/94 11/05/93 00166 02.2	IT CORPORATION	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP008-C SEMIVOLATILE ORGANICS	ADMIN RECORD	SEMIVOLATILES	
M00681 001078 DATA 0873	05/24/94 11/05/93 00166 02.2	IT CORPORATION	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP008-F PESTICIDES AND PCBs	ADMIN RECORD	PESTICIDES PCB	
M00681 001079 DATA 0403	05/24/94 11/05/93 0166 02.2	IT CORPORATION	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP008-N VOLATILE ORGANICS	ADMIN RECORD	VOC	
M00681 001080 DATA 0935	05/24/94 11/05/93 00166 02.2	IT CORPORATION	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP008-A METALS, BORON, CYANIDE AND MOLYBDENUM	ADMIN RECORD	METALS CYANIDE	
M00681 001081 DATA 0171	05/24/94 11/05/93 00166 02.2.	IT CORPORATION	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP008-E DEISEL FUEL HYDROCARBONS	ADMIN RECORD	TFH	
M00681 001082 DATA 0185	05/24/94 11/05/93 00166 02.2	IT CORPORATION	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP008-D GASOLINE FUEL HYDROCARBONS	ADMIN RECORD	TFH	

UIC No. DOC. NO. DOCUMENT . TYPE . . . CONTR/GUID . . NO . . APPROX. # . OF . PAGES	PRC . DATE DOC . DATE CTO . NO . . EPA . CAT#	FROM . . . . . FROM . SIGNATURE . TO . . . . . TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . .
M00681 001054 DATA 000000000000000 0100	05/24/94 11/11/93 00166 02.2	IT CORPORATION DAVE MARK	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP010-H WATER	ADMIN RECORD	WATER	SOUTHWEST DIVISION
M00681 001098 DATA 0581	05/25/94 11/11/93 00166 02.2	IT CORPORATION	ANALYSIS DATA FOR MCB CAMP PENDLETON SDG# CP006-A METALS, BORON, CYANIDE AND MOLYBDENUM	ADMIN RECORD	METAL CYANIDE	
M00681 001050 DATA 000000000000000 0375	05/24/94 11/12/93 00166 02.2	IT CORPORATION DAVE MARK	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON CSQB# CP010-N VOLATILE ORGANICS USING COMBINED GAS CHROMATOGRAPHY-MASS	ADMIN RECORD	VOA	SOUTHWEST DIVISION
M00681 001051 DATA 000000000000000 0667	05/24/94 11/12/93 00166 02.2	IT CORPORATION DAVE MARK	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON CSQB# CP010-A TAL METALS, BORON, CYANIDE AND MOLYBDENUM	ADMIN RECORD	METALS CYANIDE	SOUTHWEST DIVISION
M00681 001052 DATA 000000000000000 0320	05/24/94 11/12/93 00166 02.2	IT CORPORATION DAVE MARK	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON CSQB# CP010-C SEMIVOLATILE ORGANICS	ADMIN RECORD	SEMIVOLATIL ES	SOUTHWEST DIVISION
M00681 001053 DATA 000000000000000 0141	05/24/94 11/12/93 0166 02.2	IT CORPORATION DAVE MARK	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON CSQB# CP010-E BOILING FUEL HYDROCARBONS DIESEL	ADMIN RECORD	TFH	SOUTHWEST DIVISION
M00681 001056 DATA 000000000000000 0319	05/24/94 11/12/93 00166 02.2	IT CORPORATION DAVE MARK	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP010-F PESTICIDES AND PCBs	ADMIN RECORD	PESTICIDES PCB	SOUTHWEST DIVISION
M00681 001057 DATA 000000000000000 1013	05/24/94 11/12/93 00166 02.2.	IT CORPORATION DAVE MARK	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP010-O WATER	ADMIN RECORD	WATER	SOUTHWEST DIVISION
M00681 001058 DATA 000000000000000 0124	05/24/94 11/12/93 00166 02.2	IT CORPORATION DAVE MARK	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP010-D FUEL HYDROCARBONS GASOLINE	ADMIN RECORD	TFH GROUP B	SOUTHWEST DIVISION
M00681 001061 DATA 0764	05/24/94 11/12/93 00166 02.2	IT CORPORATION DAVE MARK	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP009-A TAL METALS, BORON, CYANIDE AND MOLYBDENUM	ADMIN RECORD	METALS CYANIDE	SOUTHWEST DIVISION

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . / TO . . . . . / TO . SIGNATURE	. . . . . SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site . . . . . Location . .
M00681 DATA 1540	001062	05/24/94 11/12/93 00166 02.2	IT CORPORATION DAVE MARK	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP009-O WATER	ADMIN RECORD	WATER	SOUTHWEST DIVISION
M00681 DATA 0746	001064	05/24/94 11/12/93 00166 02.2	IT CORPORATION DAVE MARK	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP009-C SEMICOLATILES ORGANICS	ADMIN RECORD	SEMIVOLATILES	SOUTHWEST DIVISION
M00681 DATA 0502	001065	05/24/94 11/12/93 00166 02.2	IT CORPORATION DAVE MARK	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP009-N VOLATILE ORGANICS	ADMIN RECORD	VOA	
M00681 DATA 0173	001067	05/24/94 11/12/93 00166 02.2	IT CORPORATION	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP009-E DIESEL FULE HYDROCARBONS	ADMIN RECORD	TFH	
M00681 DATA 0162	001068	05/24/94 11/12/93 00166 02.2	IT CORPORATION	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON ODG# CP009-D GASOLINE FUEL HYDROCARBONS	ADMIN RECORD	TFH	
M00681 DATA 000000000000000 0382	001055	05/24/94 11/16/93 0166 02.2	IT CORPORATION DAVE MARK	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP011-A TAL METALS, BORON, CYANIDE AND MOLYBDENUM	ADMIN RECORD	METALS CYANIDE	SOUTHWEST DIVISION
M00681 DATA 000000000000000 0150	001059	05/24/94 11/16/93 00166 02.2	IT CORPORATION DAVE MARK	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP012-H WATER AND SOIL	ADMIN RECORD	WATER	SOUTHWEST DIVISION
M00681 DATA 000000000000000 0538	001060	05/24/94 11/17/93 00166 02.2.	IT CORPORATION DAVE MARK	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP011-C SEMIVOLATILES ORGANICS	ADMIN RECORD	SEMIVOLATILES	SOUTHWEST DIVISION
M00681 DATA 000000000000000 0507	001063	05/24/94 11/19/93 00166 02.2	IT CORPORATION DAVE MARK	CERTIFICATE OF ANALYSIS FOR MCB CAMP PENDLETON SDG# CP000-F PESTICIDES AND PCBs	ADMIN RECORD	PESTICIDES PCB	GROUP B SOUTHWEST DIVISION
M00681 DATA 000000000000000 0007	002168	06/30/94 12/03/93 00000 00.0	IT CORPORATION W.N. THORNTON MCB CAMP PENDLETON	UNDERGROUND STORAGE TANK SITE ASSESSMENT	ADMIN RECORD	PR ESR UST	SOUTHWEST DIVISION

MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY DOC. DATE)

UIC No. / DOCUMENT . TYPE . . . / CONTR/GUID . . NO . . / APPROX. # . OF . PAGES	DOC. NO.	PRC . DATE / DOC . DATE / CTO . NO . . / EPA . CAT#	FROM . . . . . / FROM . SIGNATURE . . . . . / TO . . . . . / TO . SIGNATURE	. . . . . .SUBJECT	CLASSIFICATION	KEY WORDS	. . . Site	. . . . . .Location . . . . .
M00681 DATA 000000000000000 0052	002211	06/30/94 02/03/94 00166 04.4	I.T. CORPORATION SHERRY GAZZIGLI SOUTHWEST DIVISION CHRIS POTTER	CORRECTIONS TO SDG'S SENT BY THE IT LAB.	ADMIN RECORD			SOUTHWEST DIVISION
M00681 DATA 000000000000000 0021	003293	08/25/97 03/08/95 00000 01.1		MISCELLANEOUS DATA INCLUDING ATTENDANCE SHEET TO MAR. 8, 1995 ECOLOGICIAL RISK ASSESSMENT SCOPING SESSION AND SOIL EXPOSURE FOR VARIOUS SITES	ADMIN RECORD INFO REPOSITORY	DATA SOIL HABITAT RA	1D 1E 2B 2C 10 16 17 25N 26 27 28 29 30 35	SOUTHWEST DIVISION MCB CAMP PENDLETON

TOTAL RECORDS PRINTED: 1360

REPORT SPECIFICATION FOR: RPT210

TITLE: MCB CAMP PENDLETON ADMINISTRATIVE RECORD FILE INDEX (SORTED BY D

FILE: Central Activity File Documents

SELECTION CRITERIA:
(01) Type IS "DATA" & UIC. No. IS "M00681"

SORT CRITERIA:
01 Doc. Date

PAGE BREAK LEVEL:
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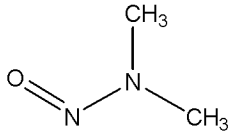
TYPE REPORT FORM
PAPER MASTER ACTIVITY FILE (with key/Add Info)

N-NITROSODIMETHYLAMINE
CAS No. 62-75-9

First Listed in the *Second Annual Report on Carcinogens*



CARCINOGENICITY

N-Nitrosodimethylamine is *reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity in experimental animals (IARC 1978, 1982). When administered orally, *N*-nitrosodimethylamine induced liver hemangiosarcomas, hepatocellular carcinomas, and kidney and lung tumors in mice. When mice were exposed by inhalation, the compound induced tumors in the lung, liver, and kidney. When administered by intramuscular injection, the compound induced hemangiosarcomas of the liver and abdominal tissues and lung tumors in adult mice, and parenchymal cell and vascular tumors of the liver and lung adenomas in new born and suckling mice. When administered by intraperitoneal injection, the compound induced liver tumors in adult and newborn mice, and increased the incidence of lung and kidney tumors in mice. When administered orally, *N*-nitrosodimethylamine induced kidney and bile duct tumors in rats; when rats were exposed by inhalation, it induced tumors of the lung, liver, kidney, and nasal cavity. When administered by intramuscular injection, the compound induced kidney tumors in adult rats and kidney and liver tumors in newborn and suckling rats; it induced kidney and nasal cavity tumors in rats when administered by intraperitoneal injection. When administered orally, *N*-nitrosodimethylamine induced hepatocellular carcinomas and bile duct tumors in hamsters; when administered by intramuscular injection, it induced hemangiosarcomas in the liver and bile duct and nasal cavity tumors in hamsters. When administered orally, the compound induced hepatocellular carcinomas and bile duct tumors in rabbits and guinea pigs, liver hemangiosarcomas in ducks, and liver adenomas and adenocarcinomas in fish. When administered by intramuscular injection, the compound induced bile duct tumors in mastomys; when administered by intraperitoneal injection, it induced liver tumors in newts.

No adequate human studies of the relationship between exposure to *N*-nitrosodimethylamine and human cancer have been reported (IARC 1978, 1987).

PROPERTIES

N-Nitrosodimethylamine is a volatile, yellow, oily liquid of low viscosity. It is soluble in water, alcohol, ether, other organic solvents, and lipids. The compound is sensitive to light, especially ultraviolet light, and undergoes relatively rapid photolytic degradation. *N*-Nitrosodimethylamine is combustible, and when heated to decomposition, it emits toxic fumes of nitrogen oxides. It is incompatible with strong oxidizers and strong bases (HSDB 2000).

USE

N-Nitrosodimethylamine is used primarily as a research chemical. Prior to April 1, 1976, the compound was used as an intermediate in the electrolytic production of 1,1-dimethylhydrazine, a storable liquid rocket fuel containing approximately 0.1% *N*-nitrosodimethylamine as an impurity. Other uses of *N*-nitrosodimethylamine include the control of nematodes, inhibition of nitrification in soil, plasticizer for rubber and acrylonitrile polymers, in active metal anode-electrolyte systems (high-energy batteries), in the preparation of thiocarbonyl fluoride polymers, and as a solvent in the fiber and plastics industry, an antioxidant, a softener of copolymers, and an additive to lubricants (Sittig 1985, Merck 1983).

PRODUCTION

Current production data were not available, and there was no evidence that *N*-nitrosodimethylamine is manufactured commercially in the United States (IARC 1978, HSDB 2000). Chem Sources (2001) reported that there were nine U.S. suppliers of *N*-nitrosodimethylamine in 2000. The 1979 TSCA Inventory reported four U.S. companies producing 1,000 lb in 1977 with some site limitations. No import or export data were reported (TSCA 1979). The last commercial producer of *N*-nitrosodimethylamine closed its plant in 1976. Commercial production began in the mid 1950s for use in the manufacture of 1,1-dimethylhydrazine (IARC 1978).

EXPOSURE

The primary routes of potential human exposure to *N*-nitrosodimethylamine are ingestion, inhalation, and dermal contact. There is some potential for occupational exposure of laboratory, copolymer, lubricant, and pesticide workers. The National Occupational Exposure Survey (1981-1983) indicated that 747 workers, including 299 women, were potentially exposed to *N*-nitrosodimethylamine (NIOSH 1984). OSHA regulations concerning *N*-nitrosodimethylamine designate strict procedures to avoid worker contact. Mixtures containing ≥1.0% *N*-nitrosodimethylamine must be maintained in isolated or closed systems, workers must observe special hygiene rules, and certain procedures must be followed for movement of the material and in case of accidental spills and emergencies. Synthetic cutting fluids, semisynthetic cutting oils, and soluble cutting oils may contain nitrosamines, either as contaminants in amines or as products from reactions between amines and nitrite. Concentrations of nitrosamines have been found in certain synthetic cutting oils at levels ranging from 1 to 1,000 ppm. There are approximately 8 to 12 additives that could be responsible for nitrosamine formation in cutting oils. Approximately 750,000 to 780,000 workers employed by more than 1,000 cutting fluid manufacturing firms are potentially exposed to nitrosamines in cutting oils. In addition, there is potential exposure of an undetermined number of machine shop workers who use these fluids. The general population may possibly be exposed to unknown quantities of *N*-nitrosodimethylamine present in foods and beverages, tobacco smoke, herbicides, pesticides, drinking water, and industrial pollution. Estimates indicate that air, diet, and smoking contribute to potential human exposure at levels of a few micrograms per day. *N*-Nitrosodimethylamine is present in a variety of foods including cheeses, soybean oil, canned fruit, various meat products, bacon, various cured meats, frankfurters, ham (cooked), fish and fish products, spices used for meat curing, apple brandy, other alcoholic beverages, and beer. Concentrations in these foodstuffs have been measured to be between 0 and 85 μg/kg. FDA and CPSC have determined that *N*-nitrosamines, such as *N*-nitrosodimethylamine, are frequently produced during rubber processing and may be present as contaminants in the final rubber product. Potential exposure

depends on the ability of the nitrosamine to migrate from the product into the body. *N*-Nitrosodimethylamine has been detected in numerous drugs formulated with aminopyrine, including tablets, suppositories, injections, drops, and syrups, at concentrations ranging from <10 to 371 μg/kg. *N*-Nitrosodimethylamine has been detected in tobacco smoke at concentrations of 0 to 140 ng/cigarette. Mainstream smoke of nonfiltered cigarettes contained 13 to 65 ng/cigarette, and 5.7 to 43 ng/cigarette for filtered cigarettes. Sidestream smoke of nonfiltered cigarettes contained 680 to 823 ng/cigarette, and 1,040 to 1,770 ng/cigarette for filtered cigarettes. An analysis of smoke-filled rooms, such as bars, indicated concentrations of 90 to 240 ng/m^3 *N*-nitrosodimethylamine, and residences contained <5 ng/m^3. Indoor air polluted with tobacco smoke has been shown to contain up to 0.24 ng/L *N*-nitrosodimethylamine (HEEP 1980).

N-Nitrosodimethylamine is widespread in the environment, but it is rapidly decomposed by sunlight, and thus does not usually persist in ambient air or water illuminated by sunlight (HEEP 1980). *N*-Nitrosodimethylamine was detected as an air pollutant in Baltimore, MD, and in Belle, WV. In Baltimore, the prime source was found to be a chemical plant that manufactured 1,1-dimethylhydrazine. The concentration of *N*-nitrosodimethylamine at the factory ranged from 6,000 to 36,000 ng/m^3, 1,000 ng/m^3 in adjacent residential neighborhoods, and approximately 100 ng/m^3 two miles away in downtown Baltimore. This plant was closed in April 1976. In Belle, the source of the *N*-nitrosodimethylamine was found to be a chemical factory manufacturing and using dimethylamine; the *N*-nitrosodimethylamine was being produced as an unwanted by-product. Concentrations in downtown Belle and Charleston, WV ranged from 1 to 40 ng/m^3. Similar concentrations of *N*-nitrosodimethylamine have been detected at chemical factories making and/or using dimethylamine, including plants in New York City, Boston, and New Jersey. *N*-Nitrosodimethylamine has been detected in sea water adjacent to the Baltimore factory at concentrations of 0.08 to 0.25 μg/L and in an adjacent sewage treatment facility at 3 μg/L. Industrial wastewater from chemical factories was found to contain 0.2 to 5 μg/L (IARC 1978). *N*-Nitrosodimethylamine has been detected in deionized water at concentrations of 0.012 to 0.34 μg/L, in high-nitrate well water at <0.01 μg/L, and in chlorinated drinking water at 0.02 to 0.82 μg/L. Soil samples taken from locations near industrial plants contained 0 to 15.1 ng/g *N*-nitrosodimethylamine. Dimethylamine-formulated pesticides and herbicides were found to contain 190 to 640 mg/L (IARC 1978). Significant levels of *N*-nitroso compounds have been identified in a number of materials including pesticides, cosmetics, drugs, cutting fluids, and fire-resistant hydraulic fluids. The *N*-nitroso compounds found in these products were apparently formed *in situ* during storage or handling as the result of a reaction between amines present in the mixture and inorganic nitrite, which may have been added as a corrosion inhibitor (CHIP, 1978). Additional exposure information may be found in the ATSDR Toxicological Profile for *N*-Nitrosodimethylamine (ATSDR 1989).

REGULATIONS

EPA regulates *N*-nitrosodimethylamine under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), which established a reportable quantity (RQ) of 10 lb. EPA also regulates *N*-nitrosodimethylamine under the Resource Conservation and Recovery Act (RCRA) as a constituent of hazardous waste and under the Clean Water Act (CWA) with respect to accidental releases of the compound. The Superfund Amendments and Reauthorization Act (SARA) identifies *N*-nitrosodimethylamine as an extremely hazardous substance and establishes threshold planning quantities and facility notification responsibilities for state and local emergency response plans. SARA also subjects *N*-nitrosodimethylamine to reporting requirements and requires the preparation of its toxicological profile. Under the Toxic Substances Control Act (TSCA), EPA has prohibited the addition of nitrites to fluids used in

metal cutting if they contain triethanolamine salt, tricarboxylic acid, or a tricarboxylic acid intermediate.

An enforcement policy was issued by the Consumer Products Safety Commission (CPSC) announcing that the Commission may take action against pacifiers, containing more than 60 ppb nitrosamines, entering interstate commerce. These studies have determined the presence of specific nitrosamines, including *N*-nitrosodimethylamine, in pacifiers and nipples, and the amounts released into saliva stimulant and food.

FDA has set a 10-ppb limit on nitrosamines in rubber nipples for baby bottles. An ASTM standard has been developed which sets the level of nitrosamines in pacifiers at 10 ppb for any individual nitrosamine. FDA also established action levels of 5 ppb *N*-nitrosodimethylamine in malt beverages and 10 ppb in barley malt, which is expected to reduce or eliminate exposure from these sources.

NIOSH recommends that levels of *N*-nitrosodimethylamine be kept as low as feasible. OSHA promulgated a standard for *N*-nitrosodimethylamine that includes requirements for protective clothing, respirators, medical surveillance, and engineering controls. OSHA regulates *N*-nitrosodimethylamine under the Hazard Communication Standard and as a chemical hazard in laboratories. Regulations are summarized in Volume II, Table 128.

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Water Quality Management Plan for HOAs and Property Management Companies

In Aliso Viejo, approximately 50 percent of all street mileage and 95 percent of public parks and landscaped areas are maintained and managed by HOAs and property management companies. Water quality is a critical element to the quality of life in Aliso Viejo and the City of Aliso Viejo is committed to protecting the water quality of our local water-bodies which include Aliso Creek and Wood Canyon Creek and ultimately the ocean from pollution.

In order to protect and preserve these water-bodies, the City and HOAs/property management companies must work together to achieve the common goal of improving the water quality. To accomplish our water quality objectives the City of Aliso Viejo is requiring all HOAs and Property Management Companies to develop and implement a Water Quality Management Plan (WQMP) through City Council action. A WQMP is practical plan that is designed to address and manage threats to water quality. These management plans will require the use Best Management Practices (BMPs) that in essence are practical and effective methods for preventing urban runoff from entering the storm drain system and our local water-bodies.

Urban runoff has been identified as one of the most significant sources of pollution in our nation's streams, creeks, and oceans. According to the U.S. Environmental Protection Agency (EPA), urban runoff is the second largest source of water quality damage in waterways and a significant contributor to the damage to lakes, rivers, and bays. Urban runoff occurs when excessive water use from irrigation, car washing and other activities drains off paved surfaces and into the storm drain system carrying with it pollutants such as oil, trash, vegetation, pesticides, and bacteria. These pollutants carried by urban runoff, flow untreated directly into our local water-bodies and eventually into the Pacific Ocean. Under the City of Aliso Viejo's Water Quality Ordinance, which was adopted earlier this year, all non-storm water discharges, including irrigation water, are prohibited from entering the storm drain system. Common violations include washing down sidewalks or streets or any other facility if no preventive measures are taken to protect the storm drain system. Also prohibited is excessive runoff from over-irrigation or faulty irrigation systems which lead to runoff from lawns, gardens, and other irrigated surfaces.

The Water Quality Ordinance was adopted in order to meet the requirements of the Municipal Storm Water Permit as issued by the San Diego Regional Water Quality Control Board (SDRWQCB) of which the City is a regional member. This region's permit is one of the toughest in the state. The City must implement all provisions of the permit which also addresses water quality pollution from HOA/Property Management managed areas. The Municipal Storm Water Permit contains provisions that allow the SDRWQCB to levy fines against the City for non-compliance. These fines can reach a maximum of $25,000 a day per violation so it is imperative that the City and HOAs/property management companies work together to achieve compliance.

To address the prohibitions under the Water Quality Ordinance, the City of Aliso Viejo has identified the following conditions as contributory factors to urban runoff and prohibited discharges of non-storm water:

- Over-irrigation
- Improper maintenance and cleaning procedures/activities
- Improperly maintained facilities such as:
    - Streets
    - Dumpster enclosures
    - Catch Basins
- Residential car-washing

A WQMP includes the following seven basic elements for the prevention of urban runoff:

- Common Area Landscaping and Irrigation
- Resident/Tenant Area Landscaping and Irrigation
- Cleaning and Maintenance Activities
- Private Street Maintenance
- Street Sweeping
- Inspections/Cleaning of Storm Drain Catch Basins
- Carwashing
- Education (residents, tenants, staff, and contract staff)

WQMP Program Elements

Each major WQMP Program Element is discussed in the following pages.

COMMON AREA LANDSCAPING & IRRIGATION

Common area landscaping and irrigation activities can be major contributors to ocean pollution. Soils, yard wastes, and garden chemicals combined with over watering become part of the urban runoff mix that winds its way through streets, gutters, and storm drains before entering the ocean. Poorly functioning sprinklers and over watering, for example, waste water and increase the number of pollutants flowing into storm drains.

Fertilizers (including organic manures), pesticides and herbicides are washed off lawns and landscaped areas. These chemicals, fecal bacteria, and excess nutrients from fertilizers, and pet-waste contaminate ground and surface waters. Leaves, grass clippings, and tree trimmings that are swept or blown into the street and gutters clog catch basins, increasing the risk of flooding on your street.

To prevent pollution from landscaping and over irrigation from entering the storm drain system, each HOA or property management company must develop and implements methods/programs for pollution prevention. These methods/programs must be implemented on all sites where landscaping and irrigation occurs that are maintained by the HOA or property management company. Bellow are general and site-specific BMPs that are to be implemented to prevent pollution from landscaping and irrigation activities.

Landscaping

- Protect stockpiled materials (mulch, fertilizer, sod, etc.) from wind and rain by storing them under tarps or secured plastic sheeting. All stockpiles must be effectively bermed to prevent materials from leaving area due to rain or run off.
- Schedule grading and excavation projects for dry weather.
- Protect all storm drain inlets, grates, and culverts when working in an area where there is soil disturbance or use of landscaping materials (mulch, fertilizer, sod, etc.).
- Place landscaping materials away from sidewalks, streets, and pathways. Downstream storm drains with possible contamination from bulk landscaping materials must be protected.
- Do not wash down sidewalk or driveways. Instead, sweep up loose materials and place in trash can.
- Store pesticides, fertilizers, and other chemicals in a covered area to prevent runoff. Provide secondary containment where necessary.

- Irrigation controllers must be adjusted to seasonal requirements. Controllers must have radio feed for weather control or be manually adjusted. All controllers need rain gauges to eliminate watering during a rain event.

Irrigation

- Do not over water. Conserve water by using irrigation practices such as drip irrigation, soaker hoses, or micro-spray systems.
- Group plantings according to water requirements and whenever possible, select drought-tolerant native plants which naturally require little fertilizer or water once established.
- Periodically inspect and fix leaks and misdirected and/or broken sprinklers.

Landscape Maintenance

- Do not blow or rake leaves into the street, gutter, or storm drains.
- Do not wash down sidewalk or driveways. Instead, sweep up loose materials and place in trash can.
- Use organic or non-toxic fertilizers if possible.
- Do not over fertilize and do not fertilize near ditches, streams, or other water bodies. Read labels and use only as directed. Spot apply, rather then blanketing and entire area.
- Never apply pesticides or fertilizers when rain is in the forecast.
- Store pesticides, fertilizers, and other chemicals in a covered area to prevent runoff.
- Use native vegetation where applicable.
- Schedule irrigation and chemical application to minimize runoff and contamination of the storm drain system.
- Emphasize the proper collection and disposal of unused pesticides, herbicides, and fertilizers.
- Remove animal feces, leaves, paper and other debris on a daily basis.
- Train (and keep records of that training) the workers in the proper procedures.
- Obtain permits, certifications and other measures required for applicators

Minimum BMPs

The following Best Management Practices (BMPs) need to be implemented at every site where landscaping activities are underway.

Erosion and Sediment Control: BMPs for Landscaping Projects

All landscaping projects, regardless of size, are required to implement BMPs to prevent discharges into the storm drain system or water bodies. At a minimum, all landscaping project sites are to implement and be protected by an effective combination of erosion and sediment controls and waste and materials management BMPs. The minimum requirements are summarized in the table shown below. These minimum requirements are to be conveyed to landscaping staff/contractors as part of the WQMP requirements.

Minimum Requirements for All Landscaping Sites

CATEGORY	MINIMUM REQUIREMENTS
Erosion and Sediment Control	Sediments from areas disturbed by landscaping activity shall be retained on site using an effective combination of erosion and sediment controls to the maximum extent practicable, and stockpiles of soil shall be properly contained to minimize sediment transport from the site to streets, drainage facilities or adjacent properties via runoff, vehicle tracking, or wind. Protect all storm drain inlets/catch basins from sediment.
Waste and Materials Management Control	Landscaping-related materials, wastes, spills or residues shall be retained on site to minimize transport from the site to streets, drainage facilities, or adjoining property by wind or runoff. Protect all storm drain inlets/catch basins from landscaping waste and materials.

Examples of Erosion and Sediment Control BMPs:

Sandbag berms:

Sandbag berms may be used during landscaping activities to contain sediment in place and prevent sediment and landscaping waste and materials from leaving the landscape project site. Sandbag berms can also be used in conjunction with waterproof tarps and plastic sheeting to cover and protect storm drain inlets/catch basins. All landscaping materials and waste should be covered with a tarp or other water proof cover when not actively being used as part of the landscaping project. At no time should landscaping materials or waste be place on the sidewalk or street regardless of containment.

Appropriate Applications:

- Along the perimeter of the project site
- Across swales with small catchments
- Around stockpiled landscape materials and waste

- To divert or direct flow away from storm drain inlets/catch basins
- To capture and detain non-storm water flows for proper disposal into sanitary sewer or permeable turf areas for infiltration

SILT FENCE

A silt fence is made of a filter fabric that has been entrenched, attached to supporting poles, and sometimes backed by a plastic or wire mesh for support. This silt fence detains sediment-laden water, promoting sedimentation behind the fence.

Appropriate Applications:

- Along the perimeter of the project site
- Below the toe or down slope of exposed and erodible slopes
- Around temporary spoil areas and stockpiles
- Below other small cleared areas

STRAW BALE BARRIER

A straw bale barrier is a series of straw bales placed on a level contour to intercept sheet flows. Straw bale barriers pond sheet-flow runoff, allowing sediments to settle out and prevent runoff.

Appropriate Applications:

- Along the perimeter of the project site
- Below the toe of slopes and erodible slopes
- Below other cleared areas
- Down slope of exposed soil areas
- Parallel to roadway to keep sediment off paved areas

IRRIGATION

Improper irrigation can lead to runoff of irrigation water. Runoff from improper irrigation carries many pollutants from landscaped areas such as fertilizer, pesticides, herbicides, and sediment into the storm drain system. Improper irrigation also invites disease, increases the need for fertilizer and wastes water. An efficient and environmentally friendly irrigation program must include three basic steps:

1. Determining how much should be applied.
2. Deciding how water is to be applied.
3. Maintenance of irrigation system

Amount of water to apply

The amount of water to apply at any one time varies with the amount of water present in the soil, the water-holding capacity of the soil, and drainage characteristics. An efficient watering wets only the turf grass root-zone, does not saturate the soil, and does not allow water to run off. Generally, turf grasses require no more than 0.3 inches of water per day. Under extreme summer conditions, water use can be as high as 0.4 inches of water per day. During the winter when grasses are not actively growing, water use can be as little as 0.05 inches of water per day.

A simple watering schedule would be to apply ¾ inch of water when the turf grasses show water deficiency symptoms as discussed earlier. Once this ¾ inch of water is applied, do not apply any more until water stress symptoms are again noticeable. Typically, two to three waterings per week in the summer and once every 10 to 14 days in the winter are required. If rainfall occurs, irrigation should be suspended according to the rainfall amount.

Manner of applying water

Water should never be applied at a rate faster than it can be absorbed by the soil. If the sprinkler applies too much water, water runs off, and is wasted and contributes to water quality pollution.

Avoid extremes in watering frequency and amount. Light, frequent watering is inefficient and encourages shallow root systems. Excessive irrigation, which keeps the root system saturated with water, is harmful to landscape. Roots need a balance of water and air to function and grow properly and the time of watering is important. The best time for lawn irrigation is in the early morning hours. Watering during the day can waste water by excessive evaporation and during very hot periods can scald the lawn.

Maintenance of Irrigation System(s)

Proper maintenance of an irrigation system is required to insure efficient uniform irrigations and to prevent runoff. Ensuring that the sprinklers and emitters are working properly is a major part of irrigation system maintenance. The following items help keep sprinklers operating properly:

- Keep heads properly aligned, leveled, and rotating.
- Clean plugged sprinklers, emitters and filters when needed.
- Replace broken sprinklers, worn nozzles and emitters with appropriate parts to maintain matched application rates and uniformity.

- Keep grass and plants away from sprinklers so spray patterns are not disturbed by them. Raise sunken heads.
- Insure that sprinklers apply water to landscape area and **do not overspray** onto sidewalks, or streets.

RESIDENT/TENANT LANDSCAPING & IRRIGATION

Residential and tenant owned and maintained landscape and hard surfaces also require the same pollution prevention methods/programs to be implemented. It is the duty of the HOA or property management company to ensure that residents and tenants abide by the same rules and proper methods of landscaping and irrigation.

As part of the WQMP, HOAs and Property Management Companies must develop a program to encourage residents/tenants to use pollution prevention methods to prevent pollution and runoff from improper irrigation. This program should also contain provisions for enforcement and penalties should violations of the Water Quality Ordinance occur repeatedly. Staff may wish call Aliso Viejo's Water Pollution Reporting Hotline (the Hotline number is (949) 425-2554 to report violators. City staff will respond in a timely manner to take the appropriate action. However, it is the responsibility of the HOA/property management company to ensure that residents do not violate any provisions of the Water Quality Ordinance. This will require educating and informing residents/tenants of proper landscaping and irrigation methods.

Residents/Tenants are also required to apply for a **Water Quality Permit** (the Water Quality Permit will be discussed in further detail under the Education component) should they engage in any activity that results in the disturbance of soil such as grading, excavation, clearing, construction, structure construction, or structure demolition; and sites where uncovered storage of materials and wastes such as dirt, sand or fertilizer occurs; or exterior mixing of cementaceous products such as concrete, mortar or stucco will occur. Residents/Tenants should be advised of the new requirements and a plan for informing residents/tenants should be developed. Methods for informing residents/tenants can include newsletters, brochures, and workshops.

Cleaning and Maintenance Activities

When cleaning and maintaining HOA/Property Management facilities, you need to follow these guidelines in order to prevent waste or washwater from entering the storm drains where it flows untreated to the ocean.

- Do not wash down sidewalk or driveways. Instead, sweep up loose materials and place in trash can. If water must be used (steam cleaning, pressure washing) to remove stains or other residues, block all local downstream storm drains and collect all water/waste for disposal to the sanitary sewer.
- Clean floormats, filters and garbage cans in a mop sink, or in an area with a floor drain that is connected to the sanitary sewer or in an area which will contain the washwater.
- Pour all washwater into a janitorial or mop sink.
- Keep dumpster areas clean and lids closed. If water must be used (steam cleaning, pressure washing) to remove stains or other residues, block all local downstream storm drains and collect all water/waste for disposal to the sanitary sewer.

These methods or BMPs must be implemented for the cleaning and maintenance for all facilities and hard surfaces. These BMPs also apply to resident/tenant cleaning activities and each HOA/Property Management is required to ensure that residents/tenants are aware of and comply with these regulations.

STREET SWEEPING

One major contributor of pollutants to local water bodies such as Aliso Creek and Wood Canyon Creek are our streets both public and private. During a rain storm, public and private streets act as conveyance structures for rainfall as it makes its way into the storm drain system before discharging into Aliso or Wood Canyon Creek. Any pollutant or contaminant on the street is carried by the rainwater directly into the storm drain system, thus negatively impacting the water quality of Aliso and Wood Canyon Creeks. Typical pollutants found on our local streets include trash, vegetation, sediment, cigarette butts, and animal waste.

As part of the WQMP, HOAs/Property Management Companies are required to sweep their privately owned/maintained streets at least once a month. All public streets that are maintained by the City are swept twice a month and the City would like the cooperation and assistance of your association by developing and implementing similar protective measures and activities that would eliminate or effectively reduce the threat to water quality posed by pollutants on public/private streets. In order to verify compliance with this new requirement, please attach invoices or work orders for street sweeping to the WQMP when you submit a copy to the City. These invoices or other types of documentation will be used to ensure that the most effective measures are in place for dealing with pollutants and contaminants.

INSPECTION/CLEANING OF STORM DRAIN CATCH BASINS

Another basic measure for pollution prevention is annual cleaning of storm drain catch basins prior to the commencement of the rainy season which starts on October 1 of each year. The annual cleaning of storm drain catch basins prior to the rainy season is and should be implemented by October 15th of each year. Cleaning catch basins prior to the rainy season will remove trash and other debris that is captured in the catch basin. This trash and debris is often washed out by the first rain storm and is flushed out into our local water-bodies via the storm drain system.

In order to verify compliance with this new requirement, please attach invoices or work orders for catch basin cleaning services to the WQMP when you submit a copy to the City. These invoices or other types of documentation will be used to ensure that the most effective measures are in place for dealing with pollutants and contaminants.

PRIVATE STREET MAINTENANCE

Slurry sealing, cutting concrete, repairing or replacing asphalt, and other activities related to the maintenance of private streets can potentially have a negative impact on water quality if not conducted properly. To prevent pollution from entering the storm drain system and ultimately into local water bodies, specific minimum BMPs must be implemented. These minimum BMPs should be implemented to achieve the following goals:

- Protect the storm drain system. All storm drain inlets must be covered with an impermeable material during street maintenance
- Eliminate vehicle tracking from project site
- Implement a spill prevention and clean-up program
- Designate a clean up area for equipment. Post procedures for job in progress
- Place all temporary outhouses away from drainage facilities such as catch basins and provide secondary containment

Prior to commencement of street maintenance or street improvement projects, the City must be notified at least **three days in advance.** Please call the Public Works Department at (949) 425-2530 for notification.

CARWASHING

When washing a car, wash water containing soap and detergent, residues from exhaust fumes, brake pads, gasoline and motor oil washes off the car, flows off the pavement and into nearby storm drains. Alone, one car may not create a significant adverse environmental impact. But, collectively, car washing by residents/tenants can contribute significant amounts of wash water and pollutants to the storm drain system.

To address this potentially negative impact to water quality, HOAs/Property Management Companies must designate specific areas/locations for car-washing. These areas/locations must be designed to allow all wash water to either drain into the sanitary sewer or be located at a site where the wash water can soak into grass, gravel, or be diverted to nearby landscaping. This will allow the wash water to filter through the vegetation and/or soil instead of flowing directly into a storm drain. If you select a site that drains into a street, block off the storm drain with sandbags and either divert the wash water to an area where the water can pool and evaporate throughout the day or arrange to dispose of the wash water down a sanitary sewer drain.

Under the WQMP, these specific locations for carwashing should be identified and methods/procedures to inform both staff and residents/tenants of these new car-washing requirements. Please provide a map of the location(s)/site(s) as well as details regarding how the wash water will be prevented from entering the storm drain system.

EDUCATION

Public education is an essential part of the WQMP. Developing programs to inform and involve residents/tenants are an effective method for controlling urban sources of pollution. Emphasizing the relevant impact of stormwater pollution to each particular target audience increases the likelihood that the messages will be noticed and that the audience will support and participate in the program implementation. Target audiences for the education program under the WQMP include; HOA/property management company staff, residents/tenants, contract cleaning/maintenance staff.

The City recognizes that when a community has a clear idea of where the pollution comes from, how it directly affects them and what they can do to prevent those affects, it will be more willing to support and participate in the pollution prevention program implementation. A comprehensive public education is needed to change their behaviors.

The following are goals for education under the WQMP:

- Measurably increase the knowledge of target audiences regarding the storm drain system , impacts to urban runoff on receiving waters, and potential BMP solutions for the target audiences
- Measurably change the behavior of target audiences and thereby reduce pollutant releases to the storm drain system and the environment

Target Audiences:

The education element of the WQMP should be designed to target two audiences; 1) HOA/Property Management staff & other contract staff, 2) Residents/tenants. These two core audiences require different approaches to the same problems which is urban runoff and the pollutants that are associated with urban runoff. There will be some overlap due to similarities in some of the activities conducted by members of each of the core audiences and that will be reflected in the educational material and information disseminated to these groups. The sections below describe the basic elements that should be the core of the educational outreach to the target audience.

HOA/Property Management Company Staff & Contract Staff Education:

Members of this audience need to be aware of basic pollution prevention BMPs as related to specific landscaping and maintenance activities. The WQMP must detail the approach that your HOA/property management company will take in order to educate staff on issues regarding pollution prevention awareness and BMPs that are necessary to prevent pollution as related to specific landscaping, irrigation, and maintenance activities/programs. The training and education of staff should be documented and records should be maintained for review. Training/education needs to be conducted on a least a minimum of twice a year and should be part of the orientation process for new employees and/or contract staff.

Resident/Tenant Education:

The WQMP should have a program to outreach to residents/tenants regarding pollution prevention from urban runoff typical associated with residential activities such as landscaping, over irrigation, washing down of sidewalks and walkways and other impervious surfaces and the of Water Quality Permit. Residents/Tenants should also be aware of the fact that non-storm water discharges into the storm drain are in violation of the Water Quality Ordinance and residents/tenants may be subjected to citations and fines should they be found liable for incidences of non-storm water discharges from their property. Residents/tenants should also be aware that they are liable for contracted staff

hired to work on their property (i.e. landscaping, pool maintenance, irrigation) in the event of a prohibited discharge or failure to comply with terms of the Water Quality Permit.

The Water Quality Permit is a permit that is required for any projects that are defined as follows:

> *"Any site where an activity results in the disturbance of soil such as soil movement, grading, excavation, clearing, road construction, structure construction, or structure demolition; and sites where uncovered storage of materials and wastes such as dirt, sand or fertilizer occurs; or exterior mixing of cementaceous products such as concrete, mortar, or stucco will occur".*

It is this City's responsibility to regulate any and all project activities, which fall under this definition, whether or not a building and/or encroachment permit is otherwise required. The City's water quality enforcement will consist of a system of escalating administrative procedures and fines. Chronic violators will be subject to permit revocation and/or permit denial. Residents/tenants should be aware of the Water Quality Permit and they must be informed that there should be a Water Quality Permit for any work as defined above conducted on their property. The Water Quality Permit is issued by the Build & Safety Department at City Hall and will require applicants to:

- To effectively prohibit non-storm water discharge into the storm sewer.
- Control and reduce discharge of pollutants in the storm water discharge system to the maximum extent practical, including management practices, control techniques and systems, design and engineering methods and other provisions as the administrator or the State determines appropriate for the control of such pollutants.

There is also a $192.00 fee for issuance of the Water Quality Permit and applicants must follow the terms of the Water Quality Permit or they may be subjected to escalating administrative procedures and fines.

The City of Aliso Viejo is more than willing to assist you in the development of your education program. The City's educational outreach program provides a common message and pollution prevention theme, and we would like to coordinate with your HOA/property management company to get that message out to the public including your constituents to ensure that media overflow messages are compatible, and provides accurate practical information. In coordination with the County of Orange, the City has developed and has available the following brochures and informational materials that can be made available per your request:

- "The Ocean Begins at Your Front Door" Brochure
- "Do You Know Where The Water in Your Storm Drain Goes?" Brochure
- "Mobile Detailing and the Water Quality Act" Brochure
- "Pool Maintenance and the Water Quality Act" Brochure
- "Waste Oil Collection Centers –South Orange County" Brochure

- "Water Quality Guidelines for Exterior Restaurant Cleaning Operations" Brochure
- "Keeping Pest Control Products Out of Creeks, Rivers and the Ocean" Brochure
- "Water Quality Guidelines for Pet Care Activities" Brochure
- "Water Quality Guidelines for Carpet Cleaning" Brochure
- "Water Quality Guidelines for Permitted Lot and Pool Drains" Brochure
- "Water Quality Guidelines for Car Wash Fundraisers" Brochure

Please contact Jim Merid at (949) 425-2530 if you would like to receive copies of any of the brochures listed above.

List of Large Quantity Generators in the United States

The National Biennial RCRA Hazardous Waste Report (Based on 1995 Data)

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INTRODUCTION TO THE LIST OF LARGE QUANTITY GENERATORS

This document contains a list of large quantity generators (LQG) of hazardous waste. RCRA hazardous waste generation information is obtained from data reported by RCRA LQGs. The RCRA hazardous waste generation quantities in this Report are limited to generation quantities that are managed in units subject to RCRA permitting standards. All hazardous waste generation reported to be managed on-site in units exempt from RCRA permitting standards, such as treatment systems permitted by the National Pollutant Discharge Elimination System (NPDES), is excluded from the RCRA generation quantities provided in this Report. There are 20,867 LQGs on this list.

The Federal Definition of a Large Quantity Generator

A generator was defined as a Federal LQG in 1995 if it met or exceeded any one of the following Federal criteria:

- The generator generated in any single month 1,000 kg (2,200 pounds or 1.1 tons) or more of RCRA hazardous waste; or
- The generator generated in any single month, or accumulated at any time, 1 kg (2.2 pounds) of RCRA acute hazardous waste; or
- The generator generated, or accumulated at any time, more than 100 kg (220 pounds) of spill cleanup material contaminated with RCRA acute hazardous waste.

The EPA and the States endeavor to control for variation in State programs, and ensure that only federally regulated wastes are counted in the determination of Federal LQGs. However, it is not always possible to determine if a generator has correctly classified itself as a Federal LQG solely on the basis of its Federally regulated waste generation and the Federal generation thresholds. This difficulty is due to the fact that LQG status is primarily based on the monthly generation thresholds, but the generation amounts reported are for the entire report year. For data quality purposes, EPA separated generators that reported as LQGs into three categories based on the Federal LQG thresholds:

1. Generators who must be Federal LQGs based on their reported Federal waste generation amounts. This category includes generators who, in the Report year, either:

   - Generated at least 13.2 tons of RCRA hazardous waste; or
   - Generated at least 26.4 pounds (0.0132 tons) of RCRA acute hazardous waste; or
   - Generated or accumulated more than 220 pounds (0.11 tons) of spill cleanup material contaminated with RCRA acute hazardous waste.

   These generators must be Federal LQGs because they could not have generated their reported quantities without exceeding a monthly threshold in at least one month of the report year.

2. Generators for whom Federal LQG status cannot be definitively determined based on their reported Federal waste generation amounts. This category includes generators who in the report year either:

   - Generated at least 1.1 tons, but less than 13.2 tons of RCRA hazardous waste; or
   - Generated at least 2.2 pounds (0.0011 tons), but less than 26.4 pounds (0.0132 tons) of RCRA acute hazardous waste.

   The Federal generator status for these generators cannot be definitively determined on the basis of their reported generation because they could have generated the quantities reported without exceeding the monthly threshold in any one month of the report year.

3. Generators who cannot be Federal LQGs based on their reported Federal waste generation amounts. This category includes generators who in the report year:

   - Generated less than 1.1 tons of RCRA hazardous waste; and
   - Generated less than 2.2 pounds (0.0011 tons) of RCRA acute hazardous waste; and

- Generated or accumulated 220 pounds (0.11 tons) or less of spill cleanup material contaminated with RCRA acute hazardous waste.

These generators cannot be Federal LQGs because their reported generation quantities for the entire year are less than the monthly quantity thresholds.

Of the 20,873 generators who identified themselves as LQGs in 1995, 13,576 are generators who must be Federal LQGs based on their reported Federal waste generation amounts; 6,297 are generators for whom the Federal LQG status cannot be definitively determined based on their reported Federal waste generation amounts; and 1,000 are generators who cannot be Federal LQGs based on their reported Federal waste generation amounts.

For a complete description of what is included in this Report, please see the Executive Summary sections, “RCRA Hazardous Waste” and “RCRA Hazardous Waste Generation.” Wastes exempt from regulation under 40 CFR §§ 264.1 or 265.1 and not subject to the substantive standards in 40 CFR Parts 262 and 263 are not counted when determining whether a generator is an LQG.

What Is on This List

The generators on this list are here because they identified themselves as LQGs by entering the appropriate value in Box A1, Section V on the Identification and Certification Form of the "1995 Hazardous Waste Report Instructions and Forms" or on State-developed Biennial Report forms.

A generator on the list may no longer be an LQG because the list is based on information concerning waste generation practices in 1995. This would be the case where:

- A generator was a one-time waste generator, possibly as the result of a cleanup activity. (EPA hopes that users of these data recognize and support clean-up actions that result in one-time waste generation, which are activities that are often undertaken at significant expense.)
- A generator introduced waste minimization procedures, thereby reducing their waste generation below the LQG thresholds.

- A generator discontinued the activity that resulted in the generation of the waste.

A generator on the list may not have been an LQG, if, for example:

- It applied a lower, state-defined threshold in its self-appraisal as an LQG. This would lead to a respondent identifying itself as an LQG, when, according to the Federal definition, it is not.
- It counted wastes regulated only by its state and not by the Federal government toward the LQG threshold, thereby crossing the Federal threshold for an LQG with wastes that are not Federal wastes.
- It counted wastes exempt from regulation under 40 CFR §§ 264.1 and 265.1 and not subject to the substantive standards in 40 CFR Parts 262 and 263.

A generator on the list may have its associated generation quantity listed as zero if:

- It identified itself as an LQG but did not report any information about its generation quantities.
- It identified itself as an LQG because of wastes it shipped but did not generate. Transfer facilities, for example, may receive wastes from other generators and then ship them without having actually generated any waste, yet still be classified as an LQG.

The presence of a generator on the list is not intended to suggest that any of its wastes were subsequently managed in an improper fashion. Strict Federal requirements for treatment prior to land disposal mean that generators that managed their hazardous waste in accordance with those requirements were acting responsibly to ensure that their hazardous waste did not cause environmental or human health problems.

States with a Different Definition for Large Quantity Generators

The generators on this list are here because the States submitted data stating that these generators were LQGs of hazardous waste, regardless of the actual waste generation quantities reported by the generator. Either the generator or the State provided the appropriate value for Box A1, Section V on the Identification and Certification Form of the "1995 Hazardous Waste Report Instructions and Forms" (or corresponding State-developed

Biennial Report form) that identified a generator as an LQG. Even though the generator supplied the value indicating it was an LQG, that does not necessarily mean that a generator generated enough waste to meet the Federal criteria.

The Federal definition of an LQG of hazardous waste is a minimum regulatory standard. States with delegated RCRA authority may use standards that are broader in scope or more stringent. They may use different definitions of an LQG of hazardous waste, or use different methods of calculating waste generation quantities to apply to the regulatory threshold. Though these States are expected to report the correct number of generators according to the Federal definition, some may report a higher number. The following States used different definitions of an LQG in 1995:

California	Kansas
Kentucky	Maryland
Massachusetts	Maine
Missouri	Nebraska
New Hampshire	New Jersey
New York	Oregon
Pennsylvania	Washington
Wisconsin	

For More Information Regarding a Generator's Status

For more information regarding the status of an LQG, you may wish to contact the person listed for your State in the following "List of Contacts by State."

Confidential Business Information

LQGs that submitted their data as Confidential Business Information (CBI) in Georgia are not included in the State's list of reported LQGs.

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LIST OF CONTACTS BY STATE

Alabama

Alabama Land Div. - Report Section
Alabama Dept. of Environmental Management
P.O. Box 301463
Montgomery, AL 36130-1463

Questions: Amy Zachry
334-271-7736

Alaska

U.S. EPA Region 10
Office of Waste and
Chemicals Management
1200 6th. Avenue - WCM122
Seattle, WA 98101

Questions: Maureen Toelkes
206-553-0758

Arizona

Arizona Dept. of Environmental Quality
Waste Programs Division
Technical Programs Unit
3033 North Central Ave.
Phoenix, AZ 85012

Questions: Kathy Feliberty
602-207-4214

Arkansas

Arkansas Dept. of Pollution Control & Ecology
Hazardous Waste Division
P.O. Box 8913
Little Rock, AR 72219

Questions: Tom Ezell
501-682-0876

California

Biennial Report Staff
CA Dept. of Toxic Substances Control
P.O. Box 806
Sacramento, CA 95812-0806

Questions: Biennial Report Staff
916-322-2880
916-322-5585
916-323-4721 (FAX)

Colorado

Colorado Dept. of Public Health and Environment
4300 Cherry Creek Drive South
Mailcode: HMWMD - HWC - B2
Denver, CO 80222-1530

Questions: Mira Neumiller
303-692-3350

Connecticut

Connecticut Department of Environmental Protection
Waste Bureau
79 Elm Street
Hartford, CT 06106

Questions: Inga Rubecka
203-424-3566

Delaware

Delaware Dept. of Natural Resources and Environmental Control
Hazardous Waste Mgt. Branch
P.O. Box 1401
89 Kings Highway
Dover, DE 19903

Questions: Jane Frank
302-739-3689

District of Columbia

DCRA/ERA
Hazardous Waste Mgmt. Branch
2100 Martin Luther King, Jr. Avenue, S.E.
Suite 203
Washington, DC 20020

Questions: Mark Hughes
202-645-6080 ext. 3023

Florida

Jack Griffith
Florida DEP
BRS Coordinator-MS-4555
2600 Blair Stone Road
Tallahassee, FL 32399-2400

Questions: Jack Griffith
904-921-9219

Georgia

Georgia Dept. of Natural Resources
Hazardous Waste Management Branch
205 Butler Street,
Floyd Tower East, Ste. 1154
Atlanta, GA 30334

Guam

Guam Environmental Protection Agency
P.O. Box 22439 GMF
Barrigada, GU 96921
ATTN: Francis Damian

Questions: Francis P. Damian
671-472-5703

Hawaii

Hawaii Dept. of Health
Solid & Hazardous Waste Branch
5 Waterfront Plaza, Suite 250
919 Ala Moana Boulevard, Rm. 212
Honolulu, HI 96814

Idaho

Idaho Div. of Environmental Quality
1410 North Hilton, Third Floor
Boise, ID 83706

Questions: John Brueck
208-378-0502

Illinois

Illinois EPA
Bureau of Land #24
P.O. Box 19276
Springfield, IL 62794-9276

Questions: Helpline
217-782-6760

Indiana

Jenny Ranck Dooley
Solid and Hazardous Waste
Indiana Dept. of Environmental Management
100 North Senate Ave.
P.O. Box 7035
Indianapolis, IN 46207-7035

Questions: Jenny Ranck Dooley
317-232-8925

Iowa

U.S. EPA Region 7
ARTD/IOWA
726 Minnesota Avenue
Kansas City, KS 66101

Questions: Beth Koesterer
913-551-7673

Kansas

Kansas Dept. of Health & Environment
Bureau of Waste Management
Hazardous Waste Section
Forbes Field, Building 740
Topeka, KA 66620-0001

Questions: Candy Williamson
913-296-6898

Kentucky

Kentucky Dept. of Environmental Protection
Frankfort Office Park
14 Reilly Road
Frankfort, KY 40601

Questions: Van Fritts
502-564-6716

Louisiana

Louisiana Dept. of Environmental Quality
Hazardous Waste Division
ARIM Section-5th Floor
P.O. Box 82178
Baton Rouge, LA 70884-2178

Questions: 504-765-0332

Maine

Maine Dept. of Environmental Protection
BHM SWC
State House Station 17
Augusta, ME 04333-0017

Questions: Cherrie Plummer
207-287-2651

Maryland

Maryland Dept. of the Environment
Hazardous Waste Program
2500 Broening Highway
Baltimore, MD 21224

Massachusetts

Massachusetts Dept. of Environmental Protection
Div. of Hazardous Waste - 7th Floor
One Winter Street
Boston, MA 02108

Questions: Beth McDonough
617-574-6895

Michigan

U.S. EPA Region 5
P.O. Box A 3587
Chicago, IL 60690
ATTN: Mary Villarreal

Questions: Mary Villarreal
312-886-7439

Minnesota

Minnesota Pollution Control Agency
HW/PD
520 Lafayette Road, North
St. Paul, MN 55155

Mississippi

Mississippi Dept. of Environmental Quality
Hazardous Waste Division
P.O. Box 10385
Jackson, MS 39289-0385

Questions: Terrell Chester
601-961-5038

Missouri

Missouri Dept. of Natural Resources
Hazardous Waste Program
P.O. Box 176
Jefferson City, MO 65102

Montana

Montana Dept. of Environmental Quality
WMD Hazardous Waste
P.O. Box 200901
Helena, MT 59620-0901

Questions: Chellie Longmire
406-444-2891

Navajo Nation

Navajo Nation EPA
P.O. Box 339
Window Rock, AZ 86515
ATTN: Debbie McBride

Questions: Debbie McBride
602-729-4146

Nebraska

Nebraska Dept. of Environmental Quality
1200 N Street, Suite 400, The Atrium Building
Lincoln, NE 68509-8922

Questions: Teri Swarts
402-471-4217

Nevada

Nevada Div. of Environmental Protection
333 West Nye Lane, Capitol Complex
Carson City, NV 89710

Questions: Hazardous Waste
Information Line
800-882-3233
(within NV only)

New Hampshire

New Hampshire Dept. of Environmental Services
Waste Management Division-Reporting Section
6 Hazen Drive
Concord, NH 03301

Questions: Karen A. Way
603-271-6350

New Jersey

New Jersey DEP
Bureau of Revenue
c/o Solid and Hazardous Waste
CN 417
Trenton, NJ 08625-0417

Questions: 609-292-8341

New Mexico

New Mexico Environment Dept.
Hazardous and Radioactive Materials Bureau
525 Camino de Los Marquez
Santa Fe, NM 87502

New York

New York Department of Environmental Conservation
Division of Solid and Hazardous Materials
Bureau of Technical Support
Reporting Section
Room 493
Albany, NY 12233

Questions: Technical Assistance
Helpline
800-452-1925 (In NY)
518-457-0532 (Outside NY)

North Carolina

North Carolina Hazardous Waste Section
DEHENR
P.O. Box 27687
Raleigh, NC 27611-7687

North Dakota

North Dakota Dept. of Health
P.O. Box 5520
Bismarck, ND 58506-5520

Questions: Christine Roob
701-328-5166

Ohio

Ohio EPA
Div. of Hazardous Waste Management
Data Management Section
P.O. Box 1049
Columbus, OH 43216-1049

Questions: Paula Canter/Mike Rath
614-644-2977

Oklahoma

Oklahoma Dept. of Environmental Quality
Waste Management Div.
1000 N.E. 10th Street
Oklahoma City, OK 73117-1212

Oregon

Oregon DEQ
Waste Management & Cleanup Div.
811 SW 6th Ave.
Portland, OR 97204

Questions: 503-229-6938

Pennsylvania

PA DEP-LRWM
Division of Reporting and Fee Collection
P.O. Box 8550
Harrisburg, PA 17105-8550

Questions: Robert Finkel
717-783-9258

Puerto Rico

Environmental Quality Board
Land Pollution Control Area
P.O. Box 11488
San Juan, PR 00910

Questions: Ms. Carmen J. Nunez
809-767-8181 ext. 2805

Rhode Island

Rhode Island DEM
Div. of Waste Management
291 Promenade Street
Providence, RI 02908

South Carolina

South Carolina DHEC
Solid and Hazardous Waste Management
2600 Bull Street
Columbia, SC 29201

Questions: Lisa Yeager
803-896-4138

South Dakota

South Dakota DENR
Waste Management Program
319 South Coteau
523 East Capitol Avenue-Joe Foss Bldg.
Pierre, SD 57501

Questions: Carrie Jacobson
605-773-3153

Tennessee

Tennessee Dept. of Environment & Conservation
Div. of Solid Waste Management
5th Floor, L & C Tower
401 Church St.
Nashville, TN 37243-1535

Questions: 800-237-7018 (In TN)
615-532-0878 (Outside TN)

Texas

Texas Natural Resource Conservation Commission
Industrial & Hazardous Waste Division
Waste Evaluation Section
P.O. Box 13087
Austin, TX 78711-3087

Questions: 512-239-6832

Trust Territories

U.S. EPA Region 9
(H-2-1)
75 Hawthorne St.
San Francisco, CA 94105

Questions: Bridget Coyle
415-744-2046

Utah

Utah DEQ/DSHW
P.O. Box 144880
Salt Lake City, UT 84114-4880

Questions: Jim Smith
801-538-6170

Vermont

Vermont Agency of Natural Resources
Hazardous Materials Management Div.
Technical Services Section
103 South Main Street / West Building
Waterbury, VT 05671-0404

Questions: Technical Services Section
802-241-3888

Virgin Islands

U.S. EPA Region 2
290 Broadway
New York, NY 10007-1866

Questions: Elizabeth Van Rabenswaay
(212) 637-4119

Virginia

Virginia Dept. of Environmental Quality
OTA/Waste
629 East Main Street
Richmond, VA 23219

Questions: Claire Slaughter
804-762-4177

Washington

Washington Dept. of Ecology
Hazardous Waste Information
P.O. Box 47658
Olympia, WA 98504-7658

Questions: 206-407-6170

West Virginia

West Virginia DEP
Office of Waste Management
1356 Hansford Street
Charleston, WV 25701

Wisconsin

Wisconsin Dept. of Natural Resources
Bureau of Solid & Hazardous Waste Mgmt.
P.O. Box 7921
Madison, WI 53707-7921

Questions: 608-266-2621

Wyoming

U.S. EPA Region 8
Hazardous Waste Mgt. Div.
(8HWM-HW)
999 18th Street, Suite 500
Denver, CO 80202-2466
ATTN: Biennial Report

ALABAMA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
ALD983190646	ABC RAIL PRODUCTS CORP	CALERA	440.24	.00	.00
ALD003397569	ACIPCO (AMERICAN CAST IRON PIPE COM	BIRMINGHAM	2,077.25	.00	.00
ALD983191776	AERO CORPORATION	HUNTSVILLE	5,001.78	.00	.00
ALD008161176	AKZO CHEMICALS, INC.	AXIS	277.12	.00	.00
ALD004011342	AKZO NOBEL COATINGS INC	BIRMINGHAM	232.83	.00	.00
ALD049150030	ALABAMA INTER-FOREST CORPORATION	EUFAULA	28.75	.00	.00
ALD000615625	ALABAMA POWER GENERAL SERVICES COMP	CALERA	118.99	.00	.00
ALD063680367	ALL LOCK CO INC	SELMA	43.43	.00	.00
ALD981756968	ALLIED SIGNAL AIRLINE SERVICES	ANNISTON	16.40	.00	.00
ALD031499833	ALLIED SIGNAL INC FAIRFIELD TAR	BIRMINGHAM	744.31	107,720.00	.00
ALD079119558	ALLTRISTA METAL SERVICES CO	TRUSSVILLE	446.91	.00	.00
ALD094476793	ALLWORTH, INC.	BIRMINGHAM	779.43	.00	.00
ALD004001731	ALTEC INDUSTRIES INC	BIRMINGHAM	14.67	.00	.00
ALD002985554	AMOCO CHEMICALS CORP	DECATUR	1,725.12	.00	.00
ALD982144735	AMPAC, INC.	ALBERTVILLE	57.45	.00	.00
ALD003297116	AMPEX RECORDING MEDIA CORPORATION	OPELIKA	13,891.60	.00	.00
ALD983170010	AMPS (AFTERMARKET PARTS & SUPPLY, I	MOBILE	30,605.13	.00	.00
AL3210020027	ANNISTON ARMY DEPOT	ANNISTON	2,998.41	75.00	.00
ALD983191859	ANNISTON PLATING	ANNISTON	90.52	.00	.00
ALR000005058	ARIZONA CHEMICAL	BAY MINETTE	99.97	16,920.00	.00
ALD046480513	ARROWHEAD COMPOSITES/THERMOPLASTICS	ELMORE	20.87	.00	.00
ALD061149712	ASHLAND CHEMICAL CO	BIRMINGHAM	75.02	540.02	.00
ALD059661454	ASHLAND CHEMICAL COMPANY	MOBILE	17.36	.00	.00
ALD983179748	ATLANTIC MARINE INC	MOBILE	59.60	.00	.00
ALD000826958	AUBURN UNIVERSITY	AUBURN UNIVERSI	18.93	32.00	.00
ALD983168097	AVANTI POLAR LIPIDS, INC.	ALABASTER	130.26	.00	.00
ALD041903139	AVEX ELECTRONICS, INC.	HUNTSVILLE	71.04	.00	.00
ALD982114704	BALDWIN POLE & PILING CO INC	BAY MINETTE	568.37	.00	.00
ALD982080855	BEECH AEROSPACE SVC INC.	SELMA	81.13	.00	.00
ALD981472798	BENJAMIN MOORE & CO	PELL CITY	358.72	.00	.00
ALD983187873	BEVIS CUSTOM FURNITURE	FLORENCE	14.33	.00	.00
ALD000622852	BIRMINGHAM STEEL CORPORATION	BIRMINGHAM	555.87	.00	.00
ALD983166653	BIRMINGHAM WOOD INC.	WARRIOR	2,822.62	.00	.00
ALD983184276	BONE THIRD PARTY SITE	GADSDEN	161.59	.00	.00
ALD084956911	BRENT INDUSTRIES, INC.	BRENT	579.14	.00	.00
ALD044075109	BUSH HOG CORPORATION	SELMA	24.86	.00	.00
ALD983176405	BUSH HOG SELFIELD PLANT	SELMA	36.78	.00	.00
ALD051574937	CHAMPION INTERNATIONAL CORP	COURTLAND	8.07	182.00	.00
ALD000622464	CHEMICAL WASTE MANAGEMENT, INC.	EMMELLE	34,073.55	.00	.00
ALD001817295	CHRYSLER HUNTSVILLE ELECTRONICS	HUNTSVILLE	21.15	.00	.00
ALD981932882	CHRYSLER HUNTSVILLE ELECTRONICS	HUNTSVILLE	81.70	.00	.00
ALD001221902	CIBA-GEIGY CORPORATION	MCINTOSH	854,169.10	790,124,914.00	.00
AL0000029355	COOK PUBLICATIONS	BIRMINGHAM	83.72	.00	.00
ALD004022166	COYNE CYLINDER CO	HUNTSVILLE	16.23	.00	.00
ALD008175408	CYTEC INDUSTRIES INC	MOBILE	33.73	1,050.00	.00
ALD983192253	DAIKIN AMERICA, INC	DECATUR	58.83	.00	.00
ALD072099690	DANA CORP ARAB HYDRAULICS	ARAB	74.45	.00	.00
ALD982142960	DANNY ISBELL INC	PELL CITY	2,841.64	.00	.00
ALD002982858	DAUBERT COATED PRODUCTS INC	CULLMAN	158.63	.00	.00
ALD004023180	DECATUR ALUMINUM CORPORATION	DECATUR	91.06	.00	.00
ALD077935203	DEFENSE RESEARCH INC	ANNISTON	371.90	.00	.00
ALD075045575	DEGUSSA CORPORATION	THEODORE	2,105.32	4,050.00	.00
ALD097751317	DELPHI HARRISON THERMAL SYSTEMS	TUSCALOOSA	75.58	.00	.00
ALD078964970	DEXTER PACKAGING PRODUCTS	BIRMINGHAM	700.28	.00	.00
ALD982098311	DISCTRONICS MANUFACTURING INC	HUNTSVILLE	16.39	.00	.00

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ALABAMA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
ALD003395043	DIXIE ELECTRICAL MANUFACTURING CO	BIRMINGHAM	431.42	.00	.00
ALD003397643	DORSEY TRAILERS INC	ELBA	66.58	.00	.00
ALD980843999	DOW-UNITED TECHNOLOGIES	TALLASSEE	24.71	.00	.00
ALD057208712	DUNLOP TIRE CORPORATION	HUNTSVILLE	25.37	.00	.00
ALD981860539	DURA-CAST INC	ENTERPRISE	30.53	.00	.00
ALD093179315	E.I.DU PONT DE NEMOURS & CO.	AXIS	3,992.16	15.00	.00
ALD044075919	EATON CORP ATHENS ALABAMA PLANT	ATHENS	44.00	.00	.00
ALD000827154	ELF ATOCHEM NORTH AMERICA INC	AXIS	184.70	.00	.00
ALD094483591	EMCO, INC.	GADSDEN	112.90	.00	.00
ALD981020894	FISHER INDUSTRIAL SERVICE, INC.	GLENCOE	6,976.21	.00	.00
ALD981026677	GENERAL ELECTRIC BURKVILLE	BURKVILLE	105.12	.00	.00
ALD000645416	GENERAL ELECTRIC CO	DECATUR	17.93	.00	.00
ALD980839310	GERRARD STEEL PICKLING	FLORENCE	2,340.00	.00	.00
ALD983191651	GLOBE ELASTIC CO., INC.	TUSCALOOSA	230.94	.00	.00
ALD078960234	GMC SAGINAW STEERING GEAR DIV	ATHENS	208.14	.00	.00
ALD004012050	GRAVES PLATING CO	FLORENCE	15.25	.00	.00
ALD004019485	GREIF BROS CORP	CULLMAN	54.57	.00	.00
ALD041023086	GRIFFIN WHEEL COMPANY	BESSEMER	238.27	.00	.00
ALD983167925	GULF COAST GALVANIZING	CITRONELLE	414.25	.00	.00
ALD004014973	GULF STATES STEEL	GADSDEN	15,315.19	.00	.00
ALD037491909	GUZZLER MANUFACTURING INC	BIRMINGHAM	178.99	.00	.00
ALD000608216	HAGER HINGE CO	MONTGOMERY	492.80	.00	.00
ALD094472651	HAGER HINGE CO	OXFORD	411.60	.00	.00
ALD981919368	HAMILTON PLASTIC PRODUCTS	HAMILTON	21.42	.00	.00
ALD004029294	HANNA STEEL CORP	FAIRFIELD	4,875.81	.00	.00
ALD058036054	HEIL MFG CO INC	FORT PAYNE	59.78	.00	.00
ALD000608224	HULS AMERICA (KAY-FRIES)	THEODORE	1,210.66	.00	.00
ALD008185407	HUXFORD POLE & TIMBER COMPANY, INC.	HUXFORD	1,596.75	.00	.00
ALD004002333	ICD PARKER HANNIFIN CORP	HUNTSVILLE	14.53	.00	.00
ALD980726558	ICD PARKER HANNIFIN CORP	BOAZ	59.36	.00	.00
ALD004010120	INDURALL COATINGS, INC.	BIRMINGHAM	57.27	.00	.00
ALD077655934	INLAND BUILDINGS	CULLMAN	93.22	.00	.00
ALD980846828	INTEGRAPH CORPORATION	HUNTSVILLE	192.38	.00	.00
ALD000653022	IRONDALE MANUFACTURING CO INC	IRONDALE	22.95	.00	.00
ALD059903641	J&A ENTERPRISES	HUNTSVILLE	24.37	.00	.00
ALD002166338	JAY R SMITH MFG CO	MONTGOMERY	33.07	.00	.00
ALD981923659	JIM BISHOP CABINETS, INC.	MONTGOMERY	13.30	.00	.00
ALD982097073	JVC DISC AMERICA	TUSCALOOSA	29.45	.00	.00
ALD982115180	JVC MAGNETICS AMERICA COMPANY	TUSCALOOSA	1,214.10	.00	.00
ALD981475304	K & W TROY	TROY	1,351.25	.00	.00
ALD131160475	KANS INC	RAINBOW CITY	17.20	.00	.00
ALD003396637	KENT CORP	BIRMINGHAM	32.34	.00	.00
ALD031479157	KERR MCGEE REFINING CORP	ANNISTON	98.83	.00	.00
ALD004009403	KOPPERS INDUSTRIES, INC. (MONTGOMER	MONTGOMERY	77.98	.00	.00
ALD085765808	KOPPERS INDUSTRIES, INC. (ORGANICS)	HUEYTOWN	20.24	.00	.00
ALD082053422	KRAFT FOODS INC	TARRANT	54.74	.00	.00
AL0000629469	LEGACY CABINETS LLC	EASTABOGA	14.25	.00	.00
ALD050983394	LILLY INDUSTRIAL COATINGS INC	DOTHAN	72.60	.00	.00
ALD020852422	LL&E PETROLEUM MARKETING, INC.	SARALAND	28.27	.00	.00
ALD061311569	LOZIER CORPORATION	SCOTTSBORO	419.45	.00	.00
ALD070513767	M & M CHEMICAL & EQUIPMENT COMPANY,	ATTALLA	40,071.66	.00	.00
ALD981027097	M&M STEEL DRUM DIVISION	GADSDEN	55.22	.00	.00
ALD004020855	MADIX INC	GOODWATER	288.57	.00	.00
ALD000737296	MARATHON OIL COMPANY	BIRMINGHAM	318.89	.00	.00
ALD000737304	MARATHON OIL COMPANY	MONTGOMERY	398.54	.00	.00

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ALABAMA

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- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
AL1800013863	MARSHALL SPACE FLIGHT CENTER	MARSHALL SPACE	61.41	305.00	.00
ALD004028148	MARTIN INDUSTRIES	ATHENS	22.59	.00	.00
ALD067129676	MARTIN INDUSTRIES INC	SHEFFIELD	31.20	.00	.00
ALD000737288	MASTER LOCK COMPANY	AUBURN	399.09	.00	.00
ALD155638570	MATLACK INC MOBILE TERMINAL	CREOLA	509.98	.00	.00
ALD063679567	MCCORD PAYEN INC	ATHENS	25.01	.00	.00
ALD983192246	MDA MANUFACTURING INC	DECATUR	428.27	.00	.00
AL0000029322	MESKER DOOR INC	HUNTSVILLE	20.47	.00	.00
ALD094476470	MICHELIN TIRE CORP	DOTHAN	20.56	.00	.00
ALD983176520	MOBILE AEROSPACE ENGINEERING	MOBILE	38.06	.00	.00
ALD008163115	MOBILE PAINT MFG CO INC DEL	THEODORE	1,146.61	.00	.00
ALD008180572	MOBILE PULLEY & MACHINE WORKS INC	MOBILE	27.43	.00	.00
ALD980708036	MOBILE TANK WASH INC	MOBILE	154.04	.00	.00
ALD062464748	MOLECULAR SIEVE PLANT	CHICKASAW	1,199.97	.00	.00
AL0000262634	MONOMER SCIENCES	HUNTSVILLE	24.66	.00	.00
ALD006320774	MONSANTO CHEMICAL CO	DECATUR	2,861.83	.00	.00
ALD053360897	MORTON INTERNATIONAL	DECATUR	769.73	.00	.00
ALD077657427	MUELLER CO	ALBERTVILLE	212.03	.00	.00
ALD054571278	NATIONAL-STANDARD COLUMBIANA PLANT	COLUMBIANA	307.23	.00	.00
ALD055798037	NORANDAL USA INC	SCOTTSBORO	348.16	.00	.00
ALD981867062	NOVACOR CHEMICALS INC	DECATUR	2,275.59	.00	.00
ALD004019642	OCCIDENTAL CHEMICAL CORPORATION	MUSCLE SHOALS	1,652.21	.00	.00
ALD008163388	OCCIDENTAL CHEMICAL CORPORATION	MOBILE	110.21	.00	.00
ALD049699366	OPELIKA FOUNDRY	OPELIKA	13.70	.00	.00
ALD981469992	OWENS-ALABAMA METAL FINISHING	ATHENS	199.74	.00	.00
ALD004025235	OXFORD PLATING COMPANY INC	OXFORD	26.70	.00	.00
ALD983188293	PEAVEY ELECTRONICS CORPORATION	FOLEY	70.48	.00	.00
ALD063680391	PEERLESS CHEMICAL COATINGS INC	CULLMAN	80.08	.00	.00
ALD004002077	PEMCO AEROPLEX, INC.	BIRMINGHAM	111.42	.00	.00
ALD009825944	PEMCO WORLD AIR SERVICES	NAPIER FIELD	113.84	.00	.00
ALD098850787	PHILLIPS PETROLEUM CO	BIRMINGHAM	263.25	.00	.00
ALD084367317	PLANTATION PIPELINE CO	HELENA	61.51	.00	.00
ALR000002618	PLANTATION TREE COMPANY	SELMA	25.00	.00	.00
ALD980843940	POLYMER COIL COATERS INC	FAIRFIELD	45.42	.00	.00
ALD047154182	PPG INDUSTRIES INC WORKS 22	HUNTSVILLE	33.45	.00	.00
ALD983191206	PRESSAC INCORPORATED	CULLMAN	569.81	.00	.00
ALD004003620	PRESTOLITE ELECTRIC INC	DECATUR	23.31	.00	.00
ALD981756901	R D WERNER CO., INC. ANNISTON DIV.	ANNISTON	242.50	.00	.00
AL7210020742	REDSTONE ARSENAL	REDSTONE ARSENA	1,056.97	156.00	.00
ALD983176439	RESEARCH GENETICS	HUNTSVILLE	14.64	.00	.00
ALD095687679	REYNOLDS METALS COMPANY-ALLOYS PLAN	MUSCLE SHOALS	317.64	.00	.00
ALD053365169	REYNOLDS METALS COMPANY-SHEFFIELD P	SHEFFIELD	389.18	.00	.00
ALD057207417	RHEEM MANUFACTURING CO	MONTGOMERY	13.67	.00	.00
ALR000002378	RONNY SMITH	EIGHT MILE	75.00	5.00	.00
ALD983179722	RYDER TRUCK RENTAL	MONTGOMERY	18.75	.00	.00
ALD981028798	SAFETY-KLEEN CORP	HUNTSVILLE	53.62	.00	.00
ALD983191537	SAFETY-KLEEN CORPORATION	DOLOMITE	17.45	.00	.00
ALD046481032	SANDERS LEAD COMPANY, INC.	TROY	184,391.70	.00	.00
ALD102066636	SCHLUMBERGER INDUSTRIES	TALLASSEE	1,768.65	.00	.00
ALD983166257	SCI SYSTEMS INC PLANT 13	HUNTSVILLE	33.47	.00	.00
ALD054563887	SIRCO SYSTEMS INC	BIRMINGHAM	14.16	.00	.00
ALD055610158	SLOSS INDUSTRIES ARICHEM FACILITY	ARITON	31.15	.00	.00
ALD067123570	SMI STEEL INC	BIRMINGHAM	8,575.82	.00	.00
ALD040653636	SONY MAGNETIC PRODUCTS OF AMERICA I	DOTHAN	1,956.79	.00	.00
ALD097751507	SOUTHEAST TERMINAL	BIRMINGHAM	131.69	.00	.00

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- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
ALD000616532	SOUTHERN FACILITIES-BIRMINGHAM	BIRMINGHAM	98.62	.00	.00
ALD061137055	SOUTHERN TOOL INC.	OXFORD	231.82	.00	.00
ALD005346432	SPEEDRING MFG	CULLMAN	39.56	.00	.00
ALD003396983	SQUARE D CO/ANDERSON PLT	LEEDS	420.31	.00	.00
ALD063669410	STABLER PAINT MFG CO	BIRMINGHAM	21.37	.00	.00
ALD000827352	STEELCASE INC	ATHENS	637.55	.00	.00
ALD057202558	STERLING PLUMBING GROUP INC	HUNTSVILLE	50.46	.00	.00
ALD003397288	STOCKHAM VALVES & FITTINGS INC	BIRMINGHAM	127.34	.00	.00
ALD087638755	SULLIVAN GRAPHICS INC	SYLACAUGA	16.96	.00	.00
ALD983184250	SUTTLES TRUCK LEASING INC	CREOLA	260.00	520,000.00	.00
ALD095704011	SUTTLES TRUCK LEASING, INC.	DEMOPOLIS	423.70	.00	.00
ALD008161416	T.R. MILLER MILL COMPANY, INC.	BREWTON	29.40	.00	.00
ALD085774875	TAYLOR-WHARTON GAS EQUIPMENT	THEODORE	19.83	.00	.00
ALD982167678	TECHTRIX INC	GADSDEN	14.55	.00	.00
ALD982095580	TELEDYNE CONTINENTAL MOTORS	ABBEVILLE	118.04	.00	.00
ALD052065117	TELEDYNE CONTINENTAL MOTORS APD	MOBILE	115.91	.00	.00
ALD072086275	TERRA INTERNATIONAL INC	MONTGOMERY	.32	636.00	.00
ALD000652974	TEXACO INC	BIRMINGHAM	137.81	.00	.00
ALD982092579	THERMALEX INC.	MONTGOMERY	155.32	.00	.00
AL0000266569	TITAN COATINGS INC	BESSEMER	75.84	.00	.00
ALD983167891	TRANS-CYCLE INDUSTRIES INC.	PELL CITY	836.91	.00	.00
ALD004017729	TRINITY IND. PULLMAN STANDARD MFG.	BESSEMER	103.12	.00	.00
AL8640015410	TVA BROWNS FERRY NUCLEAR PLANT	ATHENS	16.33	.00	.00
AL3640090004	TVA ENVIRONMENTAL RESEARCH CENTER	MUSCLE SHOALS	1,288.80	5,855.20	.00
ALD002904506	U. S. STEEL-FAIRFIELD WORKS	FAIRFIELD	979.06	.00	.00
ALD004017901	U.S. PIPE & FOUNDRY CO	BIRMINGHAM	31.59	.00	.00
ALD004017869	U.S. PIPE & FOUNDRY COMPANY	BESSEMER	2,393.62	.00	.00
ALD010394021	UNIROYAL CHEMICAL CO INC	BAY MINETTE	67.81	44,920.00	.00
ALD067111450	UNITED PLATING, INC.	HUNTSVILLE	58.00	.00	.00
ALD021257951	UNITED REDWING CARRIERS CREOLA	CREOLA	123,079.88	246,159,764.54	.00
ALD063690705	UNIVERSITY OF ALABAMA, BIRMINGHAM	BIRMINGHAM	22.92	.00	.00
ALD079474037	UNIVERSITY OF SOUTH ALABAMA, MAIN C	MOBILE	14.16	163.10	.00
AL6210020776	US ARMY AVIATION CENTER	FORT RUCKER	111.18	7.00	.00
AL4210020562	US ARMY FORT MCCLELLAN	FORT MCCLELLAN	22.29	46.00	.00
AL0570024182	USAF MAXWELL AIR FORCE BASE	MONTGOMERY	22.52	24.00	.00
ALD077911915	UTILITY TRAILER MFG CO INC	ENTERPRISE	32.67	.00	.00
ALD094476413	VERMONT AMERICAN CORPORATION	AUBURN	40.32	.00	.00
ALD044496966	VULCAN, INC	FOLEY	3,599.57	.00	.00
ALD003326444	WALKER-WILLIAMS LUMBER COMPANY, INC	HATCHECHUBBEE	22.50	.00	.00
ALD139657860	WALLACE METAL PRODUCTS	ANNISTON	155.64	.00	.00
ALD137666855	WALTER, JIM RESOURCES INC	BROOKWOOD	24.44	.00	.00
ALD031482037	WELLBORN CABINET INC.	ASHLAND	67.98	.00	.00
ALD982088379	WESTINGHOUSE ELECTRIC CORP	FORT PAYNE	13.32	.00	.00
ALR000002758	WHITE ROSE RENTAL LAUNDRY	TUSCUMBIA	16.75	.00	.00
ALD053363776	WOLVERINE TUBE, INC.	DECATUR	78.83	.00	.00
ALD095688875	ZENECA INC-COLD CREEK	BUCKS	10,330.00	.00	.00
ALD004023164	3M DECATUR	DECATUR	3,928.43	.00	.00
ALD004019691	3M GUIN	GUIN	447.09	.00	.00

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ALABAMA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
ALD981023229	AL NATL GUARD CSMS NO 1	MONTGOMERY	12.50	.00	.00
ALD003276854	ALA-GA WOOD PRESERVING CO	LAFAYETTE	2.00	.00	.00
ALD000615583	ALABAMA POWER CO/JH FARLEY NUCLEAR	COLUMBIA	2.63	.00	.00
ALD031490501	BALDWIN POLE & PILING COMPANY, INC.	BAY MINETTE	2.32	.00	.00
ALD114298573	BLUE CIRCLE CEMENT	CALERA	1.11	.00	.00
ALR000000380	BRIGGS & STRATTON CORPORATION	AUBURN	7.64	.00	.00
ALD006901250	CAPITOL CHEVROLET INC	MONTGOMERY	9.54	.00	.00
ALD057226904	CAVENHAM FOREST INDUSTRIES, INC.	MOBILE	8.67	.00	.00
AL0000989541	COASTAL INDUSTRIAL FABRICATIONS	THEODORE	10.33	.00	.00
ALD083741249	COLONIAL PIPELINE CO-PELHAM JUNCTIO	PELHAM	1.75	.00	.00
ALD000652677	COPELAND CORPORATION	HARTSELLE	1.93	.00	.00
ALD008150617	COURTAULDS FIBERS, INC.	AXIS	3.61	.00	.00
ALD052682762	CRAFT PLATING & FINISHING INC	ATTALLA	8.15	.00	.00
ALD980728703	CSX TRANSPORTATION	PERDIDO	6.25	.00	.00
ALD004488169	EVERWOOD TREATMENT CO INC	SPANISH FORT	3.40	.00	.00
ALD983179839	GADSDEN MACHINE AND ROLL CO	GADSDEN	11.42	.00	.00
ALD106912389	GATES RUBBER CO-RED BAY	RED BAY	3.72	.00	.00
ALD983167933	GAULD EQUIPMENT CO., INC.	THEODORE	2.64	.00	.00
ALD982150427	GE RAILCAR REPAIR SERVICES CORP	DOTHAN	7.81	.00	.00
ALD078983301	GENERAL ELECTRIC CO	DOTHAN	8.02	.00	.00
AL0000359224	GENERAL ELECTRIC COMPANY	DOTHAN	6.60	.00	.00
ALD067132936	GLOBE MOTORS	DOTHAN	10.31	.00	.00
ALD000823344	GOODYEAR TIRE & RUBBER CO	GADSDEN	8.82	.00	.00
ALD000622860	GULF LUMBER COMPANY, INC.	MOBILE	7.25	.00	.00
ALD004009320	HUNT OIL COMPANY, TUSCALOOSA REFINE	TUSCALOOSA	7.09	.00	.00
ALD004000790	KIMBERLY CLARK CORPORATION	COOSA PINES	7.71	10.00	.00
ALD040649915	MARTIN INDUSTRIES INC	HUNTSVILLE	7.20	.00	.00
ALD981758188	MATTHEWS INDUSTRIES INC	DECATUR	9.91	.00	.00
ALD983166638	MEAD INK PRODUCTS	ANNISTON	5.28	.00	.00
ALD983166455	NELSON BROTHERS INC.	PARRISH	9.30	.00	.00
ALD072096126	ONA CORPORATION	HUNTSVILLE	9.37	.00	.00
ALD983182981	PENTASTAR ELECTRONICS	HUNTSVILLE	3.47	.00	.00
ALD983174830	REYNOLDS METALS COMPANY MTL	MUSCLE SHOALS	2.07	.00	.00
ALD980839112	ROHR INDUSTRIES INC	FOLEY	9.00	.00	.00
ALD071951628	SAFETY-KLEEN CORPORATION	WHISTLER	2.08	.00	.00
ALD034046730	SEAMAN TIMBER COMPANY, INC.	MONTEVALLO	1.72	.00	.00
AL0000859280	SEARS & ROEBUCK-1046	BIRMINGHAM	5.20	.00	.00
AL0000859272	SEARS & ROEBUCK-8706	BIRMINGHAM	8.20	.00	.00
ALR000002345	SEARS UNIT #2316 & 7356	FLORENCE	1.78	.00	.00
ALD000604645	SHELL OIL COMPANY	BIRMINGHAM	12.51	.00	.00
ALD980844054	SIKORSKY SUPPORT SERVICES INC	TROY	11.91	.00	.00
ALD000828848	SLOSS INDUSTRIES CORP.BHAM FAC	BIRMINGHAM	8.37	.00	.00
ALD983180118	SOUTHERN BIOSYSTEMS INC	BIRMINGHAM	2.60	.00	.00
ALR000002204	SOUTHERN BIOSYSTEMS INC	BIRMINGHAM	7.47	.00	.00
ALR000001891	SOUTHERN DUCTILE CASTING CO	BESSEMER	3.59	.00	.00
ALD980555973	SOUTHERN NATURAL GAS CO	TARRANT	7.48	.00	.00
ALD982097172	TELEDYNE BROWN ENGINEERING	HUNTSVILLE	11.65	.00	.00
ALD980540280	TEXAS EASTERN GAS-BARTON STATION	TUSCUMBIA	6.36	.00	.00
AL5640090002	TVA BELLEFONTE NUCLEAR PLT	HOLLYWOOD	3.62	.00	.00
AL2640090005	TVA MUSCLE SHOALS POWER SERVICE CEN	MUSCLE SHOALS	7.25	.00	.00
AL8640006690	TVA WIDOWS CREEK FOSSIL PLANT	STEVENSON	5.35	.00	.00
AL6640006668	TVA WILSON HYDRO PLANT	MUSCLE SHOALS	6.93	.00	.00
ALD980603641	U.S. PIPE & FOUNDRY-ANNISTON PLANT	ANNISTON	12.68	.00	.00
ALD077647691	UNIVERSITY OF ALABAMA, CE/UA PILOT	TUSCALOOSA	2.97	.00	.00
AL2690320435	US COAST GUARD GROUP MOBILE	MOBILE	3.22	.00	.00

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ALABAMA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
AL7570024185	USAF MAXWELL AFB GUNTER ANNEX	MONTGOMERY	2.75	.00	.00
ALD139657969	USBI COMPANY	HUNTSVILLE	7.51	.00	.00
ALD983195140	VULCAN ELECTRO-COATING INC	COLUMBIANA	7.63	.00	.00
ALD067142406	WEYERHAEUSER CO WOOD PRODUCT PLANT	MILLPORT	2.74	.00	.00
ALD087638060	WILLAMINA LUMBER CO	CENTREVILLE	1.58	.00	.00

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ALABAMA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO CANNOT BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- LESS THAN 1.1 TONS RCRA HAZARDOUS WASTE, AND
- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
ALD004022448	ALABAMA PLATING COMPANY, INC.	VINCENT	.00	.00	.00
ALD982105892	COASTAL MOBILE REFINING CO	CHICKASAW	.99	.00	.00
ALD106168081	SCI SYSTEM INC PLANT 4	LACEYS SPRING	1.07	.00	.00
AL0000971739	SOUTHERN TOOL INC CATV FACILITY	OXFORD	.70	.00	.00
ALD981019045	SYSTECH ENVIRONMENTAL CORPORATION	DEMOPOLIS	.00	.00	.00
ALD983177015	TERRA FIRST INC-AL STORAGE OPS	VERNON	.00	.00	.00

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ALASKA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

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- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
AKD983066366	AK, DEPARTMENT OF TRANSPORTATION	JUNEAU	66.54	.00	.00
AKR000000570	ARCTIC COOPERAGE	ANCHORAGE	15.60	.00	.00
AKD000643239	BP EXPLORATION ALASKA INC PRUDHOE B	PRUDHOE BAY	61.75	.00	.00
AKD000831750	CHEVRON USA ANCHORAGE TERMINAL #100	ANCHORAGE	47.84	.00	.00
AK1570028638	CLEAR AIR FORCE STATION	ANDERSON	22.31	.00	.00
AK5971522185	DFSP ANCHORAGE	ANCHORAGE	89.09	.00	.00
AK1570028646	EIELSON AFB	EIELSON AFB	110.61	5.00	.00
AK8570028649	ELMENDORF AFB, ALASKA	ELMENDORF AFB	253.91	.00	.00
AK3210022155	FORT GREELY, ALASKA	DELTA JUNCTION	29.19	.00	.00
AKD035419795	KENAI PIPELINE CO NIKISKI TERMINAL	KENAI	92.94	.00	.00
AKD009252230	KETCHIKAN PULP CO., KETCHIKAN PULP	KETCHIKAN	20.54	.00	.00
AKD000850701	MAPCO ALASKA PETROLEUM INC, NORTH P	NORTH POLE	62.20	.00	.00
AK0000043117	NOAA NMFS AUKE BAY LABORATORY	JUNEAU	1.97	771.00	.00
AKD983066028	NORTH SLOPE BOROUGH SRVC AREA 10	PRUDHOE BAY	80.14	.00	.00
AKD983066390	RED DOG MINE COMINCO AK INC	KIVALINA	14.92	.00	.00
AKD052581758	TAPS VALDEZ MARINE TERMINAL	VALDEZ	150.33	20.85	.00
AKD048679682	TESORO ALASKA KENAI	KENAI	111.59	.00	.00
AKD055503825	TEXACO REFINING AND MARKETING INC.	ANCHORAGE	47.51	.00	.00
AKD000800888	TOTEM OCEAN TRAILER EXPRESS	ANCHORAGE	14.24	.00	.00
AK1210022157	U.S. ARMY FORT RICHARDSON	FORT RICHARDSON	134.86	18.00	.00
AK6210022426	U.S. ARMY FORT WAINWRIGHT	FORT WAINWRIGHT	274.15	101.00	.00
AK4170024323	U.S. NAVAL AIR STATION ADAK, AK	ADAK	376.15	.00	.00
AKD048679567	UNIVERSITY OF ALASKA FAIRBANKS	FAIRBANKS	17.70	12.17	.00
AKD092876390	UNOCAL AGRICULTURAL PRODUCTS	KENAI	818.43	.00	.00
AK8690360492	US DOT COAST GUARD BASE KETCHIKAN	KETCHIKAN	15.69	.00	.00
AK9570028705	USAF EARECKSON AIR STATION	SHEMYA ISLAND	88.27	.00	.00
AK9690330742	USCG SUPPORT CENTER, KODIAK, AK	KODIAK	94.17	.00	.00
AK4690500166	USDOT FAA ANIAK	ANIAK	185.53	.00	.00

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ALASKA

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- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
AKD035403641	ALASKA CLEANERS, INC.	ANCHORAGE	6.88	.00	.00
AKD981767403	ALASKA RAILROAD CORP ANCHORAGE YARD	ANCHORAGE	3.10	.00	.00
AKD980738066	ALYESKA NORDALE STORAGE YARD	FAIRBANKS	3.35	.00	.00
AKD981766199	ALYESKA PIPELINE SRV CO ANCHORAGE	ANCHORAGE	1.13	.00	.00
AKD061038816	ANCHORAGE INTERNATIONAL AIRPORT	ANCHORAGE	7.23	.00	.00
AKD991281221	ARCO ALASKA, INC. PRUDHOE BAY	PRUDHOE BAY	7.49	2.00	.00
AK5141190103	CAPE SABINE DEWLINE STATION	POINT HOPE	5.02	.00	.00
AK5210090002	DFSP WHITTIER TERMINAL	WHITTIER	12.68	.00	.00
AKD983068677	FAIRBANKS INTERNATIONAL AIRPORT ADO	FAIRBANKS	8.95	.00	.00
AKR000000448	FMUS COMPLEX PP NTP IST AVE	FAIRBANKS	4.94	.00	.00
AKD063351340	HALLIBURTON ENERGY SERVICES	ANCHORAGE	2.67	.00	.00
AKD983068842	JOE'S BODY PAINT & FRAME	ANCHORAGE	3.63	.00	.00
AK0141190082	KOGRU RIVER DEWLINE STATION	BARROW	2.18	.00	.00
AKR000000513	MOTOROLA MOUNT SUSITNA	MOUNT SUSITNA	5.72	.00	.00
AKD983069493	PETROLITE CORP. KENAI FACILITY	KENAI	2.53	.00	.00
AKR000000471	PUBLIC WORKS	FAIRBANKS	5.84	.00	.00
AK0000552257	QUALITY FABRICATION INC	ANCHORAGE	1.20	.00	.00
AKD981766595	SPRUCE PARK MOBILE HOME PARK	ANCHORAGE	9.17	.00	.00
AKD982658619	TAPS PUMP STA 1	DEADHORSE	2.63	.00	.00
AKD983066010	TAPS PUMP STA 10	PAXSON	3.45	.00	.00
AKD980329551	TAPS PUMP STA 3	OKSRUKUYIK	1.56	.00	.00
AKD980329601	TAPS PUMP STA 8	FAIRBANKS	2.40	.00	.00
AKD980329585	TAPS PUMP STATION #6	LIVENGOOD	1.39	.00	.00
AK0570028712	TIN CITY LONG RANGE RADAR STATION	TIN CITY	5.95	.00	.00
AK3570028669	USAF KING SALMON AIRPORT	KING SALMON	6.84	.00	.00
AK0690390042	USDOT CG CUTTER SWEETBRIAR WLB405	CORDOVA	5.89	.00	.00
AK4690500174	USDOT FAA FAIRBANKS N SECTOR	FAIRBANKS	1.80	.00	.00
AK5690500181	USDOT FAA LEVEL ISLAND	LEVEL ISLAND	1.20	.00	.00
AKD079261830	WASTEWATER TREATMENT	FAIRBANKS	3.14	.00	.00

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ALASKA

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- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
AK0000113829	ANALYTICAL SRVCS MOBILE LAB	ANCHORAGE	.18	.00	.00
AKR000000588	BEN LOMMOND SITE	ANCHORAGE	.88	.00	.00
AKR000000240	PAUL'S BODY SHOP	ANCHORAGE	.00	.00	.00
AKD980329643	TAPS PUMP STA 12	GLENALLEN	.62	.00	.00
AKD980977318	TAPS PUMP STA 4	DEADHORSE	.46	.00	.00
AKD980329577	TAPS PUMP STA 5 PROSPECT CREEK	DEADHORSE	.32	.00	.00
AKR000000190	USDOT FAA ANCHORAGE FLT INSP	ANCHORAGE	.90	.00	.00

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ARIZONA

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- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
AZD982434383	ACME ELECTRIC	TEMPE	30.50	.00	.00
AZD983485053	ADFLEX DOUGLAS WHSE	DOUGLAS	51.22	.00	.00
AZD983483488	ADFLEX SOLUTIONS	CHANDLER	481.85	.00	.00
AZ0000962530	ADVANCED MTRLS TECH	CHANDLER	16.03	.00	.00
AZD018517698	ALLIED SIGNAL	TEMPE	98.64	.00	.00
AZD983468166	ALLIED SIGNAL	PHX	81.93	.00	.00
AZD981421449	ALLIED SIGNAL AEROSPACE	TUCSON	23.19	.00	.00
AZ0000278820	ALLIED SIGNAL AIRCRAFT	KINGMAN	26.18	.00	.00
AZD009000050	ALLIED SIGNAL ENGINES	PHX	141.57	.00	.00
AZD980735179	ALLIED SIGNAL LAMINATE SYS	CHANDLER	136.48	.00	.00
AZD982468035	AMERICA WEST AIRLINES	PHX	84.65	.00	.00
AZD983476185	AMERICAN TUBE AND PIPE	PHX	154.50	.00	.00
AZD009002908	ARIZONA PLATING & ANODIZING	PHX	23.93	.00	.00
AZD042017723	ARIZONA STATE UNIVERSITY	TEMPE	63.07	107.00	.00
AZD000626606	ASARCO	KEARNY	14.23	.00	.00
AZD982495921	AUTOMOTIVE PARTS EXCHANGE	YUMA	51.97	.00	.00
AZD025200833	AVANTI CIRCUITS	PHX	24.85	.00	.00
AZD983474453	BFI	PHX	150.00	.00	.00
AZD008394454	BURR BROWN	TUCSON	84.58	.00	.00
AZR000000208	CABEL CON INC, USA	PHX	34.03	.00	.00
AZD039534995	CARADON BETTER BILT	PRESCOTT VALLEY	81.91	.00	.00
AZD981462591	CHROMALLOY AZ	PHX	18.54	.00	.00
AZD983466673	CIRCUIT EXPRESS	TEMPE	57.22	.00	.00
AZD983472291	CMI/COMPOSITE MTRLS	PHX	52.03	.00	.00
AZD063274609	CONTINENTAL CIRCUITS	PHX	509.78	.00	.00
AZD980896310	CONTINENTAL CIRCUITS CORP	PHX	1,427.13	.00	.00
AZD043839349	CSI	PHX	65.69	.00	.00
AZD982478216	CYPRUS SIERRITA CORP	GREEN VLY	.08	160.00	.00
AZ4570024055	DAVIS MONTHAN AFB	TUCSON	93.39	14.00	.00
AZD982508855	DESERT SAMARITAN MED CTR	MESA	23.63	47,253.20	.00
AZD045810553	DIVERSEY WATER TECHNOLOGIES	PHX	25.61	.00	.00
AZD058787086	DOLPHIN	PHX	177.38	.00	.00
AZ0001039478	DUREL CORP	CHANDLER	15.35	.00	.00
AZD982503385	DYNACO	TEMPE	600.07	.00	.00
AZD980893143	ESH	TEMPE	50.97	.00	.00
AZD980818165	EVERGREEN AIR CTR	MARANA	66.95	.00	.00
AZT050010636	GILBERT ENGINEERING	GLENDALE	319.71	.00	.00
AZD020122479	GM DESERT PROV GRD	MESA	90.09	.00	.00
AZ0000206565	GOLDEN FALCON INTL	SAN LUIS	1.92	225.00	.00
AZD981971419	GOOD SAMARITAN REGIONAL MED CTR	PHX	83.71	157,570.90	.00
AZD000625715	GOULD	CHANDLER	778.50	39.00	.00
AZD079014221	GOWAN CO	YUMA	45.37	50,246.00	.00
AZD982498149	HEIL	PHX	18.16	.00	.00
AZD003987997	HEXCEL CORP	CASA GRANDE	125.94	.00	.00
AZD009004961	HONEYWELL	PHX	168.58	.00	.00
AZD981582216	HUCK	TUCSON	82.60	.00	.00
AZ0000115600	HUGHES	TUCSON	14.75	.00	.00
AZD009005422	HUGHES MISSILE SYSTEMS	TUCSON	32,860.41	56.00	.00
AZD091235457	INTEL CORP	CHANDLER	196.55	.00	.00
AZR000001107	INTEL CORP	CHANDLER	20.72	.00	.00
AZ0000337402	JOHN C LINCOLN HOSPITAL	PHX	52.42	.00	.00
AZD981636129	KACHINA TESTING LABS	PHX	48.79	.00	.00
AZD042018184	KARSTEN MFG	PHX	53.00	.00	.00
AZD049318009	LAIDLAW ENV SVC	PHX	24.45	.00	.00
AZD020703310	LEARJET	TUCSON	90.79	.00	.00

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- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
AZD982434409	LOCKHEED AEROMOD CENTER	TUCSON	99.10	.00	.00
AZ0570024133	LUKE AFB	LUKE AFB	47.68	.00	.00
AZD001886597	MAGMA METALS	SAN MANUEL	2,575.82	8,060.00	.00
AZD982469595	MARICOPA MEDICAL CTR	PHX	17.67	.00	.00
AZ8170024493	MARINE CORP	YUMA	25.85	.00	.00
AZD982483695	MARYVALE SAMARITAN	PHX	27.32	53,174.90	.00
AZD981988967	MASTERCRAFT	MESA	83.06	.00	.00
AZD982320202	MAYO CLINIC SCOTTSDALE	SCOTTSDALE	33.74	.00	.00
AZD041458555	MCCULLOCH CORP	LAKE HAVASU CIT	172.23	.00	.00
AZD980881163	MCDONNELL DOUGLAS	MESA	254.39	.00	.00
AZD093660579	MEDTRONIC/MICRO REL	TEMPE	47.94	.00	.00
AZD982486169	METCO METAL FINISHING	PHX	1,488.96	.00	.00
AZD981624166	MICOM CIRCUITS WEST	TEMPE	69.66	.00	.00
AZD077537108	MICROCHIP TECHNOLOGY	CHANDLER	47.35	.00	.00
AZD981667686	MICROCHIP TECHNOLOGY	TEMPE	16.49	.00	.00
AZD000024745	MICROSEMI CORP	SCOTTSDALE	28.55	.00	.00
AZD982519746	MINNESOTA MINING & MFG	TUCSON	73.04	.00	.00
AZD008399636	MOTOROLA	SCOTTSDALE	13.59	18.00	.00
AZD009004177	MOTOROLA	PHX	750.24	.00	.00
AZD043848050	MOTOROLA	MESA	751.58	.00	.00
AZD980816920	MOTOROLA	CHANDLER	333.18	.00	.00
AZT000618512	MOTOROLA	TEMPE	30.57	.00	.00
AZD982485484	NATIONAL AIRCRAFT INC	TUCSON	229.56	.00	.00
AZD980818330	NELCO TECHNOLOGY	TEMPE	208.87	.00	.00
AZD981997182	NELTEC INC	TEMPE	54.05	.00	.00
AZD982041907	NORTHROP GRUMMAN	CHANDLER	96.16	.00	.00
AZD070258017	OBERG AZ	CHANDLER	543.70	.00	.00
AZ0000146373	OLIN CORP	PHX	18.87	.00	.00
AZD982508335	OLIN MICROELECTRONIC MATERIALS	CHANDLER	13,851.61	.00	.00
AZD980818090	PACIFIC SCIENTIFIC	CHANDLER	6.26	160.00	.00
AZT000624429	PALO VERDE NUCLEAR GEN STA	WINTERSBURG	72.95	.00	.00
AZ0000203372	PETE'S CUSTOM POLISHING & PLAT	PHX	319.00	.00	.00
AZT000615286	PHOENIX TERMINAL CHEVRON	PHX	100.58	.00	.00
AZD981666670	PHX TRANSIT SYS	PHX	30.82	.00	.00
AZD982435166	PRINTPACK	PRESCOTT VLY	50.20	.00	.00
AZD983583048	QUALITY PRINTED CIRCUITS	PHX	472.10	.00	.00
AZD074440470	QUICK TURN CIRCUITS	PHX	27.85	.00	.00
AZD083726034	REVLON CONSUMBER PRDTS	PHX	236.79	.00	.00
AZD042018689	ROGERS CORP	CHANDLER	13.78	.00	.00
AZD980886477	SABRE TECH	PHX	37.60	.00	.00
AZD089308803	SAFETY KLEEN	PHX	29.79	.00	.00
AZD982467839	SARGENT CONTROLS	TUCSON	19.15	.00	.00
AZD983475153	SCOTTSDALE MEDICAL IMAGING	SCOTTSDALE	14.43	.00	.00
AZT050010131	SFPP L.P. TUCSON TERMINAL	TUCSON	40.60	.00	.00
AZD094527587	SFPP, L.P. PHOENIX TERMINAL	PHOENIX	52.30	.00	.00
AZ0000886572	SGS THOMSON MICROELECTRONICS	PHX	50.12	.00	.00
AZD983481631	SOUTHWEST TECH	PHX	15.36	.00	.00
AZD982328387	ST.JOSEPHS HOSPITAL	PHX	43.56	110.00	.00
AZD981964273	STERIS LABS	PHX	13.60	.00	.00
AZD020132502	TALLEY DEFENSE SYS	MESA	22.86	1,066.30	.00
AZD072433816	TED LEVINE DRUM	MESA	107.66	.00	.00
AZD097116362	TESSENDERLO KERLEY, INC.	SAHUARITA	41.40	227.00	.00
AZT000617548	TEXACO REFINING & MKTNG	TUCSON	102.20	.00	.00
AZD068411651	TEXACO REFINING & MKT	PHX	232.50	.00	.00
AZD983476706	THOMAS DAVIS MEDICAL CENTER	TUCSON	17.23	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
AZD983468216	THUNDERBIRD SAMARITAN	GLENDALE	28.12	51,460.50	.00
AZD041456872	TREFFERS PRECISION	PHX	57.92	.00	.00
AZD005200613	TRIUMPH CORP	TEMPE	19.07	.00	.00
AZD982471062	TRW	MESA	433.13	73,115.00	.00
AZD982491649	TRW	MESA	884.98	47,139.00	30,100.00
AZD006902688	TUCSON AIRPORT AUTHORITY	TUCSON	3.81	606.00	.00
AZD981630049	TUCSON FOUNDRY	TUCSON	15.19	.00	.00
AZD108149642	TUCSON MEDICAL CTR	TUCSON	41.23	.30	.00
AZT000615245	TUCSON TERMINAL CHEVRON	TUCSON	153.64	.00	.00
AZD981636665	TUSONIX	TUCSON	14.74	.00	.00
AZ5213820991	U.S. ARMY PROV GRND	YUMA	42.34	.00	.00
AZD099383085	UHAUL TECH CTR	TEMPE	15.39	.00	.00
AZT000612135	UNITED MUSICAL INSTRUMENTS	NOGALES	29.81	.00	.00
AZD980814479	UNIVERSAL PROPULSION	PHX	21.23	.00	.00
AZD982479354	UNIVERSITY MEDICAL CTR	TUCSON	44.41	1,268.00	.00
AZD000819615	UNIVERSITY OF AZ- TUCSON	TUCSON	121.85	.00	.00
AZ0210020434	US ARMY GARRISON	FT HUACHUCA	53.82	54.00	.00
AZ0000182915	VALLEY LUTHERAN HOSP	MESA	24.60	.00	.00
AZD982477234	WALTER O BOSWELL MEMORIAL HOSP	SUN CITY	26.64	.00	.00
AZD982400889	WEISER LOCK	TUCSON	96.61	.00	.00
AZD982441263	WESTATES CARBON	PARKER	67.86	.00	.00
AZ3142390027	YUMA DESALTING PLT	YUMA	16.17	.00	.00

Note: Please refer to the introduction for an explanation of this list.

ARIZONA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
AZD981996820	ADOT	PRESCOTT	7.44	.00	.00
AZD981997232	ADOT	TUCSON	7.47	.00	.00
AZD982443236	ADOT	PHX	8.08	.00	.00
AZD008399263	APACHE NITROGEN PRDTS	BENSON	11.89	.00	.00
AZ4211890021	ARIZ ARMY NATIONAL GUARD	PHX	2.73	.00	.00
AZ9573124055	ARIZONA AIR NATL GUARD	TUCSON	10.16	.00	.00
AZ0000068957	ARIZONA GALVANIZING	GOODYEAR	3.15	.00	.00
AZT000623678	ASARCO	SAHUARITA	6.48	.00	.00
AZD981577273	ASHLAND CHEMICAL	CHANDLER	10.93	.00	.00
AZD981460678	ATCHISON TOPEKA & SANTA FE RR	PHX	2.79	.00	.00
AZD981460496	ATCHISON, TOPEKA & SANTA FE RR	WINSLOW	8.87	.00	.00
AZ7213820635	CAMP NAVAJO	BELLEMON	12.83	.00	.00
AZD981582869	CARDINAL INDUSTRIAL FINISHES	PHX	5.05	.00	.00
AZD982514663	DUREL CORP	TEMPE	9.51	.00	.00
AZD983483470	DUREL CORP	CHANDLER	12.54	.00	.00
AZD983470931	EXXON SERV ST #1588	TUCSON	1.25	.00	.00
AZD983470642	EXXON SVC STA#3686	PHX	2.08	.00	.00
AZD035900729	F & B MFG	PHOENIX	9.45	.00	.00
AZD982414393	FIBERITE	TEMPE	12.33	.00	.00
AZD000628610	HONEYWELL	GLENDALE	10.30	.00	.00
AZ0000921387	LORAL AERONUTRONIC	GOODYEAR	7.25	.00	.00
AZD982469033	LOU GRUBB	SCOTTSDALE	5.76	.00	.00
AZ4572190029	LUKE DRMO	GLENDALE	1.41	.00	.00
AZT000624353	MAGMA COPPER	MIAMI	3.25	.00	.00
AZT050010040	MAGMA COPPER	MIAMI	3.44	.00	.00
AZD983470691	METCO METAL FINISHING	PHX	2.92	.00	.00
AZD982517104	MULAY PLASTICS	CASA GRANDE	5.06	.00	.00
AZD102815974	NORTHWEST HOSPITAL	TUCSON	8.08	.00	.00
AZD009010273	PHOENIX HEAT TREATING	PHX	7.90	.00	.00
AZD983481656	PIMA COUNTY	TUCSON	11.39	.00	.00
AZD982491631	PRAXAIR	KINGMAN	3.01	.00	.00
AZT050010644	PROCTER & GAMBLE	PHX	12.80	.00	.00
AZD009005224	R.E. DARLING	TUCSON	6.80	.00	.00
AZD048383939	RINGIER AMERICA	PHX	7.86	.00	.00
AZD981969504	SAFETY KLEEN	CHANDLER	12.93	.00	.00
AZT000603787	SHELL OIL COMPANY	PHOENIX	9.61	.00	.00
AZD983479064	SOUTHWEST AIRLINES	PHX	2.37	.00	.00
AZD983473547	SPECIAL DEVICES	MESA	12.09	.00	.00
AZD000628560	SRP	GLENDALE	8.69	.00	.00
AZD981629926	SRP-NORTHEAST	SCOTTSDALE	1.39	.00	.00
AZD006335152	STURM, RUGER & CO	PRESCOTT	12.25	.00	.00
AZT050010792	SUB-ZERO FREEZER	PHX	3.69	.00	.00
AZD983478926	THOMAS DAVIS MEDICAL CENTER	TEMPE	8.16	.00	.00
AZD063276000	TIERNAY TURBINES	PHX	7.03	.00	.00
AZD983481391	TRANSWESTERN PIPELINE	MOHAVE VALLEY	4.39	.00	.00
AZT050010768	TRANSWESTERN PIPELINE	FLAGSTAFF	6.11	.00	.00
AZD982503948	TRIUMPH AIR REPAIR	PHX	4.85	.00	.00
AZD982438004	UNITED MUSICAL INSTRUMENTS	NOGALES	10.20	.00	.00
AZR000000406	UNIVERSITY OF AZ -YUMA	YUMA	1.48	.00	.00
AZD089304216	VAN WATERS & ROGERS	PHX	10.44	.00	.00
AZD042018994	W.L. GORE	FLAGSTAFF	9.96	.00	.00
AZD981425481	W.L. GORE & ASSOC.	FLAGSTAFF	5.91	.00	.00

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ARIZONA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO CANNOT BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- LESS THAN 1.1 TONS RCRA HAZARDOUS WASTE, AND
- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
AZT050010180	ADVANCED ENV TECH/CHEM WASTE MGMT	PHX	.00	.00	.00
AZT050010685	ALLIED PRECIOUS METALS	TUCSON	.00	.00	.00
AZ4570024139	BARRY M GOLDWATER RANGE	YUMA	.04	.00	.00
AZD089308811	BREA AGRI PUREGRO	YUMA	.00	.00	.00
AZ0000352153	CORNING CLINICAL LABORATORIES	PHX	.49	.00	.00
AZD982345423	ECO RECYCLING	PHX	.00	.00	.00
AZD983473133	ECO RECYCLING	PHX	.00	.00	.00
AZD980892731	GREENFIELD ENV OF AZ	PHX	.00	.00	.00
AZD982465486	RHONE POULENC	PHX	.00	.00	.00
AZD009015389	ROMIC ENVIRONMENTAL TECHNOLOGIES	CHANDLER	.00	.00	.00
AZD983484684	ROUSE	PHX	.50	.00	.00
AZD980892897	SAFETY KLEEN	TUCSON	.00	.00	.00
AZD000182915	VALLEY LUTHERN HOSPITAL	MESA	.00	.00	.00
AZ0000029264	WASTE MGMT OF AZ\CYPRESS ENV	PHX	.00	.00	.00
AZD980735500	WORLD RESOURCES	PHX	.00	.00	.00

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ARKANSAS

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
ARD071247365	AEROQUIP CORP	MOUNTAIN HOME	39.90	.00	.00
ARD982552754	AGL CORPORATION	JACKSONVILLE	17.57	.00	.00
ARD052528809	ALBEMARLE CORP SOUTH PLANT	MAGNOLIA	5,068.30	.00	.00
ARD982558561	ALBEMARLE CORP WEST PLANT	MAGNOLIA	1,056.40	.00	.00
ARR000000083	ALUMAX COATED PRODUCTS	W HELENA	13.41	.00	.00
ARD983272808	AMERICAN FREIGHTWAYS INC	LITTLE ROCK	62.55	.00	.00
ARD007023179	AMERICAN GREETINGS CORP	OSCEOLA	47.66	.00	.00
ARD007240716	AMERON PROTECTIVE COATINGS	LITTLE ROCK	408.68	.00	.00
ARD008049298	AMFUEL PLANT I	MAGNOLIA	98.95	.00	.00
ARD021344700	AMTRAN CORPORATION	CONWAY	77.49	.00	.00
ARD091683045	AMTROL INC	ROGERS	25.52	.00	.00
ARD000632752	ARK PWR & LIGHT ANO	RUSSELLVILLE	16.25	.00	.00
ARD982552739	ARKANSAS ARMY NATIONAL GUARD	N LITTLE ROCK	21.41	.00	.00
ARD982558595	ARKANSAS GALVANIZING INC	PRAIRIE GROVE	476.93	.00	.00
AR0001001361	ARKANSAS SILVER RECOVERY CO INC	N LITTLE ROCK	33.73	.00	.00
ARR000000794	ARKANSAS STATE UNIVERSITY	JONESBORO	.45	72.14	.00
ARD091691261	ARKANSAS STEEL ASSOCIATES	NEWPORT	3,553.61	.00	.00
ARD093415578	ARROW AUTOMOTIVE INDS INC	MORRILTON	33.53	.00	.00
ARD981512270	ASH GROVE CEMENT COMPANY	FOREMAN	130.08	.00	.00
ARD006341119	AT&T CUSTOM MANUFACT CENTER	LITTLE ROCK	6.61	67.00	.00
ARD091688283	ATLANTIC RESEARCH CORP	E CAMDEN	83.17	.00	.00
ARD055684633	BAIRD MFG INC	CLARENDON	31.07	.00	.00
ARD006338537	BALDOR ELECTRIC COMPANY	FT SMITH	15.07	.00	.00
ARD006344972	BALL METAL FOOD CONTAINER CORPORATI	SPRINGDALE	247.40	.00	.00
ARD075673079	BEKAERT CORPORATION	VAN BUREN	14.80	.00	.00
ARD983267733	BEKAERT CORPORATION	ROGERS	906.39	.00	.00
ARD983288572	BPS INC UNIT 2	W HELENA	13.87	16,229.00	.00
ARD092923184	BRYCE CORPORATION	SEARCY	343.57	.00	.00
ARD990660649	CEDAR CHEMICAL CORP	W HELENA	2,160.54	.00	.00
ARD006341796	CENTRAL MOLONEY INC	PINE BLUFF	29.74	.00	.00
ARD093404143	CENTURY TUBE CORPORATION	PINE BLUFF	264.51	.00	.00
ARD035519537	CHAMBERDOOR IND INC	HOT SPRINGS	31.19	.00	.00
ARD021349691	CHAMPION BOATS INC	MOUNTAIN HOME	26.08	.00	.00
ARD010330561	CHAMPION PARTS INC	HOPE	26.73	.00	.00
ARD010304475	CHEM FAB CORPORATION	HOT SPRINGS	89.20	.00	.00
ARD006338099	CLARIDGE PRODUCTS	HARRISON	136.46	.00	.00
ARD001989375	COASTAL UNILUBE INC	W MEMPHIS	27.77	.00	.00
ARD005413273	COOPER ENGINEERED PRODUCTS	EL DORADO	24.95	.00	.00
ARD005543335	COOPER TIRE & RUBBER CO	TEXARKANA	16.60	.00	.00
ARD093792067	CPS CHEMICAL COMPANY	W MEMPHIS	6,068.17	.00	.00
ARD983273590	CRANE KEMLITE COMPANY INC	JONESBORO	222.33	.00	.00
ARD990869737	CROSS OIL REFINING & MARKETING	SMACKOVER	132.06	.00	.00
ARD139607048	CYRO INDUSTRIES	OSCEOLA	367.99	.00	.00
ARD000023531	DAISY MANUFACTURING CO INC	ROGERS	15.38	.00	.00
ARD107289001	DANAHER TOOL GROUP FAYETTEVILLE AR	FAYETTEVILLE	31.52	.00	.00
ARD044484780	DANAHER TOOL GROUP SPRINGDALE OPS	SPRINGDALE	151.96	.00	.00
ARD049984214	DARLING STORE FIXTURES	PARAGOULD	242.10	.00	.00
ARD057647224	DARLING STORE FIXTURES	PIGGOTT	32.22	.00	.00
ARD062143938	DASSAULT FALCON JET CORP	LITTLE ROCK	19.90	.00	.00
ARD065317059	EAGLE AVIATION SERVICES INC	LITTLE ROCK	67.32	.00	.00
ARD089234884	EASTMAN CHEMICAL CO ARK DIV	BATESVILLE	45,301.27	.00	.00
ARD001700657	EL DORADO CHEMICAL COMPANY	EL DORADO	21.17	.00	.00
ARD041432311	EMERSON ELECTRIC CO	ROGERS	21.66	.00	.00
ARD069748192	ENSCO INC	EL DORADO	35,723.61	27,110.00	.00
ARD082578162	EPOXYN PRODUCTS	MT HOME	16.31	.00	.00

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ARKANSAS

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- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
ARD981908973	FARR COMPANY	JONESBORO	29.17	.00	.00
ARD075675785	FLORIDA DRUM DELTA COMPANY	PINE BLUFF	48.62	.00	.00
ARD086635018	FM STRUCTUAL PLASTIC TECHNOLOGY INC	ROGERS	19.25	.00	.00
ARD035495563	FORT SMITH INDUSTRIAL SERVICE	FT SMITH	56.80	.00	.00
ARD006346829	FRANKLIN ELECTRIC CO INC	SILOAM SPRINGS	22.26	.00	.00
ARD983287889	GARRISON INDUSTRIES INC	EL DORADO	3,433.62	.00	.00
ARD089233126	GATES RUBBER COMPANY	SILOAM SPRINGS	14.77	.00	.00
ARD008052474	GE RAILCAR REPAIR SERVICE	TEXARKANA	46.20	.00	.00
ARD006511588	GENCORP	BATESVILLE	35.54	.00	.00
ARD990661050	GENERAL DYNAMICS	E CAMDEN	54.13	.00	.00
ARD043192988	GEORGIA PACIFIC ASHDOWN	ASHDOWN	19.46	.00	.00
ARD980621239	GEORGIA-PACIFIC RESINS INC	CROSSETT	35.04	.00	.00
ARD075656454	GNB INDUSTRIAL BATTERY CO	FT SMITH	29.67	.00	.00
ARD055602098	GOODNER AIRCRAFT PAINTING	MENA	40.17	.00	.00
ARD082577602	GRACE MANUFACTURING INC	RUSSELLVILLE	54.03	.00	.00
ARR000000992	GRAYS AIRCRAFT REFINISHING	OZARK	73.52	.00	.00
ARD043195429	GREAT LAKES CHEMICAL CORP MAIN	EL DORADO	745,527.00	.00	.00
ARD000022186	GREAT LAKES CHEMICAL CORP SOUTH PLA	EL DORADO	83.29	.00	.00
ARD059634659	GUARDSMAN PRODUCTS INC	LITTLE ROCK	353.11	.00	.00
ARD030414494	HELENA CHEMICAL COMPANY	W HELENA	133.12	28,144.00	.00
ARD981146715	HH ROBERTSON	SHERIDAN	22.26	.00	.00
ARR000000489	ICI EXPLOSIVES USA INC	E CAMDEN	26.38	.00	.00
AR0000885889	IMI-TECH CORPORATION	MAGNOLIA	302.31	.00	.00
ARD035497056	INDUSTRIAL GLOVE CLEANERS	FT SMITH	28.62	.00	.00
ARD000804179	INTERNATIONAL PAPER PINE BLUFF MILL	PINE BLUFF	18.60	.00	.00
ARD981155427	JAN-EZE PLATING INC	NASHVILLE	50.74	.00	.00
ARD038882676	KAWNEER CO INC	SPRINGDALE	97.39	.00	.00
ARD006344824	KOPPERS INDUSTRIES INC	N LITTLE ROCK	294.85	.00	.00
ARD091690867	LECTRA CIRCUITS INC	MOUNTAINBURG	66.50	.00	.00
ARD000021998	LION OIL COMPANY	EL DORADO	479.00	.00	.00
ARD000604959	LORAL VOUGHT SYSTEMS	E CAMDEN	67.16	.00	.00
ARD980621155	LORAL VOUGHT SYSTEMS	E CAMDEN	76.98	.00	.00
ARD983274911	LORAL VOUGHT SYSTEMS	E CAMDEN	34.46	.00	.00
ART060010345	MATTHEWS INTERNATIONAL CORPORATION	SEARCY	22.90	.00	.00
ARD077395283	MAYBELLINE PRODUCTS CO INC	N LITTLE ROCK	52.16	14.50	.00
ARD980877666	MOLEX INC	MAUMELLE	28.00	.00	.00
ARD047926449	MONROE AUTO EQUIPMENT COMPANY	PARAGOULD	53.60	.00	.00
ARD062145388	NESTE POLYESTER INC	FT SMITH	208.75	.00	.00
ARD006351464	NORANDAL USA INC	NEWPORT	15.23	.00	.00
ARD983278243	NUCOR STEEL ARKANSAS	BLYTHEVILLE	32,403.00	.00	.00
ARD981908890	NUCOR YAMATO STEEL	BLYTHEVILLE	33,973.00	.00	.00
ARD075664243	PACKAGING SPECIALTIES	FAYETTEVILLE	29.59	.00	.00
ARD035565068	PARKER SOLVENTS COMPANY INC	LITTLE ROCK	58.98	.00	.00
ARD006345292	PEL FREEZ INC	ROGERS	18.29	.00	.00
ARD990722316	PHILIPS LIGHTING COMPANY	LITTLE ROCK	29.70	.00	.00
ARD006351241	POLYVEND MANUFACTURING INC	CONWAY	49.95	.00	.00
ARD982562654	PRESTOLITE WIRE CORP	PARAGOULD	13.70	.00	.00
ARD982557308	PROGRESSIVE INK COMPANY	SHERIDAN	15.84	.00	.00
ARD983267295	QUALITY BEARING SERVICE	N LITTLE ROCK	97.56	.00	.00
ARR000000547	QUALITY BEARING SERVICE	LITTLE ROCK	147.25	.00	.00
ARD053730701	QUANEX MACSTEEL DIVISION	FT SMITH	5,256.49	.00	.00
ARD051961829	R & P ELECTROPLATING INC	FAYETTEVILLE	28.55	.00	.00
ARD983275504	RAYTHEON AIRCRAFT COMPANY	LITTLE ROCK	387.38	.00	.00
AR0000064311	REMINGTON ARMS CO INC	LONOKE	474.38	.00	.00
ARD006354161	REYNOLDS METALS CO GUM SPRINGS PLAN	GUM SPRINGS	9,971.29	.00	.00

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ARKANSAS

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
ARD006354187	REYNOLDS METALS CO HURRICANE CRK PL	BAUXITE	20.29	45.00	.00
ARD981057870	RINECO	BENTON	48,058.76	.00	.00
ARD058698937	RINGIER AMERICA INC	JONESBORO	43.22	.00	.00
ARD006339931	RIVERSIDE FURNITURE MAIN PLANT	FT SMITH	92.53	.00	.00
ARR000000752	ROBBINS INC - WITT PLANT	WARREN	15.78	.00	.00
ARD990722233	SANYO MANUFACTURING CORP	FORREST CITY	23.30	.00	.00
ARD980509848	SF SERVICES BLYTHEVILLE WAREHOUSE	BLYTHEVILLE	2.06	4,130.00	.00
ARD077389393	SLOAN VALVE COMPANY	AUGUSTA	33.88	.00	.00
ARD082578956	SMI JOIST COMPANY	HOPE	33.27	.00	.00
ARD069747459	SMITH BLAIR INC	TEXARKANA	14.40	.00	.00
ARD006347280	SMITH FIBERGLASS PRODUCTS INC	LITTLE ROCK	20.02	.00	.00
ARD035500818	SOUTHERN STEEL & WIRE CO	FT SMITH	177.28	.00	.00
ARD980867642	SR OF ARKANSAS	WILSON	198.70	.00	.00
ARD000388983	STERLING PLUMBING GROUP	SHERIDAN	130.77	.00	.00
ARD000709584	SUPERIOR INDUSTRIES INTL INC	FAYETTEVILLE	1,123.18	.00	.00
ARD084938455	SWEPCO FLINT CREEK POWER PLANT	GENTRY	59.00	.00	.00
ARD035663301	THE COLONELS FACTORY OUTLET OF ARKA	W MEMPHIS	55.02	.00	.00
ARD980621288	THE COLONELS FACTORY OUTLET OF ARKA	W MEMPHIS	27.65	.00	.00
ARD006349724	TIMEX PRODUCTS INC	LITTLE ROCK	64.07	.00	.00
ARD983267600	TOKUSEN USA INC	CONWAY	667.28	.00	.00
ARD983272485	TREFILARBED ARKANSAS INC	PINE BLUFF	424.50	.00	.00
ARD981058076	UNION CAMP CORP	MONTICELLO	29.67	.00	.00
ARD075661595	UNION PACIFIC RR NLR JENKS SHOP CO	N LITTLE ROCK	55.83	.00	.00
ARD055600001	UNIV OF ARKANSAS MAIN CAMPUS	FAYETTEVILLE	18.90	4,792.00	.00
AR0213820707	US ARMY PINE BLUFF ARSENAL	PINE BLUFF	133.95	.00	.00
AR6571824808	USAF LITTLE ROCK AFB	LITTLE ROCK AFB	65.26	3.00	.00
AR6140090006	USEPA INCINERATION RESEARCH FACILIT	JEFFERSON	98.14	116,246.00	.00
ARD006355341	VICKERS INCORPORATED	SEARCY	14.29	.00	.00
ARD059637710	VIRCO MFG CORPORATION	CONWAY	127.67	.00	.00
ARD983275595	WADE JONES COMPANY	LOWELL	38.81	.00	.00
ARD983274143	WAL MART RETURN CENTER	BENTONVILLE	185.56	.00	.00
ARD071264089	WATERLOO INDUSTRIES INC	POCAHONTAS	42.43	.00	.00
ARD067671313	WEYERHAEUSER DEQUEEN TREATING PLANT	DEQUEEN	835.97	.00	.00
ARD122185192	WHEATLAND TUBE CO OMEGA DIV	LITTLE ROCK	71.36	.00	.00
ARD042755389	WHIRLPOOL CORPORATION	FT SMITH	159.28	.00	.00
ARD006354294	WHITE-RODGERS COMPANY	BATESVILLE	105.12	.00	.00
ARD071263925	WHITE-RODGERS DIV	HARRISON	28.36	.00	.00
ARD046142956	WOOD MFG CO/RANGER BOATS	FLIPPIN	74.55	.00	.00

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ARKANSAS

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GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
ARD983288499	AEROCELL STRUCTURES INC	HOT SPRINGS	11.90	.00	.00
ARD983274119	AFCO STEEL	LITTLE ROCK	11.65	.00	.00
ARD006345052	AMFUEL PLANT III	MONTICELLO	11.65	.00	.00
ARD096669015	ARK PWR & LIGHT INDEPENDENCE PLANT	NEWARK	9.54	.00	.00
ARD093414597	ARK PWR & LIGHT WHITE BLUFF	REDFIELD	10.31	8.00	.00
ARR000000810	ASHLAND CHEMICAL COMPANY	JACKSONVILLE	10.04	.00	.00
ARD061651972	AUTOMATED CONVEYOR SYSTEMS INC	W MEMPHIS	10.20	.00	.00
ARD112906987	BABCOCK & WILCOX ST CO	LITTLE ROCK	2.40	.00	.00
ARD983275249	BPS UNIT 1	W HELENA	2.72	.00	.00
ARD982559700	BRYCE CORPORATION	SEARCY	1.14	.00	.00
AR0000145680	CLASSY CLEANERS	EL DORADO	1.52	.00	.00
ARD035494178	CRAIN INDUSTRIES INC	FT SMITH	11.43	.00	.00
ARD983286568	DACO TRAILER CORP	POCAHONTAS	3.45	.00	.00
ARD007022445	EMERSON MOTOR COMPANY	PARAGOULD	9.21	.00	.00
ARD071254247	ENGINEERED SPECIALTY PLASTICS INC	HOT SPRINGS	3.15	.00	.00
ARD007037823	GENERAL ELECTRIC CO	JONESBORO	7.01	.00	.00
ARD981512353	GREENWOOD FIXTURE	GREENWOOD	10.92	.00	.00
ARD980624415	INDUSTRIAL OIL SERVICE	W MEMPHIS	2.80	.00	.00
ARR000000125	INTERNATIONAL PAPER CULLENDALE	CAMDEN	10.43	.00	.00
ARD983287947	ITW PASLODE	AUGUSTA	3.54	.00	.00
ARD006345433	JAMES RIVER PAPER COMPANY	FT SMITH	5.88	.00	.00
ARD006342570	MAGEE COMPANY	POCAHONTAS	4.13	.00	.00
ARD982287443	MAGEE COMPANY	PIGGOTT	6.15	.00	.00
ARD983287764	MAVERICK TUBE CORPORATION	BLYTHEVILLE	10.95	.00	.00
AR0000817791	MEMPHIS DRUM SERVICE OF AR	BAUXITE	2.70	.00	.00
ART060010303	OKLA HOMER SMITH	FT SMITH	7.07	.00	.00
ARD982285447	PARKER HANNIFIN/BYRON VALVE	SILOAM SPRINGS	6.40	.00	.00
ARD000610188	POTLATCH CORP BRADLEY UNIT	WARREN	9.86	.00	.00
ARD006348270	POTLATCH CORP SOUTHERN UNIT	WARREN	3.00	.00	.00
ARD006345920	PRECISION INDUSTRIES INC PACE IND	MALVERN	1.16	.00	.00
ARD980877690	RIVERSIDE FURNITURE PLANT I	FT SMITH	9.69	.00	.00
ARD054575238	SAFETY KLEEN CORP	LITTLE ROCK	2.27	.00	.00
ARD980868491	SCROLL TECHNOLOGIES	ARKADELPHIA	6.60	.00	.00
ARD983274416	SEARS UNIT 8176	LITTLE ROCK	2.79	.00	.00
ARD044299808	SPANG & CO MAGNETICS & TODAYS KIDS	BOONEVILLE	4.64	.00	.00
ARD980810485	STONE CONTAINER CORPORATION	JACKSONVILLE	6.29	.00	.00
ARD982283921	TE PRODUCTS PIPELINE MCRAE TERMINAL	GARNER	1.15	.00	.00
ARD982283863	TEPPCO ARKANSAS CITY TERMINAL	ARKANSAS CITY	1.40	.00	.00
ARD982283970	TEPPCO EL DORADO TERMINAL	EL DORADO	3.05	.00	.00
ARD980630214	TEXAS EASTERN NLR STATION	N LITTLE ROCK	3.37	.00	.00
ARD990742330	THE TRANE COMPANY	FT SMITH	1.75	.00	.00
ARD084938737	TRACOR AEROSPACE ARK OPS	E CAMDEN	9.42	.00	.00
ARD980867873	TRACOR AEROSPACE R1/R15 FACILITY	E CAMDEN	3.47	.00	.00
AR0000135996	UNION PACIFIC RAILROAD	N LITTLE ROCK	5.79	.00	.00
ARD983287202	UNION PACIFIC RR NLR RICHARDS RD	N LITTLE ROCK	7.17	.00	.00
AR8571924473	US AIR FORCE EAKER AFB	BLYTHEVILLE	1.98	.00	.00
AR9210020187	US ARMY GARRISON FT CHAFFEE	FT CHAFFEE	9.12	.00	.00
ARR000001701	USFA OUACHITA NATL FOREST COLD SPGS	BOONEVILLE	1.25	.00	.00
ARD071245401	VAN WATERS & ROGERS, INC	JACKSONVILLE	5.77	.00	.00
ARD006354484	ZENECA AG PRODUCTS NLR PLANT	N LITTLE ROCK	8.66	.00	.00

Note: Please refer to the introduction for an explanation of this list.

ARKANSAS

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO CANNOT BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- LESS THAN 1.1 TONS RCRA HAZARDOUS WASTE, AND
- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
ARD983287806	BLACKHAWK WAREHOUSING & LEASING CO	HELENA	.03	.00	.00
ARR000001792	HERSHELL MARSHALL PROPERTY	NEWARK	1.02	.00	.00
ARD006345607	POTLATCH CORP OZAN UNIT	PRESCOTT	.92	.00	.00
ARD071255202	RIXEY IRON & METAL	N LITTLE ROCK	.00	.00	.00
ARD000709733	SAFETY KLEEN CORP	FT SMITH	.34	.00	.00
ARD089244727	THERMA-TRU CORP	VAN BUREN	.36	.00	.00

Note: Please refer to the introduction for an explanation of this list.

CALIFORNIA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
CAD982435026	W PLASTICS OF CALIFORNIA	BAKERSFIELD	217.06	.00	.00
CAD980885941	A. MEDICAL OPTICS	IRVINE	18.66	.00	.00
CAD069139376	ANALOG DEVICES, INC.	SNATA CLARA	46.83	.00	.00
CAD052418126	AAA PLATING AND INSPECTIONS CO., IN	COMPTON	58.69	.00	.00
CAD063541445	ABBOTT DIAGNOSTICS DIVISION	SANTA CLARA	32.06	.00	150.00
CAD007965049	ABLESTIK LABORATORIES	RANCHO DOMINGUE	47.73	.00	.00
CAD982497588	ACCURATE CIRCUIT ENGINEERING	SANTA ANA	80.80	.00	.00
CAD055636310	ACL ELECTRONICS USA INC.	SUNNYVALE	26.39	.00	.00
CAD009108861	ACME GALVANIZING COMPANY, INC.	OAKLAND	48.45	.00	.00
CAD041838855	ACME PACKAGING CORP. - BAY POINT PL	BAY POINT	21.90	.00	.00
CAD041835695	ACME SANITARY LANDFILL	MARTINEZ	500.32	.00	.00
CAD981692726	ADAPTIVE CIRCUITS, A DIV.	SAN JOSE	140.81	.00	.00
CAD982519605	ADI/ISOLA	FREMONT	71.09	.00	.00
CAD980885537	ADVANCED PRINTED CIRCUIT TECHNOLOGY	SANTA CLARA	227.70	.00	.00
CAD982437378	ADVANCED STRUCTURES, INC. AN OHIO C	ESCONDIDO	14.49	.00	.00
CAD008314023	AERO-ENGINES, INC.	LOS ANGELES	19.89	.00	.00
CAD093245645	AEROCHEM, INC.	ADELANTO	216.86	.00	.00
CAD000030494	AEROJET SACRAMENTO OPERATIONS	RANCHO CORDOVA	5,402.22	173.00	.00
CAD079622569	AEROJET, AZUSA OPERATIONS	AZUSA	17.34	150.00	.00
CAD983655671	AG FORMULATORS, INC.	FRESNO	3.36	6,720.00	.00
CAD056428485	AIR CARGO EQUIPMENT CORPORATION	RANCHO DOMINGUE	14.86	.00	.00
CAD009548256	AIR INDUSTRIES CORPORATION	GARDEN GROVE	65.59	.00	.00
CAD981975485	AIR INDUSTRIES CORPORATION	GARDEN GROVE	68.70	.00	.00
CAD096427299	AIR PRODUCTS AND CHEMICALS, INC.	LOS ANGELES	14.87	.00	.00
CAD000628032	AIRCRAFT X-RAY LABORATORIES, INC.	HUNTINGTON PARK	25.58	.00	.00
CAD982470510	AKZO NOBEL COATINGS INC.	ORANGE	550.78	.00	.00
CAD008517005	AL'S PLATING CO., INC.	LOS ANGELES	57.93	.00	.00
CAD008292435	ALCO CAD-NICKEL PLATING CORP.	LOS ANGELES	99.10	.00	.00
CAD982480295	ALCOA ELECTRONIC PACKAGING, INC.	SAN DIEGO	283.60	.00	.00
CAD982329534	ALDILA, INC.	SAN DIEGO	43.06	.00	.00
CAD981684384	ALL-BANN ENTERPRISES, INC.	ANAHEIM	13.84	.00	.00
CA0000940312	ALLBLACK COMPANY	SANTA FE	24.15	.00	.00
CAD038048286	ALLERGAN, INC.	IRVINE	24.45	19.00	.00
CAD982510679	ALLIED SIGNAL AMM	SANTA CLARA	25.86	.00	.00
CAD010710051	ALLIED SIGNAL OCEAN SYSTEMS	SYLMAR	21.58	.00	.00
CAD060897287	ALLIEDSIGNAL AEROSPACE EQUIP METAL	LOS ANGELES	14.17	.00	.00
CAD071896336	ALLIEDSIGNAL AEROSPACE EQUIPMENT SY	TORRANCE	68.76	.00	.00
CAD008326589	ALLIEDSIGNAL, INC.	EL SEGUNDO	770.97	.00	.00
CAD982507147	ALMATRON ELECTRONICS	SANTA ANA	39.50	.00	.00
CAD092694538	ALPHA THERAPEUTIC CORPORATION	LOS ANGELES	1,712.19	.00	.00
CA0001022680	ALTA ANALYTICAL LABORATORY	EL DORADO HILLS	24.20	.00	.00
CAD981382732	ALTAMONT SANITARY LANDFILL	LIVERMORE	77.06	.00	.00
CAD074126681	ALUMINUM CO. OF AMERICA	VERNON	232.38	420.00	.00
CAD049231541	ALZA CORPORATION (A)	PALO ALTO	14.22	.00	.00
CAD982411324	ALZA CORPORATION (D)	PALO ALTO	57.06	629.00	.00
CAD982503534	ALZA CORPORATION (M1)	MOUNTAIN VIEW	27.75	.00	.00
CAD982475964	ALZA CORPORATION (V)	VACAVILLE	573.16	65,752.00	.00
CAD981385958	AMBITECH, INC.	CHATSWORTH	209.31	.00	.00
CAD063567820	AMDAHL CORPORATION	SUNNYVALE	25.54	580.15	.00
CAD981369663	AMERCOM	CHATSWORTH	30.62	.00	.00
CAD064573405	AMERICAN ETCHING AND MFG	PACOIMA	236.81	.00	.00
CAD983641630	AMERICAN GIRL MINING JOINT VENTURE	WINTERHAVEN	14.76	.00	.00
CAD009120866	AMERICAN NATIONAL CAN - NEWARK, CA	NEWARK	59.22	.00	.00
CAD009126905	AMERICAN NATIONAL CAN CO.	SAN LEANDRO	64.77	.00	.00
CAD983591751	AMERICAN PEPTIDE CO. INC.	SUNNYVALE	22.58	.00	.00

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CALIFORNIA

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- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
CAD081094526	AMERICAN RACING EQUIPMENT, INC.	CARSON	337.30	.00	.00
CAD981450893	AMGEN INC.	THOUSAND OAKS	24.92	12.00	.00
CAD008495327	AMP INCORPORATED	TORRANCE	80.53	.00	.00
CAD009129073	AMPEX CORPORATION	REDWOOD CITY	28.52	.00	.00
CAD051612802	ANACOMP INC	SUNNYVALE	159.68	.00	.00
CAD008286551	ANADITE INC.	SOUTH GATE	248.64	.00	.00
CAD982009417	ANAHEIM PLATING INC	ANAHEIM	1,061.41	.00	.00
CAD981389232	ANALYSTS INC.	OAKLAND	15.68	.00	.00
CAD051903847	ANCHOR GLASS CONTAINER CORP.	HAYWARD	35.85	.00	.00
CAT080011034	ANCHOR GLASS CONTAINER CORPORATION	HUNTINGTON PARK	294.47	.00	.00
CAD009521089	ANILLO IND.,INC.DBA HIGHTOWER PLATI	ORANGE	48.00	.00	.00
CAD008479479	ANODYNE INC.	SANTA ANA	65.52	.00	.00
CAD076316355	APOGEE ENGINEERING	SAN JOSE	28,420.26	.00	.00
CAD981414006	APPLIED IMMUNE SCIENCES, INC.	SANTA CLARA	103.72	.00	.00
CAD983617424	APPLIED SILICONE CORPORATION	VENTURA	23.43	.00	.00
CAD097456099	APPLIED SOLAR ENERGY CORPORATION	CITY OF INDUSTR	50.78	.00	.00
CAT080010101	APPROPRIATE TECHNOLOGIES II INC	CHULA VISTA	952.50	.00	.00
CAD000627943	ARCO PIPE LINE CO., EAST HYNES	LONG BEACH	372.98	.00	.00
CAD075332882	ARCO PIPE LINE CO., TERMINAL-2	LONG BEACH	122.26	.00	.00
CAD077227049	ARCO PRODUCTS COMPANY	CARSON	838.93	.00	.00
CAD000632588	ARCO PRODUCTS COMPANY-CARSON TERMIN	CARSON	173.70	.00	.00
CAD062949938	ARCO PRODUCTS COMPANY-SACRAMENTO TE	W. SACRAMENTO	290.17	.00	.00
CAD000633032	ARCO PRODUCTS COMPANY-STOCKTON TERM	STOCKTON	175.50	.00	.00
CAD081782583	ARCO PRODUCTS COMPANY-VINVALE TERMI	SOUTH GATE	132.01	.00	.00
CAD091933895	ARISTECH CHEMICAL CORP	COLTON	851.19	.00	.00
CAD008391468	ARLON ADHESIVES AND FILMS DIVISION	SANTA ANA	152.87	.00	.00
CAD980895528	ARLON, MATERIALS FOR ELECTRONICS DI	RANCHO CUCAMONG	68.88	.00	.00
CAD008252157	ARMTEC DEFENSE PRODUCTS CO.	COACHELLA	21.48	.00	.00
CAD028348498	ARNOLD CIRCUITS, INC.	LA HABRA	55.43	.00	.00
CAD981452923	ARROW AUTOMOTIVE INDUSTRIES	SANTA MARIA	50.43	.00	.00
CAD008302002	ARROWHEAD PRODUCTS	LOS ALAMITOS	15.09	.00	.00
CAD982509523	ARTISTIC PLATING & METAL FINISHING	ANAHEIM	47.11	.00	.00
CAD046056883	ARVINYL METAL LAMINATES CORP	CORONA	38.10	.00	.00
CAD044061422	ASHLAND CHEMICAL	SANTA FE SPRING	408.00	.00	.00
CAD044046274	ASHLAND CHEMICAL CO	COMMERCE	1,861.98	.00	.00
CAD066562521	ASHLAND CHEMICAL CO.	NEWARK	139.51	.00	.00
CAD043079110	ASSOCIATED PLATING	SANTA FE SPRING	71.24	.00	.00
CAD076069780	ASTECH MANUFACTURING, INC.	SANTA ANA	31.80	.00	.00
CAD001894773	ATCHISON TOPEKA & SANTA FE RY - SAN	SAN BERNARDINO	113.60	.00	.00
CAR000005694	ATLANTIC RSRCH CORP.; NORRIS OPER.V	VERNON	65.13	.00	.00
CAD008342784	AUTOMATION PLATING CORP.	GLENDALE	161.30	.00	.00
CAD982491839	AUTOMOTIVE CALIPER EXCHANGE INCORPO	BUENA PARK	170.33	.00	.00
CAD092258326	AUTOMOTIVE WHEELS, INC.	BREA	201.98	.00	.00
CAD050745363	AVERY DENNISON	RANCHO CUCAMONG	91.41	.00	.00
CAD057339640	AVERY DENNISON CORP., FASSON ROLL D	MONROVIA	283.80	.00	.00
CAD008495608	AVIALL, INC.	BURBANK	26.90	.00	.00
CAD981448764	AVIBANK MFG., INC.	BURBANK	64.48	.00	.00
CAD046054664	B.P. CHEMICAL (HITCO)INC.,DYER RD.	SANTA ANA	60.90	.00	.00
CAD084160092	B.P. CHEMICAL (HITCO)INC.,WAKEHAM A	SANTA ANA	136.04	.00	.00
CAD009105958	B.W. FORTON MFG. CL. INC.	OAKLAND	57.82	.00	.00
CAD008294829	B&C PLATING CO.	LOS ANGELES	48.00	.00	.00
CAD982410052	BACHEM CALIFORNIA	SAN DIEGO	48.46	.00	.00
CAD077243640	BACHEM CALIFORNIA, INC.	TORRANCE	191.51	.00	.00
CAD000040436	BAF INDUSTRIES	SANTA ANA	19.40	.00	.00
CAD981984628	BAKER PERFORMANCE CHEMICALS, INC.	BAKERSFIELD	215.15	.00	.00

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CALIFORNIA

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GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
CAD008368458	BALL-FOSTER GLASS CONT. CO., L.L.	EL MONTE	120.68	.00	.00
CAT000624288	BALL-FOSTER GLASS CONTAINER CO.	LOS ANGELES	36.11	.00	.00
CAD000043364	BARKSDALE, INC.	LOS ANGELES	18.40	.00	.00
CAT080013477	BARMET ALUMINUM CORP.	TORRANCE	34.74	.00	.00
CAT000618652	BARON-BLAKSLEE DIV. OF ALLIEDSIGNAL	SAN DIEGO	41.61	.00	.00
CAD983655762	BARRY CONTROLS	BURBANK	26.93	.00	.00
CAD982319766	BASF CORPORATION, BUENA PARK, CALIF	BUENA PARK	23.62	.00	.00
CAD038051371	BAXTER HEALTHCARE CORPORATION	IRVINE	13.58	660.00	.00
CAD078761780	BAY AREA CIRCUITS 91	REDWOOD CITY	62.48	.00	.00
CAD982019069	BAY DECKING COMPANY, INC.	ALAMEDA	324.07	.00	.00
CAD982401093	BAY DECKING COMPANY, INC.	SAN DIEGO	61.01	.00	.00
CAD009126418	BAYER CORPORATION	BERKELEY	6.66	52.00	.00
CAD066702689	BDP CO./DIV. OF CARRIER CORP.	CITY OF INDUSTR	67.87	.00	.00
CAD008254708	BECKMAN INSTRUMENTS INC	FULLERTON	96.05	.00	.00
CAD048645444	BECKMAN INSTRUMENTS INC	PORTERVILLE	5,459.06	.00	.00
CAD000099259	BEHRING DIAGNOSTICS INC. - CUPERTIN	CUPERTINO	40.44	469.00	.00
CAD983610114	BEHRING DIAGNOSTICS INC. - EVERGREE	SAN JOSE	29.25	166.00	.00
CAD980814891	BEHRING DIAGNOSTICS INC. - SHOREBIR	MOUNTAIN VIEW	16.26	.00	.00
CAD008314932	BENJAMIN MOORE & CO LOS ANGELES	COMMERCE	76.80	.00	.00
CAD000819631	BERLEX BIOSCIENCES	RICHMOND	25.55	176.00	.00
CAD002604866	BETZ LABS INC	COMPTON	14.43	.00	.00
CAD060762432	BHP COATED STEEL CORP	RANCHO CUCAMONG	392.74	.00	.00
CAD983669409	BI TECHNOLOGIES	FULLERTON	13.89	148.87	.00
CAD981453871	BIO-RAD LABORATORIES	RICHMOND	212.55	.00	.00
CAD981456668	BIO-RAD LABORATORIES	RICHMOND	28.94	.00	.00
CAD983606872	BIO-RAD LABORATORIES	HERCULES	2.83	60.00	.00
CAD067786749	BKK LANDFILL	WEST COVINA	110,630.53	.00	.00
CAD009105230	BLOUNT, INC. - RCBS OPERATION	OROVILLE	62.43	.00	.00
CAD981411952	BRADLEY LANDFILL GAS RECOVERY	SUN VALLEY	29.38	.00	.00
CAD008258295	BRENT AMERICA,INC.	LAMIRADA	25.83	.00	.00
CAD067615435	BRISTOL INDUSTRIES	BREA	31.80	.00	.00
CAD009402082	BRONZE WAY PLATING CORP	LOS ANGELES	22.00	.00	.00
CAD044052801	BROWN-PACIFIC, INCELES	SANTA FE SPRING	158.30	.00	.00
CAD009603184	BURBANK PLATING SERVICES	PACOIMA	48.70	.00	.00
CAD009118886	BURKE INDUSTRIES	SAN JOSE	24.56	.00	.00
CAD983620436	BURLINGTON NORTHERN SANTA FE RY	SHAFTER	.22	450.00	.00
CA0000138354	CAE VANGUARD, INC.	SACRAMENTO	16.03	.00	.00
CAT080031552	CAL-AURUM INDUSTRIES, INC.	HUNTINGTON BEAC	24.37	.00	.00
CAD008237950	CAL-TRON PLATING, INC.	SANTA FE SPRING	65.38	.00	.00
CAD981963671	CALCOMP INC.	ANAHEIM	17.18	5,738.00	.00
CAD982440018	CALEB BRETT USA.INC.	SIGNAL HILL	19.70	.00	.00
CAT080014079	CALIFORNIA ADVANCED ENVIRONMENTAL(C	RICHMOND	1,253.31	3,191.00	.00
CAD050125053	CALIFORNIA ELECTROPLATING	LOS ANGELES	35.72	.00	.00
CAD981397458	CALIFORNIA EXPANDED METAL PRODUCTS	CITY OF INDUSTR	38.75	.00	.00
CAD982461402	CALIFORNIA FINE BLANKING CORP.	HUNTINGTON BEAC	36.17	.00	.00
CAD057470064	CALIFORNIA FINISHED METALS	RANCHO	85.34	.00	.00
CAD009584210	CALIFORNIA INSTITUTE OF TECHNOLOGY	PASADENA	58.63	482.79	.00
CAT080033392	CALIFORNIA STATE UNIVERSITY NORTHRI	NORTHRIDGE	21.08	.00	.00
CAT080031461	CALIFORNIA STATE UNIVERSITY, FULLER	FULLERTON	163.23	50.00	.00
CAD981414550	CALIFORNIA STATE UNIVERSITY, LONG B	LONG BEACH	14.64	559.20	.00
CAD118352921	CALIFORNIA STEEL INDUSTRIES, INC.	FONTANA	42.21	.00	.00
CAD057348278	CALIFORNIA TECHNICAL PLATING	SAN FERNANDO	44.19	880.00	.00
CAD983665779	CALLAWAY GOLF	CARLSBAD	216.98	.00	.00
CAD981443740	CALRESOURCES LLC - PLATFORM ELLEN/E	OCEAN OFFSHORE	34.00	.00	.00
CA7572890518	CAMP ROBERTS TRAINING SITE	CAMP ROBERTS	77.24	.00	.00

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CALIFORNIA

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GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
CAD009198367	CAMPBELL SOUP COMPANY	SACRAMENTO	20.87	.00	.00
CAD008297574	CARDINAL INDUSTRIAL FINISHES	SO. EL MONTE	56.83	.00	.00
CAD102771755	CARDINAL INDUSTRIAL FINISHES	SAN JOSE	21.10	.00	.00
CAD983648734	CARLISLE COATINGS & WATERPROOFING,	FONTANA	18.06	.00	.00
CAD053851366	CASPIAN INC.	SAN DIEGO	129.65	.00	.00
CA0000010827	CATALYTICA, INC.	EAST PALO ALTO	752.95	.00	.00
CAD075307785	CEDARS-SINAI MEDICAL CENTER	LOS ANGELES	22.14	.00	.00
CAD083149617	CENTURY LAMINATORS	ANAHEIM	458.51	.00	.00
CAD008501470	CERRO METAL PRODUCTS COMPANY	PARAMOUNT	290.85	.00	.00
CAD093435022	CERTAINTEAD CORP	CHOWCHILLA	85.76	.00	.00
CAD008508475	CHATSWORTH PRODUCTS INC.	CHATSWORTH	107.40	.00	.00
CAD990845513	CHEM-TRONICS, INC.	EL CAJON	182.36	.00	.00
CA0000010835	CHEMETAL, INC.	HAYWARD	50.21	.00	.00
CAD008302903	CHEMICAL WASTE MANAGEMENT AZUSA FAC	AZUSA	901,459.78	.00	.00
CAT000646117	CHEMICAL WASTE MANAGEMENT INC KETTL	KETTLEMAN CITY	24,622.07	19,500.00	.00
CAT000624056	CHEMICAL WASTE MANAGEMENT, INC.	BAKERSFIELD	65.62	.00	.00
CAD008493603	CHERRY TEXTRON	SANTA ANA	4,123.58	.00	.00
CAD043237486	CHEVRON CHEMICAL CO	RICHMOND	47,821.51	.00	.00
CAD009114919	CHEVRON PRODUCTS CO	RICHMOND	4,878.62	.00	.00
CAT000618603	CHEVRON RESEARCH AND TECHNOLOGY COM	RICHMOND	23.13	.00	.00
CAD008336901	CHEVRON USA PRODUCT	EL SEGUNDO	3,688.00	.00	.00
CAD982319816	CHICO METAL FINISHING INC.	OROVILLE	26.71	.00	.00
CAD046866463	CHIRON CORPORATION	EMERYVILLE	40.09	128.00	.00
CAD982049157	CHIRON CORPORATION	EMERYVILLE	6.82	100.00	.00
CAD002947836	CHROMALLOY LOS ANGELES	GARDENA	4.33	60.00	.00
CAD981974918	CIBA COMPOSITE, CHNG TO HEXCEL CORP	ANAHEIM	40.59	.00	.00
CAD093361079	CIBA-GEIGY CORPORATION	LOS ANGELES	15.33	.00	.00
CAD102104767	CIRCUIT LAM, INC.	SAN JOSE	23.34	.00	.00
CAD021074679	CIRCUIT MANUFACTURING INC.	CHATSWORTH	37.60	.00	.00
CAD982322802	CIREXX CORPORATION	SANTA CLARA	65.70	.00	.00
CAD981414295	CIRPRO TECHNOLOGY INC.	SAN JOSE	15.19	.00	.00
CAD981388655	CIRTECH INC.	ORANGE	36.63	.00	.00
CAD109227496	CITATION CIRCUITS, INC.	STOCKTON	583.52	.00	.00
CAD982370629	CITATION ENTERPRISES, INC.	STOCKTON	95.69	.00	.00
CAR000003665	CITY & CO. OF SF - CITY HALL	SAN FRANCISCO	67.70	.00	.00
CAD066698408	CITY OF HOPE NATIONAL MEDICAL CTR.	DRUARTE	18.60	84.00	.00
CAD983651308	CMC PRINTED BAG, INC.	WHITTIER	25.21	.00	.00
CAD982525073	CMR INC.	FRESNO	12.20	1,200.00	.00
CAD094979135	COHERENT LASER GROUP	SANTA CLARA	27.45	.00	.00
CAD034635730	COHERENT, INC. AUBURN GROUP	AUBURN	18.70	.00	.00
CAD983613019	COLORSTRIP, INC.	RICHMOND	194.30	.00	.00
CAD040517732	COLTON TERMINAL-CHEVRON RETAIL MARK	BLOOMINGTON	189.74	.00	.00
CAD982002818	COLTON TRUCK TERMINAL GARAGE	COLTON	34.30	.00	.00
CAR000003863	COMMUNICATIONS AND POWER INDUSTRIES	PALO ALTO	2,023.27	365,200.00	.00
CAD982324154	COMPOSITE STRUCTURES	MONROVIA	129.54	.00	.00
CAD098385875	CONEJO CIRCUITS, INC.	NEWBURY PARK	15,280.75	.00	.00
CAD088378245	CONSOLIDATED FILM INDUSTRIES	HOLLYWOOD	32.31	.00	.00
CAD069122919	CONTACT INTERNATIONAL	SUNNYVALE	16.82	.00	.00
CAD981388846	CONTAINER SUPPLY CO., INC.	GARDEN GROVE	18.75	.00	.00
CAD981418395	CONTINENTAL MARITIME OF SAN DIEGO,	SAN DIEGO	14.26	.00	.00
CAD983577537	CONTRA COSTA CARBON PLANT	RODEO	5,102.82	.00	.00
CAD981689953	CONTRA COSTA NEWSPAPERS	WALNUT CREEK	27.31	.00	.00
CAD043722958	COOK COMPOSITES & POLYMERS CO	MILPITAS	34.29	.00	.00
CAR000001289	CORDOVA PRINTED CIRCUITS INC.	MILPITAS	41.29	.00	.00
CAD982436412	CORNING NICHOLS INSTITUTE	SAN JUAN CAPIST	62.43	9.00	.00

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CALIFORNIA

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
CA0000302984	CORUAS INTERNATIONAL INC.	SAN DIEGO	20.52	.00	.00
CAD046607511	COSMOTRONIC COMPANY CORP.	IRVINE	79.43	.00	.00
CAR000005546	COSTCO WHOLESALE #143	MT. VIEW	27.09	.00	.00
CAR000003962	COSTCO WHOLESALE #144	SAN FRANCISCO	22.25	.00	.00
CAR000003632	COSTCO WHOLESALE #148	SAN JOSE	18.45	.00	.00
CAR000004838	COSTCO WHOLESALE #40	MARTINEZ	21.96	.00	.00
CAD009110867	COURTAULDS AEROSPACE	BERKELEY	426.24	.00	.00
CAD008237596	COURTAULDS AEROSPACE, INC	GLENDALE	118.18	.00	.00
CAD981691108	COURTAULDS AEROSPACE, INC	MOJAVE	260.99	.00	.00
CAD009438300	CPI-EIMAC DIVISION	SAN CARLOS	96.42	.00	.00
CAD000094243	CRITERION CATALYST CO. L.P.	PITTSBURG	98.44	.00	.00
CAD021858063	CROCKER PLATING WORKS	LOS ANGELES	15.66	.00	.00
CAD028409019	CROSBY AND OVERTON INC	LONG BEACH	260.97	.00	.00
CAD062062435	CROWN BEVERAGE PACKAGING CO	VAN NUYS	20.47	.00	.00
CAD045290996	CROWN BEVERAGE PACKAGING COMPANY	UNION CITY	15.15	.00	.00
CAD016845414	CROWN CIRCUITS, INC.	CARLSBAD	25.15	.00	.00
CAD008305062	CROWN CITY PLATING CO.	EL MONTE	249.63	.00	.00
CAD020764353	CROWN CORK & SEAL COMPANY	LA MIRADA	73.07	.00	.00
CAD009226358	CROWN CORK & SEAL COMPANY, INC.	FREMONT	29.49	.00	.00
CAD980896245	CROWN CORK & SEAL COMPANY, INC.	SAN LEANDRO	44.68	.00	.00
CAD980882369	CRYSTAL TECHNOLOGY, INC.	PALO ALTO	27.82	.00	.00
CAD029910734	CSL, INC.	SANTA CLARA	13.84	.00	.00
CAD008382293	CUBIC DEFENSE SYSTEMS, INC.	SAN DIEGO	14.80	.00	.00
CAD981447535	CYPRESS SEMICONDUCTOR	SAN JOSE	50.17	.00	.00
CAT000610931	CYTEC ENGINEERED MATERIALS, INC.	ANAHEIM	118.29	.00	.00
CA0000142331	DANA CORPORATION	STOCKTON	21.67	.00	.00
CAT080013584	DATA CIRCUIT SYSTEMS	SAN JOSE	13,012.39	.00	.00
CAD143841567	DATA ELECTRONIC SERVICES, INC.	SANTA ANA	35.83	.00	.00
CAD063544902	DAVILLA INTERNATIONAL CIRCUITS, INC	MOUNTAIN VIEW	167.60	.00	.00
CAD009637059	DAY-GLO COLOR CORP.	CUDAHY	37.97	.00	.00
CA7210020676	DEF LANGUAGE INST & PRESIDIO OF MON	PRESIDIO OF MON	49.10	.00	.00
CA8210020832	DEFENSE DISTRIBUTION REGION WEST SH	LATHROP	132.52	2,617.00	.00
CA4971520834	DEFENSE DISTRIBUTION REGION WEST TR	TRACY	81.15	436.00	.00
CA8971524360	DEFENSE FUEL SUPPORT POINT NORWALK	NORWALK	23.45	.00	.00
CAD971595236	DEFENSE FUEL SUPPORT POINT OZOL	MARTINEZ	22.53	.00	.00
CAD008254195	DEFT INC.	IRVINE	81.70	.00	.00
CAD009305848	DELCO SYSTEMS OPERATIONS	GOLETA	3.96	143.90	.00
CAD008323396	DELPHI DIVISION, GENERAL MOTORS COR	ANAHEIM	4,242.52	.00	.00
CAD981375959	DELRU COMPANY	ANAHEIM	25.16	.00	.00
CAD981450281	DELUXE LABRATORIES	HOLLYWOOD	61.03	.00	.00
CAD000633305	DEPT OF WATER POWER CITY OF LA	LOS ANGELES	22.36	.00	.00
CAD099156523	DETAILS, INC.	ANAHEIM	284.92	.00	.00
CAD009630708	DEUTSCH ENGINEERED CONNECTING DEVIC	OCEANSIDE	183.70	80.00	.00
CAD097574073	DEVOE COATINGS COMPANY	RIVERSIDE	114.80	.00	.00
CAD052251626	DEXTER ELECTRONIC MATERIALS DIVISIO	INDUSTRY	48.85	.00	.00
CAD050345438	DEXTER HYSOL AEROSPACE, INC.	PITTSBURG	77.19	.00	.00
CAD981449606	DIAGNOSTIC PRODUCTS CORP.	LOS ANGELES	57.14	130.00	.00
CAD981425713	DIEMER FILTRATION PLANT	YORBA LINDA	365.96	.00	.00
CAD027828250	DISNEYLAND	ANAHEIM	30.67	.00	.00
CAD008392722	DIXON HARD CHROME, INC.	SUN VALLEY	19.39	.00	.00
CAD983654567	DNAX RESEARCH INSTITUTE	PALO ALTO	23.34	40.00	.00
CAD008378044	DOUGLAS AIRCRAFT COMPANY	LONG BEACH	2,575.18	.00	.00
CAD086510005	DOUGLAS AIRCRAFT COMPANY	TORRANCE	308.82	20.00	.00
CAD076528678	DOW CHEMICAL COMPANY PITTSBURG	PITTSBURG	1,294.95	.00	.00
CAD009206855	DU PONT - KANSAI	SO. SAN FRANCIS	31.35	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
CAD008236648	DUNN-EDWARDS CORPORATION	LOS ANGELES	40.44	.00	.00
CAD983616194	DYNAFLEX TECHNOLOGY	SAN JOSE	20.71	.00	.00
CAD080031511	DYNAMIC CIRCUITS INC.	MILPITAS	214.82	.00	.00
CAD009151671	E. I. DU PONT DE NEMOURS & CO.	ANTIOCH	771.98	.00	.00
CAD009200031	E.D. COAT, INC.	OAKLAND	15.42	.00	.00
CAD080707045	E.I DU PONT DE NEMOURS & CO., INC.	HAYWARD	28.24	.00	.00
CAD001685338	E.I. DU PONT CO.	COMMERCE	46.22	.00	.00
CAD045521184	E.M.E., INC.	COMPTON	24.71	5,400.00	.00
CAD981387178	E-FAB INC.	SANTA CLARA	28.42	.00	.00
CAD001425206	E-SYSTEMS/GOLETA DIVISION	GOLETA	11.84	115.00	.00
CAD009525098	EASTON SPORTS, INC., VAN NUYS	VAN NUYS	239.32	.00	.00
CA0000202093	EBARA TECHNOLOGIES INC.	SACRAMENTO	34.16	.00	.00
CAD074636598	ECI SEMICONDUCTORS, INC.	SANTA CLARA	73.02	.00	.00
CAD008253957	EDGINGTON OIL COMPANY	LONG BEACH	16.80	.00	.00
CAD982348419	EEMUS MANUFACTURING CORP.	SO. EL MONTE	126.70	.00	.00
CAD981369853	EG & G BIRTCHER	EL MONTE	60.80	200.00	32,400.00
CAD982501066	EG & G IC SENSORS, INC.	MILPITAS	16.72	.00	.00
CAD009116211	ELECTRO-COATINGS INC.	BERKELEY	111.32	.00	.00
CAD009116229	ELECTRO-COATINGS INC.	EMERYVILLE	120.91	.00	.00
CAD982017394	ELECTROCHEM, DIV. OF QMECT, INC.	HAYWARD	89.05	.00	.00
CAD008391427	ELECTRONIC CHROME & GRINDING COMPAN	SANTA FE SPRING	103.97	.00	.00
CAD051498202	ELECTRONIC PLATING SERVICE, INC.	GARDENA	31.27	.00	.00
CAD981369408	ELECTRONIC PRECISION SPECIALTIES IN	BREA	57.37	.00	.00
CAD981379506	ELECTROPLY, INC.	EL SEGUNDO	20.47	.00	.00
CAD008344285	ELEXSYS INTERNATIONAL INC.	IRVINE	879.69	.00	.00
CAD981572803	ELEXSYS INTERNATIONAL, INC.	MOUTAIN VIEW	961.57	.00	.00
CAD083159707	EMERSON ELECTRIC	SANTA ANA	36.22	.00	.00
CAD077176998	ENC TECHNOLOGY, LLC	SANTA CLARA	20.87	.00	.00
CAD008368987	ENERGY SYSTEMS GROUP-DE SOTO	CANOGA PARK	14.06	.00	.00
CAT000612150	ENGELHARD WEST, INC.	ANAHEIM	17.68	.00	.00
CAD002277093	ENGINEERED POLYMER SOLUTIONS	LOS ANGELES	200.57	.00	.00
CAD044429835	ENSCO WEST INC	WILMINGTON	8,885.12	3,029.00	.00
CAD982484933	ERICKSON, INC., FONTANA, CA	FONTANA	128.06	.00	.00
CAD000628875	ESTERO MARINE TERMINAL	MORRO BAY	27.00	.00	.00
CAD064154354	ETCH-TEK, INC.	CONCORD	87.30	.00	.00
CAD982465098	EVENSTAR INC.	SANTA CLARA	54.47	.00	.00
CAD981410871	EXCEL CIRCUITS	SANTA CLARA	101.38	.00	.00
CAD062062195	EXXON CHEMICAL COMPANY	BAKERSFIELD	23.59	1.00	.00
CAD981447097	EXXON COMPANY, U.S.A.	SANTA BARBARA C	71.30	.00	.00
CAD063001770	EXXON COMPANY, U.S.A., BENICIA REFI	BENICIA	638.60	.00	.00
CAD990664617	FABRI COTE	LOS ANGELES	18.16	.00	.00
CAD000093500	FAIRCHILD SCREWCORP	INDUSTRY	25.50	.00	.00
CA4170090027	FLEET INDUSTRIAL SUPPLY CTN OAKLAN	OAKLAND	280.01	468.00	.00
CAD981682685	FLEETWOOD MOTORHOMES OF CA #47	RIVERSIDE	33.41	.00	.00
CAD008255820	FLETCHER OIL AND REFINING CO.	CARSON	56.70	.00	.00
CAD982508095	FLEX PRODUCTS, INC.	SANTA ROSA	86.31	.00	.00
CAD981383300	FLEX-LINK PRODUCTS, INC.	SAN FERNANDO	45.84	.00	.00
CAD982400665	FLIGHT OPERATIONS DETACHMENT	BARSTOW	84.96	.00	.00
CAT000625350	FLUID SYSTEMS CORPORATION	SAN DIEGO	86.81	.00	.00
CAD009147000	FMC CORPORATION	NEWMARK	717.78	.00	.00
CAD981375108	FOLSOM ST. PRISON/CAL ST. PRISON-SA	REPRESA	2,673.57	.00	.00
CAD983616731	FORD MOTOR CO	NEWPORT BEACH	22.10	.00	.00
CAD982504052	FORMER LOCKHEED PLANT A-1 SOUTH	BURBANK	1,184.99	.00	.00
CAD045256187	FORMER LOCKHEED PLANT B-1	BURBANK	29.45	.00	.00
CA8210020436	FORT HUNTER LIGGETT	FORT HUNTER LIG	61.53	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
CAD008278236	FOSS PLATING COMPANY, INC	SANTA FE SPRING	22.77	.00	.00
CAD981421860	FOUR-D METAL FINISHING, INC.	SUNNYVALE	24.19	.00	.00
CAD044331155	FRAZEE INDUSTRIES	SAN DIEGO	159.60	.00	.00
CAD009234402	FRICTION, INC.	IRVINE	61.99	.00	.00
CAD009107749	GALLO GLASS COMPANY	MODESTO	14.23	.00	.00
CAD046442612	GARDENA PLATING COMPANY	GARDENA	49,613.00	.00	.00
CAD000546630	GARRETT AVIATION SERVICES	LOS ANGELES	40.19	.00	.00
CAD010715837	GATX CARSON TERMINAL	CARSON	968.63	.00	.00
CAD000630053	GATX LOS ANGELES HARBOR TERMINAL	WILMINGTON	236.01	.00	.00
CAD000633099	GATX LOS ANGELES MARINE TERMINAL	WILMINGTON	34.30	.00	.00
CAD059240663	GCG CORPORATION	GLENDALE	18.30	.00	.00
CAD009542721	GE ENGINE SERVICES - WEST COAST OPE	ONTARIO	14.50	.00	.00
CAT000613471	GE NUCLEAR ENERGY	SAN JOSE	18.64	.00	.00
CAD077264737	GENE'S PLATING WORKS	LOS ANGELES	305.40	.00	.00
CAD080129000	GENENTECH, INC.	SOUTH SAN FRANC	34.26	17.80	.00
CAD067638957	GENERAL ATOMICS	SAN DIEGO	28.68	9.00	.00
CAD009142290	GENERAL CHEMICAL CORP BAY PT WO	PITTSBURG	828.30	.00	.00
CAD028981967	GENERAL CHEMICAL CORPORATION - RICH	RICHMOND	20.79	.00	.00
CAD041512427	GENERAL DYNAMICS COVAIR DIVISION	SAN DIEGO	1,140.65	.00	.00
CAD981393192	GENERAL DYNAMICS COVAIR DIVISION	SAN DIEGO	28.08	.00	.00
CAD000051458	GENERAL MOTORS CORP. VAN NUYS PLANT	PANORAMA CITY	204.72	.00	.00
CAD983615519	GENSIA, INC.	SAN DIEGO	15.86	122.00	.00
CAD008378887	GEORGE INDUSTRIES	LOS ANGELES	14.50	.00	.00
CAD980585053	GEORGIA-PACIFIC RESINS	ELK GROVE	35.09	.00	.00
CAD043260702	GIBSON ENVIRONMENTAL	REDWOOD CITY	177.52	.00	.00
CAD980883177	GIBSON ENVIRONMENTAL	BAKERSFIELD	158.08	.00	.00
CA0000280198	GILEAD SCIENCES	FOSTER CITY	20.48	.00	.00
CAD066557182	GILLIG CORP	HAYWARD	40.90	.00	.00
CAD981457716	GILROY FOODS, INCORPORATED	GILROY	24.95	.00	.00
CAD980896369	GLOBAL PLATING	FREMONT	17.44	.00	.00
CAD088396056	GMC ELECTRO-MOTIVE	COMMERCE	63.75	.00	.00
CAD008324832	GNB BATTERY TECHNOLOGIES	CITY OF INDUSTR	112.88	.00	.00
CAD097854541	GNB BATTERY TECHNOLOGIES	LOS ANGELES	21,446.13	.00	.00
CAD981689607	GOLD SEAL PLATING	OAKLAND	46.56	.00	.00
CAD982023988	GOLDEN GATE BRIDGE DISTRICT	SAN FRANCISCO	20.42	.00	.00
CAD009680232	GRAPHIC RESEARCH, INC.	CHATSWORTH	79.03	.00	.00
CAD009419607	GREAT WESTERN CHEMICAL CO.	RICHMOND	46.63	.00	.00
CAD982518268	GREAT WESTERN CHEMICAL CO.	SANTA FE SPRING	14.65	.00	.00
CAD057477994	GRISWOLD INDUSTRIES	COSTA MESA	668.54	.00	.00
CAD982039844	GSF ENERGY INC. DAVIS ST. LFG RECOV	SAN LEANDRO	14.45	.00	.00
CAD981395742	GSF ENERGY INC. OLINDA LFG RECOVERY	BREA	42.60	.00	.00
CAD982039786	GSF ENERGY INC.MOUNTAINGATE LFG REC	WEST LOS ANGELE	51.97	.00	.00
CAD076306836	GTE GOVERNMENT SYSTEMS CORP	MOUNTIAN VIEW	25.83	.00	.00
CAD982032229	GUARDIAN INDUSTRIES CORP.	KINGSBURG	44.98	.00	.00
CAD000096305	GUARDSMAN PRODUCTS INC.	SOUTH GATE	309.63	.00	.00
CAD981454119	GUIDANT CORPORATION	TEMECULA	42.56	.00	.00
CAD981413933	GULFSTREAM AEROSPACE CORPORATION	LONG BEACH	38.92	.00	.00
CAD004771168	H H SHIP SERVICE CO	SAN FRANCISCO	55.06	.00	.00
CAD091431056	H.F. COORS CHINA COMPANY	INGLEWOOD	52.07	.00	.00
CAD044059665	H.P. METAL FINISHING CO.	HUNTINGTON PARK	26.37	.00	.00
CAT080034101	HADCO CORP. TECH CENTER II	WATSONVILLE	226.62	.00	.00
CAR000013003	HALLMARK CIRCUITS, INC.	SAN DIEGO	194.54	.00	.00
CAD982038895	HAMMON PLATING INNC.	PALO ALTO	40.60	.00	.00
CAD982503179	HARBOR ELECTRONICS, INC.	SANTA CLARA	34.01	.00	.00
CAD079605366	HARBOR-UCLA MEDICAL CENTER	TORRANCE	60.59	250.00	.00

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CAD060763596	HARTWELL CORPORATION	RANCHO CUCAMONG	8,833.50	.00	.00
CAT000646257	HAWKER PACIFIC INC. FLIGHT ACCESSOR	SUN VALLEY	102.40	200.00	.00
CAD115333635	HAWTHORNE ENGINE SYSTEMS	SAN DIEGO	15.71	.00	.00
CAD063111769	HAYDEN INC.	CORONA	19.08	.00	.00
CAO000909523	HEADWAY TECHNOLOGIES, INC.	MILPITAS	40.64	.00	.00
CAD077385193	HELENA CHEMICAL COMPANY	KERMAN	82.61	164,528.70	.00
CAD982510802	HERCO TECHNOLOGY CORPORATION	SAN DIEGO	1,375.05	.00	.00
CAD981452857	HERMETIC SEAL CORPORATION	ROSEMEAD	41.76	.00	.00
CAD058412842	HEWLETT PACKARD-FOUNTAINGROVE SITE	SANTA ROSA	195.07	87.00	.00
CAD076314582	HEWLETT- PACKARD CO	PALO ALTO	14.45	.00	.00
CAD009122532	HEWLETT-PACKARD COMPANY	PALO ALTO	275.34	.00	.00
CAD009442484	HEWLETT-PACKARD COMPANY	SANTA CLARA	38.60	1,028.00	.00
CAD980895155	HEWLETT-PACKARD COMPANY	NEWARK	27.94	.00	.00
CAT000611400	HEWLETT-PACKARD COMPANY	SAN JOSE	185.01	.00	.00
CAD049904766	HEWLETT-PACKARD COMPANY, SAN DIEGO	SAN DIEGO	293.53	.00	.00
CAD058783952	HEXCEL CORPORATION	LIVERMORE	337.20	.00	.00
CAD000056069	HEXCEL TECHNOLOGY CENTER	DUBLIN	31.59	.00	.00
CAD990843377	HI-SHEAR CORPORATION	TORRANCE	693.85	.00	.00
CAD008292153	HIGHLAND PLATING CO., INC.	LOS ANGELES	27.25	.00	.00
CAD983600032	HILLERICH & BRADSBY CO., INC.	ONTARIO	23.21	.00	.00
CAD046452439	HITCO TECHNOLOGIES, INC.	GARDENA	81.12	.00	.00
CAR000001636	HMT TECHNOLOGY CORP.	FREMONT	.39	772.00	.00
CAD990665424	HOLGA INC.	VAN NUYS	28.40	.00	.00
CAD982481863	HOLLISTER FACILITY	GOLETA	35.92	.00	.00
CAD008494460	HOLLY SUGAR CORPORATION	BRAWLEY	16.75	.00	.00
CAT000624122	HR TEXTRON INC., VALENCIA FACILITY	VALENCIA	15.59	.00	.00
CAD044429884	HUCK INTERNATIONAL, INC.	CARSON	68.80	.00	.00
CAD000633230	HUGHES AIRCRAFT CO EOS ESS	EL SEGUNDO	89.56	2,070.00	.00
CAD063109243	HUGHES AIRCRAFT CO FULLERTON	FULLERTON	460.09	.00	.00
CAD041666819	HUGHES AIRCRAFT CO. - EDD	TORRANCE	56.14	.00	.00
CAD981451826	HUGHES AIRCRAFT COMPANY - BLDG. 684	FULLERTON	39.88	.00	.00
CAT080010853	HUGHES AIRCRAFT COMPANY, RCS, ESN	EL SEGUNDO	10.89	295.00	.00
CAD982462012	HUGHES AIRCRAFT GAO TORRANCE	TORRANCE	13.91	.00	.00
CAD008492951	HUGHES MISSILE SYSTEMS COMPANY POMO	POMONA	14.69	.00	.00
CAD982430530	HUGHES MSL SYSTEMS CO. SYCAMORE CAN	POMERADO	58.17	.00	.00
CAD041156969	HUGHES RESEARCH LABORATORY	MALIBU	74.04	1,714.00	.00
CAD060897063	HUGHES SPACE AND COMMUNICATIONS CO	EL SEGUNDO	72.71	.00	.00
CAD084239987	HUGHES TECHNOLOGY CENTER	CARLSBAD	18.62	.00	.00
CAD076543503	HULS AMERICA, INC.	PLEASANTON	219.06	.00	.00
CAD981367709	HUNTER TECHNOLOGY	SANTA CLARA	57.42	.00	.00
CAD026884783	HUNTWAY REFINING COMPANY	BENICIA	20.10	.00	.00
CAD981373053	HUNTWAY REFINING COMPANY	WILMINGTON	56.07	.00	.00
CAD981461684	HYBRITECH INCORPORATED	SAN DIEGO	1.41	216.00	.00
CAD981568520	HYDRANAUTICS	SAN DIEGO	99.51	.00	.00
CAD008388720	HYDRO-AIRE DIV CRANE CO	BURBANK	17.11	.00	.00
CAD982483885	HYPER CORPORATION	HUNTINGTON BEAC	27.94	.00	.00
CAD981390412	HYPERION TREATMENT PLANT	PLAYA DEL REY	29.78	.00	.00
CAD980881262	I.C.P.C. ETCHED CIRCUITS INC.	REDWOOD CITY	72.56	.00	.00
CAD980883292	IBM ALMADEN RESEARCH CENTER	SAN JOSE	28.15	483.00	.00
CAD990843989	IBM CORP STORAGE SYSTEMS DIVISION	SAN JOSE	8,400.78	.00	.00
CAD009589235	ICI FIBERITE INC.	ORANGE	394.11	.00	.00
CAD980585186	IMP, INC.	SAN JOSE	198.01	.00	.00
CA0000134171	INCHCAPE TESTING SERVICES, ENVIRONM	SAN JOSE	31.04	62.00	.00
CAD981449416	INDUSTRIAL PLATING CO., INC.	SAN CARLOS	13.92	.00	.00
CAD009521329	INDUSTRIAL STEEL TREATING CO.	HUNTINGTON PARK	66.95	.00	.00

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CALIFORNIA

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
CAD008334781	INDUSTRIAL TECTONICS BEARINGS	RANCHO DOMINGUE	16.88	.00	.00
CAD981378144	INSIGHT DESIGNS	OAKLAND	18.35	.00	.00
CAD982511768	INTEGRATED DEVICE TECHNOLOGY INC.	SAN JOSE	93.83	.00	.00
CAD980893267	INTEGRATED DEVICE TECHNOLOGY, INC.	SALINAS	77.31	.00	.00
CAD047897855	INTEL CORPORATION-BOWERS CAMPUS	SANTA CLARA	25.62	.00	.00
CAD000626697	INTEL CORPORATION-MISSION CAMPUS	SANTA CLARA	1,808.74	.00	.00
CAD076053701	INTERMETRO INDUSTRIES CORP.	CUCAMONGA	48.45	.00	.00
CAD982319725	INTERNATIONAL BILLING SERVICES	EL DORADO HILLS	19.21	.00	.00
CAD044405603	INTERNATIONAL EXTRUSION CORP.	ALHAMBRA	24.28	.00	.00
CAD024149817	INTERNATIONAL LEADFRAME CORP.	SANTA CLARA	58.90	.00	.00
CAD076208313	INTERNATIONAL RECTIFIER	EL SEGUNDO	81.47	.00	.00
CAD981158546	INTERNATIONAL RECTIFIER/HEXFET AMER	TEMECULA	81.03	.00	.00
CAT080010044	INTERPLASTIC CORP.,SILMAR RESINS DI	HAWTHORNE	35.01	.00	.00
CAD981632979	INTERSPACE BATTERY CORP.	WEST COVINA	343.37	.00	.00
CAD008391815	IPS CORPORATION	GARDENA	15.86	.00	.00
CAD982504458	ISIS PHARMACEUTICALS	CARLSBAD	61.14	35.00	.00
CAD000060012	IT CORP PANOCHE FACILITY	BENICIA	11,119.93	.00	.00
CAD981388630	ITALIX COMPANY, INC.	SANTA CLARA	130.93	.00	.00
CA0000138537	ITT AEROSPACE CONTROLS	VALENCIA	16.27	.00	.00
CAD044403376	ITT BARTON, CITY OF IND., CA US	CITY OF INDUSTR	45.19	.00	.00
CAD049974231	ITT CANNON	SANTA ANA	272.62	.00	.00
CAD990665556	ITT GILFILLAN	VAN NAYS	24.34	.00	.00
CAD008480204	J. H. BAXTER & CO.-LONG BEACH	LONG BEACH	68.30	.00	.00
CAD000625731	J. H. BAXTER & CO.-WEED	WEED	53.60	.00	.00
CAD009117516	JAMES RIVER CORPORATION	SAN LEANDRO	61.42	.00	.00
CAD982501983	JBL SCIENTIFIC, INC.	SAN LUIS OBISPO	84.16	.00	.00
CAD980737894	JBL/HARMAN INTERNATIONAL	NORTHRIDGE	57.22	.00	.00
CAD981425291	JENSEN FILTRATION PLANT	GRANADA HILLS	14.09	.00	.00
CA9800013030	JET PROPULSION LABORATORY	PASADENA	25.36	2,779.80	.00
CAD983649229	JOHANSON DIELECTRICS, INC.	SYLMAR	475.05	.00	.00
CAD008323388	JOHNSON CONTROLS BATTERY GROUP INC	FULLERTON	1,807.66	.00	.00
CAD047429147	JOHNSON LAMINATING AND COATING, INC	CARSON	14.13	.00	.00
CAD080914559	JOHNSON MATTHEY, INC	SAN DIEGO	18.27	.00	.00
CAD982394454	JOICO LABORATORIES, INC.	CITY OF INDUSTR	17.77	.00	.00
CAD000852889	JOINT WATER POLLUTION CONTROL PLANT	CARSON	9.88	80.00	.00
CAD097458533	JOSLYN SUNBANK CORPORATION	PASO ROBLES	22.21	.00	.00
CAD981409352	K & H FINISHING, INC.	SAN JOSE	38.54	.00	.00
CAD008304594	K & L ANODIZING CORPORATION	BURBANK	119.62	.00	.00
CAD009183948	K & L PLATING COMPANY	OAKLAND	317.62	.00	.00
CAD066568130	K&L PLATING COMPANY	OAKLAND	258.85	.00	.00
CAD009460767	KAISER AEROTECH	SAN LEANDRO	15.11	481.65	.00
CAD071683940	KAISER ALUMINUM & CHEMICAL CORPORAT	PLEASANTON	100.76	.00	.00
CAD981454887	KAISER ALUMINUM EXTRUDED PRODUCTS	LOS ANGELES	58.48	.00	.00
CAD981426893	KAISER FOUNDATION HEALTH PLAN, INC.	SACRAMENTO	20.70	.00	.00
CAD981427370	KAISER FOUNDATION HOSPITAL	SAN FRANCISCO	37.28	.00	.00
CAD981427677	KAISER HOSPITAL MARTINEZ	MARTINEZ	25.20	.00	.00
CAD981426836	KAISER PERMANENTE - SANTA ROSA	SANTA ROSA	15.98	.00	.00
CAD981427198	KAISER PERMANENTE MED. CTR, REDWOOD	REDWOOD CITY	42.89	.00	.00
CAD981426778	KAISER PERMANENTE MEDICAL CENTER	SANTA CLARA	31.01	.00	.00
CAD981426950	KAISER PERMANENTE MEDICAL CENTER	S. SAN FRANCISC	29.55	.00	.00
CAD981427495	KAISER PERMANENTE MEDICAL CENTER	SAN RAFAEL	24.90	.00	.00
CAD983653544	KAISER PERMANENTE MEDICAL CENTER, F	FRESNO	21.65	.00	.00
CAD983583709	KAISER PERMANENTE REGIONAL LABORATO	NORTH HOLLYWOOD	47.75	22.00	.00
CAD981427313	KAISER PERMANENTE SACRAMENTO MED. C	SACRAMENTO	47.25	.00	.00
CAD981427610	KAISER PERMENENTE	HAYWARD	21.15	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
CAD983605932	KAISER REGIONAL LABORATORY	BERKELEY	64.04	.00	.00
CAD042220848	KAISER ROLLMET	IRVINE	15.47	.00	.00
CAD981391576	KALLEN INDUSTRIES DBA WAMBOLD FURNI	SIMI VALLEY	20.47	.00	.00
CA0000643270	KAO INFOSYSTEMS COMPANY	FREMONT	58.50	.00	.00
CAD981997547	KAVLICO CORPORATION	MOOR PARK	23.70	.00	.00
CAD008289183	KAYNAR MANUFACTURING DIVISION	FULLERTON	159.70	.00	.00
CAT000613372	KCA ELECTRONICS, INC.	ANAHEIM	413.29	.00	.00
CAD009125303	KELLY-MOORE PAINT COMPANY, INC	SAN CARLOS	292.33	.00	.00
CAD981376049	KERR/SYBRON DENTAL MATERIALS CENTER	SANTA ANA	24.98	.00	.00
CAD047784574	KETEMA A&E	EL CAJON	13.75	.00	.00
CAD009547373	KIMBERLY-CLARK CORPORATION	FULLERTON	20.43	.00	.00
CAD088504881	KINSBURSKY BROTHERS SUPPLY INC	ANAHEIM	5,879.55	.00	.00
CAD982403792	KOMAG, INC BLDG 6	SAN JOSE	54.52	.00	.00
CAD981420821	KOMAG, INC. BLDG 2 & 4	MILPITAS	471.39	.00	.00
CAD004937793	KOP-COAT INC.	VERNON	48.70	.00	.00
CAD009112087	KOPPERS INDUSTRIES INC	OROVILLE	66.40	.00	.00
CAD008301467	KWIKSET CORPORATION	ANAHEIM	373.16	.00	.00
CAD047896097	KYOCERA AMERICA, INC.	SAN DIEGO	113.52	.00	.00
CAD983617077	L.A. FILMCO, INC.	BURBANK	16.00	.00	.00
CAD981163694	LA JOLLA PHARMACEUTICALS, INC.	SAN DIEGO	34.34	15.00	.00
CA0000137893	LA VERNE FACILITY	LA VERNE	84.85	.00	.00
CAD981576978	LAC METROPOLITAN TRANSPORTATION AUT	LOS ANGELES	129.76	.00	.00
CAD980675276	LAIDLAW ENVIRIONMENTAL SERVICES	BUTTONWILLOW	475.25	.00	.00
CAD981425598	LAKE SKINNER	WINCHESTER	43.02	.00	.00
CAD982493009	LANMARK CIRCUITS, INC.	GRASS VALLEY	37.60	.00	.00
CA4890008986	LAWRENCE BERKELEY NATIONAL LABORATO	BERKELEY	4,963.03	570.00	.00
CA2890012584	LAWRENCE LIVERMORE NATIOAL LAB MAIN	LIVERMORE	847.42	276,736.22	.00
CA2890090002	LAWRENCE LIVERMORE NATIOAL LAB SITE	TRACY	132.21	110.00	.00
CAD000626812	LEACH INTERNATIONAL	BUENA PARK	18.99	.00	.00
CAD083585604	LEACH INTERNATIONAL	ANAHEIM	16.81	.00	.00
CAD981665706	LENTHOR ENGINEERING	MILPITAS	41.82	.00	.00
CAT000624916	LIBBEY GLASS INC.	CITY OF INDUSTR	51.70	.00	.00
CAD005415633	LIBBEY OWENS FORD CO.	LATHROP	16.57	.00	.00
CAD020750659	LIGHTOLIER INC	COMPTON	14.43	.00	.00
CAD008335366	LILLY INDUSTRIES, INC.	MONTEBELLO	112.59	.00	.00
CAD071911051	LILLY INDUSTRIES, INC.	GARDENA	23.69	.00	.00
CAD008258626	LINDBERG HEAT TREATING CO.	LOS ANGELES	16.80	.00	.00
CAD980694590	LINEAR TECHNOLOGY CORPORATION	MILPITAS	37.84	.00	.00
CAD000336586	LITRONIC INDUSTRIES	COSTA MESA	61.61	.00	.00
CAT080010804	LITTON ELECTRON DEVICES	PALO ALTO	48.59	.00	.00
CAD083007799	LITTON GUIDANCE AND CONTROL SYSTEMS	WOODLAND HILLS	14.91	.00	.00
CAD056160336	LITTON IND. ELECTRON DEVICES DIV.	SAN CARLOS	37.23	.00	.00
CAD008368896	LOCKHEED MARTIN AIRCRAFT SERVICES	ONTARIO	31.05	.00	.00
CA6570090443	LOCKHEED MARTIN ASTRONAUTICS - PLAN	SAN DIEGO	16.60	.00	.00
CAD982317547	LOCKHEED MARTIN ASTRONAUTICS KEARNY	SAN DIEGO	38.55	.00	.00
CAD009125535	LOCKHEED MARTIN MISSILES AND SPACE	SUNNYVALE	2,476.02	4,040.00	.00
CAD009129354	LOCKHEED MARTIN MISSILES AND SPACE	PALO ALTO	12.13	500.00	.00
CAD981626054	LOCKHEED MARTIN MISSILES AND SPACE	SUNNYVALE	21.04	.00	.00
CAD981694656	LOCKHEED MARTIN MISSILES AND SPACE	MILPITAS	.47	640.00	.00
CAD981986086	LOCKHEED MARTIN MISSILES AND SPACE	REDWOOD CITY	421.67	.00	.00
CAD009679077	LOCKHEED MARTIN SKUNK WORKS PLANT 1	PALMDALE	119.20	.00	.00
CA5570090048	LOCKHEED MARTIN SKUNK WORKS SITE 2	PALMDALE	216.91	.00	.00
CA6570090047	LOCKHEED MARTIN SKUNK WORKS SITE 7	PALMDALE	97.74	.00	.00
CAT080014186	LOMITA GASOLINE COMPANY, INC.	LONG BEACH	78.23	.00	.00
CAD050125194	LONG BEACH TRANSIT PUBLIC	LONG BEACH	18.71	.00	.00

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CAD070635669	LONZA INC.	LOS ANGELES	1,030.57	.00	.00
CAD981978935	LORAL AERONUTRONIC (RSM)	RANCHO SANTA MA	17.29	.00	.00
CAD980638100	LORAL FAIRCHILD IMAGING SENSORS	MILPITAS	15.61	.00	.00
CAD010705143	LORAL LIBRASCOPE CORP.	GLENDALE	3.36	360.00	.00
CAD983613233	LOS ANGELES FILTRATION PLANT	SYLMAR	73.62	.00	.00
CAT080033160	LSI LOGIC CORPORATION	MILPITAS	47.04	.00	.00
CAD064483704	LUXFER USA LTD	RIVERSIDE	19.25	.00	.00
CAD008391641	LYLE VAN PATTEN CO., INC.	LOS ANGELES	128.92	.00	.00
CA0000118596	LYNX THERAPEUTICS, INC.	HAYWARD	17.08	.00	.00
CAD008317422	M.C. GILL CORPORATION	EL MONTE	66.79	.00	.00
CAD051707818	MADERA GLASS COMPANY	MADERA	19.95	.00	.00
CAD052853454	MAG INSTRUMENT, INC.	ONTARIO	35.50	.00	.00
CAD006914469	MAJOR PAINT COMPANY	TORRANCE	94.63	.00	.00
CAD043236942	MALLINCKRODT BAKER, INC.	HAYWARD	15.26	.00	.00
CAD008371379	MANSFIELD PLUMBING PRODUCTS	WALNUT	50.37	.00	.00
CAD981967797	MARCEL ELECTRONICS	ORANGE	80.13	.00	.00
CA4570024527	MARCH AFB, CA	MORENO VALLEY	675.21	.00	.00
CAO170090013	MARINE CORPS AIR GROUND COMBAT CENT	TWENTYNINE PALM	1,126.49	.00	.00
CA4170090209	MARINE CORPS MOUNTAIN WARFARE TRAIN	BRIDGEPORT	42.89	.00	.00
CA5170022573	MARINE CORPS RECRUIT DEPOT (WRR)	SAN DIEGO	86.63	.00	.00
CA5690090571	MARITIME ADMIN SUISUN BAY RES FLT	BENICIA	19.92	50.00	.00
CAD059498899	MARTEX CIRCUITS	MOUNTAIN VIEW	142.41	.00	.00
CAD981456536	MAXWELL LABORATORIES, INC.	SAN DIEGO	173.15	.00	.00
CAD009447921	MAXXIM MEDICAL	LOS GATOS	27.42	.00	.00
CAD039138797	MC DONNELL DOUGLAS AEROSPACE	MONROVIA	21.27	.00	.00
CA9170090022	MCAS TUSTIN PO	SANTA ANA	45.65	.00	.00
CAD046055893	MCCURDY CIRCUITS, INC.	ORANGE	199.80	.00	.00
CAD982467011	MCDONNELL DOUGLAS	LONG BEACH	205.83	.00	.00
CAD008384588	MCDONNELL DOUGLAS AEROSPACE	HUNNINGTON BEAC	533.99	.00	.00
CAD075304444	MCGHAN MEDICAL CORPORATION	SANTA BARBARA	163.72	.00	.00
CAD008381360	MCKAY MFG. CO./ BLUE CORAL INC.	LOS ANGELES	25.33	.00	.00
CAD076180843	MCWHORTER TECHNOLOGIES INC	LYNWOOD	2,452.76	96.00	.00
CAD073602757	MD PHARMACEUTICAL INC	SANTA ANA	124.82	.00	.00
CAD982468282	MEKTEC CORPORATION	MILPITAS	388.72	.00	.00
CAD048476683	MEL BERNIE & CO., INC.	BURBANK	59.78	.00	.00
CAD982499642	MEMC ELECTRONIC MATERIALS, INC.	SANTA CLARA	15.25	.00	.00
CAD053243051	MENLOTECH, INC.	MENLO PARK	50.70	.00	.00
CAD003068970	MERCHANTS METALS	WHITTIER	96.33	.00	.00
CAD982411993	MERCURY TECHNOLOGIES INTERNATIONAL	HAYWARD	66.17	.00	.00
CAD008358145	METAL SURFACES, INC.	BELL GARDENS	222.85	.00	.00
CAD982402570	MICRO CHEM INC.	SANTA CLARA	16.03	.00	.00
CAD057328551	MICRO MATIC USA, INC.	NORTHRIDGE	106.62	.00	.00
CAD069124717	MICRO METALLICS CORP	SAN JOSE	40.13	.00	.00
CAD983645334	MICROMODULE SYSTEMS, INC.	CUPERTINO	949.23	.00	.00
CAD051550838	MICROSEMI CORP.	SANTA ANA	40.01	.00	.00
CAD081096794	MILLER DIAL CORP.	EL MONTE	40.24	.00	.00
CA0000138313	MILLS FILTRATION PLANT	RIVERSIDE	40.67	.00	.00
CAD008354052	MOBIL OIL CORP. - TORRANCE REFINERY	TORRANCE	35,440.74	.00	.00
CAD982029969	MODESTO ENERGY	WESTLEY	2,038.01	.00	.00
CAD009667551	MODINE WESTERN, INC.	MERCED	24.54	.00	.00
CAD009539321	MOLYCORP INC	MOUNTAIN PASS	605.04	.00	.00
CAD990667198	MONOGRAM AEROSPACE FASTENERS	COMMERCE	13.39	.00	.00
CAT080010838	MONTEBELLO TERMINAL-CHEVRON USA PRO	MONTEBELLO	323.36	.00	.00
CAD982437089	MOOG INC., AIRCRAFT GROUP, TORRANCE	TORRANCE	125.85	.00	.00
CAD008232829	MOORE PRINTED CIRCUITS,INC.	SAN DIEGO	117.35	.00	.00

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CAD008334260	MORTON ELECTRONIC MATERIALS	TUSTIN	41.80	40.00	.00
CAD083024141	MORTON INTERNATIONAL, INC.	LOS ANGELES	17.72	.00	.00
CA0000086322	MOTOROLA - MOS 10	IRVINE	149.55	.00	.00
CAD096238472	MOYNO OILFIELD PRODUCTS	FAIRFIELD	33.85	.00	.00
CAD981462609	MT. ZION MEDICAL CENTER OF UC SAN F	SAN FRANCISCO	18.21	444.00	.00
CAD981576150	MULTI FINELINE ELECTRONIX INC.	ANAHEIM	163.50	.00	.00
CAD982436172	MULTILAYER TECHNOLOGY, INC.	IRVINE	396.05	.00	.00
CAD982520918	MULTILAYER TECHNOLOGY, INC.	IRVINE	921.85	.00	.00
CAD982325714	MUTIPLE PEPTIDE SYSTEMS	SAN DIEGO	26.81	.00	.00
CAD000044222	MYERS CONTAINER CORPORATION	RICHMOND	136.65	.00	.00
CAD028984268	MYERS CONTAINER CORPORATION	SAN PABLO	28.51	.00	.00
CAT000625038	MYERS CONTAINER CORPORATION	HUNTINGTON PARK	66.69	.00	.00
CAD083914911	NALCO CHEMICAL COMPANY	CARSON	14.56	.00	.00
CAD982417172	NAPA PIPE CORPORATION	NAPA	15.88	.00	.00
CAD008252355	NATIONAL AEROSOL PRODUCTS CO.	LOS ANGELES	37.88	.00	.00
CAD080709587	NATIONAL AIRMOTIVE CORPORATION	OAKLAND	16.30	.00	.00
CAD041472986	NATIONAL SEMICONDUCTOR	SANTA CLARA	151,770.61	900.00	.00
CAD009158932	NATIONAL STEEL AND SHIPBUILDING COM	SAN DIEGO	157.66	.00	.00
CA5213790038	NATIONAL TRAINING CENTER	FORT IRWIN	445.89	.00	.00
CA6170090017	NAVAL AIR FACILITY EL CENTRO	EL CENTRO	45.09	.00	.00
CA9170024740	NAVAL AIR STATION MIRAMAR	SAN DIEGO	958.00	.00	.00
CA9170027271	NAVAL AIR WEAPONS STATION	POINT MUGU	200.75	.00	.00
CA9170023130	NAVAL AMPHIBIOUS BASE, CORONADO	SAN DIEGO	286.19	.00	.00
CA4170090456	NAVAL AUX. LAND. FIELD, SAN CLEMENT	LOS ANGELES	24.99	.00	.00
CA2170024382	NAVAL COMMUNICATION STATION STOCKTO	STOCKTON	63.18	.00	.00
CA2170090011	NAVAL FACILITY ENGINEER SERVICE CEN	PORT HUENEME	7.84	2,468.00	.00
CA8170027249	NAVAL MEDICAL CENTER SAN DIEGO	SAN DIEGO	22.68	20.00	.00
CA1170090210	NAVAL ORDN.CNTR.PCF.DIV.FALLBROOD D	FALLBROOK	28.60	.00	.00
CA7170023330	NAVAL STATION TREASURE ISLAND	SAN FRANCISCO	127.67	.00	.00
CA2170023202	NAVAL TRAINING CENTER	SAN DIEGO	46.65	.00	.00
CA8170024261	NEBO ANNEX, MCLB, BARSTOW, CA	BARSTOW	32.45	.00	.00
CAD980881510	NEC ELECTRONICS, INC.	ROSEVILLE	1,735.42	.00	.00
CAD042138032	NELCO PRODUCTS,INC.	ANAHEIM	33.30	.00	.00
CAD981642804	NELCO PRODUCTS,INC.	FULLERTON	21.51	.00	.00
CAD008329963	NELSON NAME PLATE COMPANY	LOS ANGELES	29.37	.00	.00
CAD008364150	NEVILLE CHEMICAL COMPANY	ANAHEIM	18.22	.00	.00
CAD000051433	NEW UNITED MOTOR MANUFACTURING, INC	FREMONT	1,018.80	.00	.00
CAD057468944	NEWPORT BEACH	NEWPORT BEACH	50.01	.00	.00
CAD057357196	NIPPONDENSO OF LOS ANGELES	LONG BEACH	44.56	.00	.00
CAD097030993	NORRIS ENVIRONMENTAL SERVICES INC	VERNON	138,895.19	.00	.00
CAD068880657	NORTH AMERICA PACKAGING CORP	MERCED	47.78	.00	.00
CAD048456941	NORTH AMERICAN CHEMICAL COMPANY	TRONA	85.80	.00	.00
CAD044867604	NORTH AMERICAN TRANSFORMER	MILPITAS	13.59	.00	.00
CAD044429025	NORTHRIDGE FACILITY	NORTHRIDGE	26.05	.00	.00
CAD980735302	NORTHROP GRUMMAN B-2 DIVISION	PICO RIVERA	82.47	.00	.00
CAD000627752	NORTHROP GRUMMAN CORPORATION-MASD(A	HAWTHORNE	169.03	.00	.00
CAD008268302	NORTHROP GRUMMAN CORPORATION-MASD(E	HAWTHORNE	465.04	.00	.00
CAD000627273	NORTHROP GRUMMAN CORPORATION-MASD(W	EL SEGUNDO	206.20	.00	.00
CAD059586354	NORTHROP GRUMMAN, TULARE FACILITY	TULARE	18.50	.00	.00
CA4570024345	NORTON AIR FORCE BASE	SAN BERNARDINO	16.57	.00	.00
CAD982465320	NOVACAP, INC.	VALENCIA	117.03	.00	.00
CAD980818488	NU-METAL FINISHING, INC.	SANTA CLARA	68.92	.00	.00
CAT080013733	NUSIL TECHNOLOGY	CARPINTERIA	104.20	.00	.00
CAD093357317	O-I BROCKWAY GLASS, INC.	POMONA	37.70	.00	.00
CAD050116995	OAKITE PRODUCTS,INC	CITY OF INDUSTR	19.65	21.00	.00

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CALIFORNIA

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- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
CAD980815369	OCA APPLIED OPTICS	GARDEN GROVE	28.69	50.00	.00
CAD009559618	OEA AEROSPACE, INC.	FAIRFIELD	56.25	.00	.00
CAD982503328	OL ALPHANETICS, INC.	SANTA ANA	20.10	.00	.00
CAD052384328	OLIN ORDNANCE	DOWNEY	65.20	.00	.00
CAD049354533	OPTICAL RADIATION CORPORATION	AZUSA	20.83	.00	.00
CAT080012008	ORBIT SEMICONDUCTOR INC.	SUNNYVALE	1,532.53	.00	.00
CAD981420557	ORCON CORPORATION	UNION CITY	29.38	.00	.00
CAT000618918	OWENS-BROCKWAY GLASS CONTAINER	OAKLAND	45.12	.00	.00
CAD008256562	OWENS-ILLINOIS INC.	VERNON	240.51	.00	.00
CAD981695729	PACIFIC CIRCUIT SERVICES	SANTA ANA	17.99	.00	.00
CAT080011703	PACIFIC GAS & ELETRIC COMPANY	SAN FRANCISCO	57.01	.00	.00
CA0000047258	PACIFIC IMAGE COMPANY	ANAHEIM	180.26	.00	.00
CAD056588403	PACIFIC POLYMERS, INC.	GARDEN GROVE	32.03	.00	.00
CAT000617407	PACIFIC REFINING COMPANY	HERCULES	208.90	.00	.00
CAD008252405	PACIFIC RESOURCE RECOVERY	LOS ANGELES	346.00	.00	.00
CAD981412356	PACIFIC TREATMENT ENVIRONMENTAL SER	EL CAJON	690.90	.00	.00
CAD008383523	PACIFIC TUBE COMPANY	LOS ANGELES	6,026.85	.00	.00
CAD076071737	PACKARD HUGHES INTERCONNECT	IRVINE	82.20	.00	.00
CAD008271090	PALACE PLATING	LOS ANGELES	2,526.96	.00	.00
CAD981388101	PALOMAR PLATING CO. INC.	ESCONDIDO	68.01	.00	.00
CAD982471534	PARADIGM TECHNOLOGY	SAN JOSE	20.63	.00	.00
CAT080031420	PARAGON ELECTRONIC SYSTEMS INC.	SANTA CLARA	1,096.87	.00	.00
CAD008371098	PARAMOUNT PETROLEUM CORPORATION	PARAMOUNT	195.03	.00	.00
CAD982005696	PARAMOUNT PICTURES, INC.	LOS ANGELES	121.96	.00	.00
CAD981376106	PARK INTERNATIONAL, CORP	LONG BEACH	42.39	.00	.00
CAD009152364	PARKER AMCHEM	FREMONT	61.64	.00	.00
CAD981424013	PARKER HANNIFIN CORP.	IRVINE	21.22	8.00	.00
CAT080012537	PARKER HANNIFIN CORPORATION	IRVINE	23.81	.00	.00
CAD051968618	PARKER HANNIFIN\JAMBOREE FACILITY	IRVINE	36.65	.00	.00
CAD982029225	PASMINCO INCORPORATED	TORRANCE	32,301.80	.00	.00
CAD982510281	PAT X-RAY COMPANY, INC.	STOCKTON	34.20	.00	.00
CAD041160672	PB FASTENERS	GARDENA	32.89	.00	.00
CAD038682522	PCA METAL FINISHING, INC.	FULLERTON	215.71	.00	.00
CAD983592569	PCB ENGINEERING, INC.	MILPITAS	108.74	.00	.00
CAD020018479	PENINSULA LABORATORIES, INC.	BELMONT	27.21	.00	.00
CAD983614231	PENINSULA LABORATORIES, INC.	BELMONT	13.97	.00	.00
CAD981995715	PERALCO	HEALDSBURG	94.15	.00	.00
CAD008296055	PERCEPTION LAMINATES,INC.	LA VERNE	20.56	.00	.00
CAD981373806	PERKIN ELMER,APPLIED BIOSYSTEMS DIV	FOSTER CITY	96.36	.00	.00
CAD981164379	PG AND E - EL CERRITO STATION "G"	EL CERRITO	289.46	.00	.00
CAD981163843	PG+E LATHROP DEHYDRATOR	LATHROP	16.00	.00	.00
CAT080011521	PG&E - GEYSERS POWER PLANT	HEALDSBURG	37.91	.00	.00
CAD077966349	PG&E DIABLO CANYON POWER PLANT	AVILA BEACH	16.32	.00	.00
CAD056188212	PHASE II	SAN BRUNO	65.72	.00	.00
CAD008488025	PHIBRO TECH INC	SANTA FE SPRING	39,331.56	.00	.00
CAD981160948	PHIBRO TECH INC	UNION CITY	2,458.36	.00	.00
CAD070466479	PHILIPS SEMICONDUCTORS	SUNNYVALE	19.80	.00	.00
CAT000614156	PHILIPS SEMICONDUCTORS	SUNNYVALE	33.59	.00	.00
CAD983576695	PHOTO FABRICATORS, INC.	VAN NUYS	140.56	.00	.00
CAT080034267	PHOTO MILLING, INC.	HAYWARD	165.45	.00	.00
CAD982523102	PHOTOTEK	SAN JOSE	101.43	.00	.00
CAD982036782	PICK A PART AUTO WRECKING	FRESNO	239.85	.00	.00
CAD008481947	PICO RIVERA PLATING, INC.	PICO RIVERA	24.40	.00	.00
CAD009578162	PILKINGTON AEROSPACE INC.	GARDEN GROVE	28.24	.00	.00
CAT080012354	PINOLE POINT STEEL COMPANY	RICHMOND	16.30	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
CAD000132613	PIONEER CIRCUITS	SANTA ANA	52.77	.00	.00
CAD981983968	PLATECORP	ORANGE	141.91	.00	.00
CAD063134902	POLYCLAD LAMINATES, INC.	SANTA ANA	454.97	20.00	.00
CAD120849963	POWER CIRCUITS INC.	SANTA ANA	155.55	.00	.00
CAT080033087	POWER ONE LLC	CAMARILLO	19.81	.00	.00
CAD008323438	PPG INDUSTRIES INC	LOS ANGELES	397.00	.00	.00
CAD067629873	PRECISION ANODIZING AND PLATING	ANAHEIM	56.70	.00	.00
CAD009109794	PRECISION FOUNDERS, INC.	SAN LEANDRO	17.77	.00	.00
CAD084235621	PRECISION METAL PRODUCTS INC.	EL CAJON	24.10	5.00	.00
CAR000002857	PRICE CLUB #416	SAN MARCOS	15.52	.00	.00
CAR000002865	PRICE CLUB #462	CARLSBAD	16.89	.00	.00
CAD008384190	PRICE PFISTER, INC.	PACOIMA	609.46	.00	.00
CAD981635741	PRIME PLATING, INC.	SUN VALLEY	39.00	.00	.00
CAD982034241	PRINTED CIRCUITS UNLIMITED	RANCHO CUCAMONG	54.71	.00	.00
CA0000069443	PRINTRONIX, INC.	IRVINE	20.00	.00	.00
CAD980881270	PRODUCTS ENGINEERING CORP.	AZUSA	249.15	.00	.00
CAD983576760	PROGRESSIVE CIRCUIT PRODUCTIONS INC	SACRAMENTO	130.99	.00	.00
CAD981677404	PROTO ENGINEERING CORPORATION	SUNNYVALE	188.53	.00	.00
CAD043089754	PUNCH PRESS PRODUCTS	VERNON	27.06	.00	.00
CAD981382401	PYCON INC.	SANTA CLARA	250.90	.00	.00
CAD983576836	QLP LAMINATES, INC.	ANAHEIM	597.52	.00	.00
CAD008506065	QUAKER CITY PLATING + SILVER	WHITTIER	66.10	.00	.00
CA0000031997	QUALA SYSTEMS, INC.	SOUTH GATE	14.82	.00	.00
CAD982416737	QUANTERRA INC (WEST SACRAMENTO)	WEST SACRAMENTO	73.65	10,699.00	.00
CA0000149492	QUANTERRA INC (WEST SACRAMENTO)	WEST SACRAMENTO	38.30	3,031.00	.00
CA0000279000	QUANTERRA INC.	SANTA ANA	27.36	.00	.00
CAD044869469	QUEBECOR PRINTING SAN JOSE,INC.	SAN JOSE	63.04	.00	.00
CAD066233966	QUEMETCO INC	CITY OF INDUSTR	23,582.24	.00	.00
CAD009129479	RADIANT COLOR DIV.,MAGRUDER COLOR I	RICHMOND	20.54	.00	.00
CAD008330318	RAMCAR BATTERIES, INC.	COMMERCE	235.73	.00	.00
CAD009125527	RAYCHEM CORPORATION-MAIN SITE	MENLO PARK	57.77	123.00	.00
CAD009205097	RAYTHEON SEMICONDUCTOR	MT VIEW	129.11	.00	.00
CAD981395130	READ-RITE CORPORATION	MILPITAS	509.76	.00	.00
CAD983653395	READ-RITE CORPORATION - FREMONT	FREMONT	191.14	.00	.00
CAD008247900	REDMAN EQUIPMENT & MFG. CO.	TORRANCE	23.73	.00	.00
CAD087163267	REICHHOLD CHEMICALS, INC.	OXNARD	82.81	.00	.00
CAD042237735	REID METAL FINISHING	SANTA ANA	51.00	.00	.00
CAD000097287	REMCO HYDRAULICS INC.	WILLITS	15.40	.00	.00
CAD009537200	REYNOLDS METALS COMPANY	TORRANCE	58.76	.00	.00
CAD083905489	RHÔNE-POULENC INC.	LOS ANGELES	44.61	.00	.00
CAD008364432	RHO CHEM FACILITY	INGLEWOOD	46.00	.00	.00
CAD053049490	RHONE-POULENC	MARTINEZ	42.90	.00	.00
CAT000611202	RHONE-POULENC	CARSON	202.08	.00	.00
CAD009602343	RICHMOND TERMINAL	RICHMOND	64.13	.00	.00
CAD021229901	RICOH ELECTRONICS, INC.	SANTA ANA	42.87	.00	.00
CAD064467996	RICOH ELECTRONICS, INC.	IRVINE	10,519.84	.00	.00
CAD981377880	RIVERWOOD INTERNATIONAL USA, INC.	BAKERSFIELD	19.99	.00	.00
CAD008342198	ROBIN HILL FACILITY	GOLETA	42.03	.00	.00
CA0000372243	ROBINSON HELICOPTER COMPANY	TORRANCE	15.37	.00	.00
CAD982324642	ROBISON-PREZIOSO	STANTON	24.44	.00	.00
CAD981455728	ROCK INDUSTRIES, INC.	HUNTINGTON BEAC	71.02	.00	.00
CAD982479206	ROCKWELL AEROSPACE	PALMDALE	42.78	.00	.00
CA7800019419	ROCKWELL CORPORATION	DOWNEY	53.21	600.00	.00
CAD008369050	ROCKWELL INTERNATIONAL	ANAHEIM	43.31	2,215.70	.00
CAD093365435	ROCKWELL ROCKETDYNE SSFL	SIMI HILLS	173.23	2,433.00	.00

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CAD000629972	ROCKWELL ROCKETDYNE SSFL 133	SIMI HILLS	23.65	.00	.00
CAD008371437	ROCKWELL SEMICONDUCTOR SYSTEMS	NEWPORT BEACH	183.74	.00	.00
CAD062525985	ROCKWELL WIRELESS COMMUNICATIONS DI	NEWBURY PARK	21.10	.00	.00
CAD074103771	ROCKWELL-ROCKETDYNE DIV. - CANOGA	CANOGA PARK, CA	61.18	404.00	.00
CAD020513412	ROGERS CORPORATION	SAN DIEGO	44.51	.00	.00
CAD983638479	ROHM AND HAAS COMPANY, LA MIRADA PL	LA MIRADA	31.70	.00	.00
CAT000614081	ROHM CORPORATION	SUNNYVALE	109.62	.00	.00
CAD008324055	ROHR INC.; 8200 ARLINGTON AVE. RIVE	RIVERSIDE	265.92	.00	.00
CAD008382053	ROHR, INC.	CHULA VISTA	400.06	.00	.00
CAD050806850	ROLLINS OPC INC	LOS ANGELES	3,793.74	.00	.00
CAD982439895	ROMIC ENVIRONMENTAL TECHNOLOGIES	REDWOOD CITY	16.47	.00	.00
CAD009452657	ROMIC ENVIRONMENTAL TECHNOLOGIES CO	EAST PALO ALTO	15,974.45	.00	.00
CAD981376023	ROSAN/FAIRCHILD	SANTA ANA	29.54	.00	475.00
CAD000628131	S. PACIFIC LINES, L.A. (TAYLOR) FAC	LOS ANGELES	14.30	.00	.00
CAD008390247	S.U.M. INC DBA A.C. PLATING	BAKERSFIELD	17.14	.00	.00
CAD028762953	SCRIBNER'S ELECTRONICS	SIMI VALLEY	29.58	.00	.00
CAR000009878	SAFE PLATING, INC.	CITY OF INDUSTR	252.41	.00	.00
CAD093459485	SAFETY KLEEN CORP	REEDLEY	1,586.02	.00	.00
CAD070148432	SAFETY-KLEEN CORP.	BERKELY	1,394.78	.00	.00
CAT080033996	SAMSUNG SEMICONDUCTOR	MILPITAS	16.27	.00	.00
CAD008230849	SAN DIEGO GALVANIZING, INC.	SAN DIEGO	63.56	.00	.00
CAD981168107	SAN DIEGO GAS & ELECTRIC	SAN DIEGO	23.80	.00	.00
CAT000618900	SAN DIEGO GAS & ELECTRIC	CARLSBAD	14.19	.00	.00
CAD073371346	SAN DIEGO STATE UNIVERSITY	SAN DIEGO	22.46	44.00	.00
CAT000614958	SAN DIEGO TERMINAL-CHEVRON RETAIL M	SAN DIEGO	264.86	.00	.00
CAD981453194	SAN FRANCISCO DRYDOCK, INC.	SAN FRANCISCO	17.57	.00	.00
CAD982011629	SAN FRANCISCO STATE UNIVERSITY	SAN FRANCISCO	22.13	.00	.00
CAD982002412	SAN JOAQUIN DELTA COLLEGE	STOCKTON	41.23	.00	.00
CAD982519423	SAN JOSE MERCURY NEWS	SAN JOSE	57.82	.00	.00
CAD981455496	SAN PEDRO BOAT WORKS	SAN PEDRO	161.79	.00	.00
CA2890012923	SANDIA NATIONAL LABORATORIES DOE	LIVERMORE	126.15	12,689.77	.00
CAD044869295	SANDOZ AGRO INC.	PALO ALTO	16.10	.00	.00
CAD082902859	SANMINA - PLANT #1	SAN JOSE	486.40	.00	.00
CAD031546393	SANMINA - PLANT #2	SAN JOSE	290.80	.00	.00
CAD982429615	SANMINA - PLANT #3	SAN JOSE	338.00	.00	.00
CAD982485955	SANMINA - PLANT #5	FREMONT	156.90	.00	.00
CAD981419013	SANTA BARBARA AEROSPACE, INC.	SANTA BARBARA	442.00	.00	.00
CAD028260297	SANTA BARBARA RESEARCH CTN	GOLETA	47.46	.00	.00
CAD980695001	SANTA CLARA COUNTY ROADS & AIRPORTS	SAN JOSE	20.00	.00	.00
CAD038735049	SANTA MONICA COMMUNITY COLLEGE DIST	SANTA MONICA	5.32	210.00	.00
CAD082903642	SANTA TERESA COMMUNITY HOSPITAL	SAN JOSE	23.42	.00	.00
CAD009111212	SCHLAGE LOCK COMPANY	SAN FRANCISCO	29.21	.00	.00
CAD981387541	SCHULLER INTERNATIONAL, INC.	WILLOWS	24.07	.00	.00
CAD982053092	SCHUMACHER,AIR PRODUCTS & CHEMICALS	CARLSBAD	31.49	.00	.00
CAD981368574	SCIENTIFIC GAMES, INC.	GILROY	23.59	.00	.00
CAD981368632	SCIENTIFIC GAMES, INC.	GILROY	32.96	.00	.00
CAD063564132	SCOTTS VALLEY CIRCUITS	SCOTTS VALLEY	32.06	.00	.00
CAD982508061	SCRIPTO-TOKAI CORPORATION	FONTANA	82.88	.00	.00
CAD981997513	SDL, INC	SAN JOSE	20.47	.00	.00
CAD982402315	SEAGATE MAGNETICS	FREMONT	47.59	.00	.00
CAD008479941	SEMTECH CORPORATION	NEWBURY PARK	14.04	.00	.00
CAT080022171	SENIOR FLEXONICS, INC.	BURBANK	71.53	.00	.00
CAD983654765	SENSYM INC	MILPITAS	37.00	.00	.00
CAD009142415	SEQUEL, INC.	SANTA CLARA	18.88	.00	.00
CAD118555150	SERMATECH INTL, INC.	COMPTON	87.58	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
CAT080011117	SFPP, L.P.	CARSON	222.08	.00	.00
CAT080011174	SFPP, L.P.	NILAND	.31	620.00	.00
CAT080011232	SFPP, L.P.	SACRAMENTO	23.32	.00	.00
CAT080011125	SFPP, L.P. - CHICO TERMINAL	CHICO	121.58	.00	.00
CAT080011133	SFPP, L.P. - CONCORD STATION	CONCORD	108.32	.00	.00
CAT080011158	SFPP, L.P. - FRESNO TERMINAL	FRESNO	13.27	.00	.00
CAD080912587	SFPP, L.P. - MISSION VALLEY TERMINA	SAN DIEGO	37.82	.00	.00
CAT080033962	SFPP, L.P. - NORWALK STATION	NORWALD	221.12	.00	.00
CAD067618389	SFPP, LP COLTON TERMINAL	RIALTO	51.29	.00	.00
CAT080010861	SGS THOMSON MICROELECTRONIC	SAN DIEGO	19.68	.00	.00
CAD009164021	SHELL OIL CO	MARTINEZ	8,507,324.31	.00	.00
CAD000631390	SHELL OIL COMPANY	CHICO	17.50	.00	.00
CAD001687557	SHELL OIL COMPANY	LOS ANGELES	19.02	.00	.00
CAD981435449	SHELL OIL COMPANY	COALINGA	97.70	.00	.00
CAD981460454	SHELL OIL COMPANY	STOCKTON	14.50	.00	.00
CAD982327744	SHELL OIL COMPANY	BLOOMINTON	26.02	.00	.00
CAT000603845	SHELL OIL COMPANY	VENTURA	23.38	.00	.00
CAT000603852	SHELL OIL COMPANY	VAN NUYS	58.40	.00	.00
CAD042137950	SHERWIN-WILLIAMS DIVERSIFIED BRANDS	ANAHEIM	231.94	.00	.00
CAD982417214	SHIELD PACKAGING OF CALIIFORNIA INC	CHINO	18.11	.00	.00
CAD053236212	SIEMENS COMPONENTS	CUPERTINO	278.03	.00	.00
CAD000626655	SIEMENS SOLAR INDUSTRIES, L.P.	CAMARILLO	2,870.02	.00	.00
CAD982030678	SIERRA ALUMINUM COMPANY	FONTANA	106.62	.00	.00
CAD982200503	SIERRA ALUMINUM COMPANY	RIVERSIDE	175.14	.00	.00
CAD092616184	SIERRA CIRCUITS INC	SUNNYVALE	56.40	.00	.00
CAD097025779	SIERRACIN/SYLMAR CORPORATION	SYLMAR	48.90	8.00	.00
CAD981658669	SIGMA CIRCUITS, INC - SOUTHERN CA D	COSTA MESA	1,948.94	.00	.00
CAD069135846	SIGMA CIRCUITS, NORTHERN CA DIVISIO	SANTA CLARA	529.13	.00	.00
CAD053866166	SIGMA PLATING CO., INC.	LA PUENTE	92.20	.00	.00
CAD008362634	SIGNET ARMORLITE, INC.	SAN MARCOS	202.48	.00	.00
CAD066106097	SILGAN CONTAINERS CORPORATION	RIVERBANK	176.01	.00	.00
CAD980884811	SILGAN CONTAINERS CORPORATION	STOCKTON	38.02	.00	.00
CAD064469679	SILICON SYSTEMS INC.	TUSTIN	41.89	.00	.00
CAT080034036	SILICON SYSTEMS, INC.	SANTA CRUZ	69.40	10.00	.00
CAD982474645	SILICON VIDEO CORPORATION	SAN JOSE	16.77	.00	.00
CAD009131392	SILICONIX, INC	SANTA CLARA	1,289.89	.00	.00
CAD981966054	SINCLAIR PAINT CO	COMMERCE	294.02	.00	.00
CAD983578295	SKC AMERICA, INC.	SUNNYVALE	222.08	.00	.00
CAD007965007	SMITHKLINE BEECHAN CLINICAL LABORAT	VAN NUYS	14.87	.00	.00
CAD000625939	SMUD - CORPORATION YARD	SACRAMENTO	80.27	.00	.00
CAD000626010	SMUD - RANCHO SECO	HERALD	18.39	.00	.00
CAD008252140	SOCO-LYNCH CORPORATION	LOS ANGELES	75.25	.00	.00
CAD981171523	SOLA OPTICAL USA, INC.	PETALUMA	31.63	.00	.00
CAD008314908	SOLAR TURBINES INCORPORATED	SAN DIEGO	501.02	.00	.00
CAT000626549	SOLAR TURBINES, INC.	SAN DIEGO	48.04	.00	.00
CAD981391055	SOLDER STATION ONE	SANTA ANA	61.10	.00	.00
CAD059494310	SOLVENT SERVICE CO INC	SAN JOSE	10,711.00	.00	.00
CAD008489981	SONIC PLATING CD INC	SANTA FE SPRING	72.70	.00	.00
CAD061602355	SONY ELECTRONICS, INC.-- SAN DIEGO	SAN DIEGO	191.51	.00	.00
CAD054866637	SONY PICTURES STUDIOS	CULVER SITY	162.95	.00	.00
CAD980886063	SOUTH BAY CIRCUITS, INC.	SAN JOSE	334.29	.00	.00
CAD982358368	SOUTH BAY CIRCUITS, INC.	SAN JOSE	323.43	.00	.00
CAD983601360	SOUTH BAY CIRCUITS, INC.	SAN JOSE	358.83	.00	.00
CAD981383466	SOUTH BAY PLATING, INC.	COMPTON	62.89	.00	.00
CAD055753370	SOUTH GATE FACILITY	SOUTH GATE	135.40	.00	.00

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CALIFORNIA

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- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
CAD981451610	SOUTH VALLEY CIRCUITS, INC.	SUNNYVALE, CALI	40.92	.00	.00
CAD980735294	SOUTHDOWN-VICTORVILLE CEMENT PLANT	APPLE VALLEY	227.52	.00	.00
CAD000631093	SOUTHERN CALIFORNIA EDISON	REDONDO BEACH	18.34	.00	.00
CAD079548574	SOUTHERN CALIFORNIA EDISON	ETIWANDA	45.70	.00	.00
CAD981574536	SOUTHERN CALIFORNIA EDISON	PARAMONT	.13	30.00	.00
CAD981689730	SOUTHERN CALIFORNIA EDISON	WESTMINSTER	19.15	.00	.00
CAD000630921	SOUTHERN CALIFORNIA EDISON CO SONGS	SAN CLEMENTE	26.96	.00	.00
CAD983629650	SOUTHERN CALIFORNIA EDISON CO.SONGS	SAN CLEMENTE	13.99	.00	.00
CAD981694011	SOUTHERN CALIFORNIA PLATING	SAN DIEGO	16.16	.00	.00
CAD980638076	SOUTHWEST MARINE, INC.	TERMINAL ISLAND	13.45	.00	.00
CAT081734485	SOUTHWESTERN TERMINAL	TERMINAL ISLAND	48.64	.00	.00
CAD981172554	SOUTWEST MARINE, INC.	SAN DIEGO	90.09	.00	.00
CAD000030528	SPACE SYSTEMS LORAL	PALO ALTO	22.78	40.00	.00
CAD982464315	SPECIALITY FINISHES COMPANY	FONTANA	14.30	.00	.00
CAD092606102	SPECIFIC PLATING COMPANY	PALO ALTO	9.15	110.00	.00
CAD021221304	SPEEDY CIRCUITS, INC.	HUNTINGTON BEAC	58.62	.00	.00
CAD980881098	SPRIG CIRCUITS, INC.	VACAVILLE	39.00	.00	.00
CAD008266892	SPS TECHNOLOGIES	SANTA ANA,	19.30	.00	.00
CAD000097238	SRI INTERNATIONAL	MENLO PARK	25.41	.00	.00
CAD981989502	ST MARY MEDICAL CENTER	LONG BEACH	16.60	.00	.00
CAD983663170	STANDARD NICKEL-CHROMIUM PLATING CO	LOS ANGELES	24.90	.00	.00
CA8890016126	STANFORD LINEAR ACCELERATOR CENTER	MENLO PARK	93.27	.00	.00
CAD982049439	STANFORD UNIVERSITY	STANFORD	220.49	155,622.61	.00
CAD008352916	STANLEY HOME DECOR	CHATSWORTH	4,550.25	.00	.00
CAD982522427	STAR BIOCHEMICALS	TORRANCE	17.59	.00	.00
CAD982505828	STARTEX	NORTH HOLLYWOOD	34.40	.00	.00
CAD063841787	STEELCASE INC.	TUSTIN	396.90	.00	.00
CAD046590162	STEPAN COMPANY	ANAHEIM	63.38	.00	.00
CAD009212929	STOCKTON PLATING INC.	STOCKTON	81.77	.00	.00
CAD981378789	STRUCTURAL COMPOSITES INDUSTRIES	POMONA	24.29	.00	.00
CAD086513710	STRUCTURAL POLYMER SYSTEMS INC.	CULVER CITY	67.70	.00	.00
CAD041679945	STUTZMAN PLANTING, INC.	LOS ANGELES	55.30	.00	.00
CA0000068809	SUN CIRCUITS, INC.	SANTA CLARA	72.52	.00	.00
CAT000611517	SUNDSTRAND POWER SYSTEMS	SAN DIEGO	29.86	.00	.00
CAD983602939	SUNKIST GROWERS, INC.	TIPTON	151.60	.00	.00
CAD050809177	SUPERIOR INDUSTRIES INTERNATIONAL I	VAN NUYS	18.61	.00	.00
CAD010938538	SUPERTEX, INC.	SUNNYVALE	14.98	2,980.00	.00
CAD008258592	SURFACE PROTECTION INDUSTRIES, INC.	LOS ANGELES	105.56	.00	.00
CAD102110863	SYNERGY SEMICONDUCTOR	SANTA CLARA	18.47	.00	.00
CAD009238411	SYNTEX (USA) INC.	PALO ALTO	260.56	.00	.00
CAD000819839	TABC, INC.	LONG BEACH	201.72	.00	.00
CAD982361404	TAMCO	RANCHO CUCAMONG	17,074.49	.00	.00
CAD008303596	TECHNI-CAST CORPORATION	SOUTH GATE	29.44	.00	.00
CAD009118506	TECHNICAL COATINGS CO. - SANTA CLAR	SANTA CLARA	26.24	.00	.00
CAD053893400	TECHNICOLOR, INC.	NORTH HOLLYWOOD	42.61	.00	.00
CAD983578170	TECHNITRON INC.	MOUNTAIN VIEW	105.36	.00	.00
CAD057343717	TEKTOPLANE, INC.	PACOIMA	29.77	.00	.00
CAD076243815	TELEDYNE CASTING SERVICE-CAST PRODU	POMONA	29.24	.00	.00
CAD009587700	TELEDYNE ELECTRONIC TECHNOLOGIES	LOS ANGELES	18.90	.00	.00
CAD980882740	TELEDYNE ELECTRONIC TECHNOLOGIES	RANCHO CORDOVA	43.99	.00	.00
CAD990833006	TELEDYNE RELAYS	HAWTHORNE	557.01	.00	.00
CAD008382475	TELEDYNE RYAN AERONAUTICAL	SAN DIEGO	78.89	.00	.00
CAD009220898	TELEDYNE RYAN AERONAUTICAL	HOLLISTER	37.68	9.00	.00
CAD983642612	TELIOS PHARMACEUTICALS, INC.	SAN DIEGO	4.88	150.00	.00
CAD981454317	TELTEC CORPORATION	SAN JOSE	39.74	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
CAD048477376	TENNECO PACKAGING	CITY OF INDUSTR	128.10	.00	.00
CAT000618595	TESORO REFINING, MARKETING & SUPPLY	WEST SACRAMENTO	183.69	.00	.00
CAT000618637	TESORO REFINING, MARKETING & SUPPLY	STOCKTON	26.66	.00	.00
CAD083903492	TEXACO INC.-MONTEBELLO TECHNOLOGY C	S. EL MONTE	40.39	.00	.00
CAD041520644	TEXACO LOS ANGELES PLANT	WILMINGTON	18,038.40	.00	.00
CAD099457087	TEXACO REFINING & MKTG. INC.	BAKERSFIELD	1,204.42	20,000.00	.00
CAD982052094	TEXACO REFINING & MKTG. INC.	BAKERSFIELD	50.00	.00	.00
CAD000626044	TEXACO REFINING AND MARKETING, INC.	BLOOMINGTON	142.70	.00	.00
CAD000626127	TEXACO REFINING AND MARKETING, INC.	SAN DIEGO	179.10	.00	.00
CAD981386691	TEXACO REFINING AND MARKETING, INC.	BAKERSFIELD	17.60	.00	.00
CAD086516135	THE AEROSPACE CORPORATION	EL SEGUNDO	38.09	760.00	.00
CAD071684708	THE CLOROX TECHNICAL CENTER	PLEASANTON	28.43	23.30	.00
CAD039063565	THE CULVER STUDIOS	CULVER CITY	31.28	.00	.00
CAD041841297	THE DEXTER CORPORATION	HAYWARD	33.78	.00	.00
CAD009547050	THE DOW CHEMICAL CO TORRANCE	TORRANCE	1,051.37	.00	.00
CAT000617001	THE DOW CHEMICAL CO., LONG BEACH, C	SAN PEDRO	554.45	.00	.00
CAD054861539	THE GILLETTE COMPANY	SANTA MONICA	76.57	.00	.00
CAD051971604	THE HARTLEY COMPANY	COSTA MESA	35.95	.00	.00
CAT080033723	THE HON COMPANY	SOUTH GATE	52.40	.00	.00
CAD074642901	THE INTERLAKE CO.	LODI	38.30	.00	.00
CAD008352957	THE NORAC COMPANY, INC.	AZUSA	31.61	.00	.00
CAD981379415	THE NUTRASWEET KELCO COMPANY	SAN DIEGO	27.35	.00	.00
CAD009189457	THE PROCTER & GAMBLE MANUFACTURING	SACRAMENTO	114.54	.00	.00
CAD983586389	THE SCRIPPS RESEARCH INSTITUTE	SAN DIEGO	19.72	.00	.00
CAD000057109	THE SPRIPPS RESEARCH INST.-TORREY P	LA JOLLA	43.89	.00	.00
CAD001819283	THE VALSPAR CORPORATION	AZUSA	169.89	.00	.00
CAD982433252	THERMAL DYNAMICS CORPORATION	ONTARIO	29.39	.00	.00
CAD062095500	THREE BOND OF AMERICA, INC	TORRANCE	93.80	.00	.00
CAD085857928	THUNDER BOLT WOOD TREATING	RIVERBANK	17.45	.00	.00
CAD982412165	TOPPAN WEST, INC.	SAN DIEGO	1,441.50	.00	.00
CAD000072751	TOSCO REFINING COMPANY	MARTINEZ	308,782.60	.00	.00
CAD980735559	TREASURE CHEST ADV., INC.	POMONO	13.38	.00	.00
CAD980893069	TREND CIRCUITS, INC.	FREMONT	182.62	.00	.00
CAD981454598	TRI D-C CIRCUITS INC.	SIMI VALLEY	15.60	.00	.00
CAD980893051	TRI-CITY CIRCUITS, INC.	FREMONT	113.30	.00	.00
CAD982330243	TRIANGLE COATINGS, INC.	SAN LEANDRO	78.60	.00	.00
CAD008274375	TROJAN BATTERY COMPANY	SANTA FE SPRING	30.86	.00	.00
CAD981966179	TROJAN BATTERY COMPANY	SANTE FE SPRING	16.60	.00	.00
CAD008324949	TRW SPACE ELECTRONICS MANHATTAN BEA	MANHATTAN BEACH	202,275.25	.00	.00
CAD000629402	TRW/CAPISTRANO TEST SITE	SAN CLEMENTE	21.47	.00	.00
CA0000939421	TUSTIN CIRCUITS, INC.	ANAHEIM	27.30	.00	.00
CAD983599960	U.S. BATTERY MFG. CO.	CORONA	481.00	.00	.00
CA0000036293	U.S. E.P.A. REGION IX LABORATORY	RICHMOND	7.28	216.00	.00
CA1800005034	U.S. NASA AMES RESEARCH CENTER	MOFFETT FIELD	239.21	.00	.00
CAD076124981	UC DAVIS MEDICAL CENTER	SACRAMENTO	68.29	.00	.00
CAD981421399	UCSD MEDICAL CENTER	SAN DIEGO	8.85	165.00	.00
CAD066647066	ULTRAMAR INC	WILMINGTON	7,898.50	.00	.00
CAT080010796	UNCAL 76 PRODUCTS, SANTA MARIA REFI	ARROYO GRANDE	311.91	.00	.00
CAD008388894	UNION CARBIDE CORPORATION	TORRANCE	18.69	.00	.00
CAD982408031	UNITED AIRLINES - OAKFL	OAKLAND	35.36	.00	.00
CAD041319294	UNITED AIRLINES MAINTENANCE OPERATI	SAN FRANCISCO	1,160.83	.00	.00
CAD980882419	UNITED AIRLINES NORTH TERMINAL	S.F. INTL. AIRP	91.94	.00	.00
CA0000865733	UNITED AIRLINES SUPERBAY	S.F. INTL. AIRP	17.09	.00	.00
CAT080012693	UNITED AIRLINES/PM	LOS ANGELES	107.42	.00	.00
CAD041842501	UNITED CAN COMPANY	HAYWARD	196.51	.00	.00

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CAD077184745	UNITED DEFENSE LP GROUND SYSTEMS DI	SAN JOSE	202.01	.00	.00
CAD000624718	UNITED STATES CAN COMPANY	COMMERCEE	23.99	.00	.00
CAD001705235	UNITED TECHNOLOGIES CORP	SAN JOSE	4,251.10	.00	.00
CAD983650888	UNITED WESTERN ENTERPRISES, INC.	CAMARILLO	106.30	.00	.00
CAD982484826	UNIVERSAL CIRCUITS	SANTA ANA	26,453.54	.00	.00
CAT080014145	UNIVERSAL CITY STUDIOS, INC.	UNIVERSAL CITY	55.42	.00	.00
CAD047892948	UNIVERSITY OF CA SANTA CRUZ - MAIN	SANTA CRUZ	15.90	65.00	.00
CAT000624130	UNIVERSITY OF CALIFORNIA-SANTA BARB	SANTA BARBARA	30.40	.00	.00
CAD980584692	UNIVERSITY OF CALIFORNIA, BERKELEY,	BERKELEY	64.62	846.20	.00
CAD983669268	UNIVERSITY OF CALIFORNIA, BERKELEY,	RICHMOND	33.30	4.10	.00
CAD047120084	UNIVERSITY OF CALIFORNIA, DAVIS	DAVIS	116.51	500.00	.00
CAD042231431	UNIVERSITY OF CALIFORNIA, LOS ANGEL	LOS ANGELES	147.14	2,750.55	.00
CAD073134777	UNIVERSITY OF CALIFORNIA, RIVERSIDE	RIVERSIDE	23.32	.00	.00
CAD020210407	UNIVERSITY OF CALIFORNIA, SAN DIEGO	LA JOLLA	59.39	582.00	.00
CAD046516415	UNIVERSITY OF CALIFORNIA, SAN FRANC	SAN FRANCISCO	114.57	2,091.00	.00
CAT000617597	UNIVERSITY OF SOUTHERN CALIFORNIA -	LOS ANGELES	18.33	60.00	.00
CAT000617589	UNIVERSITY OF SOUTHERN CALIFORNIA -	LOS ANGELES	32.73	380.00	.00
CAT000611541	UNOCAL CHEMICALS	LA MIRADA	79.43	.00	.00
CAT080010903	UNOCAL HARTLEY CENTER	BREA	45.28	19.24	.00
CAD066571936	UNOCAL RICHMOND TERMINAL	RICHMOND	200.72	.00	.00
CAD009590118	UNOCAL SACRAMENTO TERMINAL	SACRAMENTO	124.67	.00	.00
CAD009108705	UNOCAL SAN FRANCISCO REFINERY	RODEO	5,677.44	.00	.00
CAD980367981	UNOCAL SANTA MARGARITA PUMP STATION	SANTA MARGARITA	28.46	.00	.00
CAD980673347	US CIRCUIT INC	ESCONDIDO	132.17	.00	.00
CA6690390046	US COAST GUARD GROUP SAN FRANCISCO	SAN FRANCISCO	28.62	.00	.00
CA2170023152	US NAVY CHINA LAKE NAVAL AIR WPNS S	CHINA LAKE	845.73	3,657.50	.00
CA7570024508	USAF BEALE	BEALE AFB	159.47	665.00	.00
CA3570024551	USAF CASTLE	ATWATER	287.63	3.00	.00
CA1570024504	USAF EDWARDS	EDWARDS AIR FOR	168.74	.00	.00
CA4570024337	USAF MCCLELLAN	MCCLELLAN AFB	1,507.58	.00	.00
CA2570090199	USAF PLANT 42 SITE 4 NORTHROP GRUMM	PALMDALE	81.41	.00	.00
CA5570024575	USAF TRAVIS	TRAVIS AFB	123.85	28.00	.00
CA9570025149	USAF VANDENBERG	VANDENBERG AFB	278.55	18.00	.00
CA7210020759	USARMY AMMUNITION PLANT	RIVERBANK	3,242.31	.00	.00
CA5210020843	USARMY DEPOT SIERRA	HERLONG	36.75	14.00	.00
CA1170090012	USDLA DRMO ALAMEDA	ALAMEDA	239.91	.00	.00
CA4170023788	USDLA DRMO SAN DIEGO	IMPERIAL BEACH	38.09	.00	.00
CA6170023208	USMC MCAS EL TORO	SANTA ANA	1,132.07	.00	.00
CA2170023533	USMC, CAMP PENDLETON	CAMP PENDLETON	162.00	.00	.00
CA2170023236	USNAVY AIR STATION ALAMEDA	ALAMEDA	1,309.75	1,086.00	.00
CA3170024381	USNAVY AIR STATION LEMOORE	LEMOORE	99.99	.00	.00
CA7170090016	USNAVY AIR STATION NORTH ISLAND	SAN DIEGO	7,542.75	.00	.00
CA6170023323	USNAVY CONSTRUCTION BATTALION CTN	PORT HUENEME	286.98	148.00	.00
CA6170023109	USNAVY LONG BEACH SHIPYARD	LONG BEACH	28,519.31	564.00	.00
CA7170024775	USNAVY MARE ISLAND SHIPYARD	VALLEJO,	875.67	91.00	.00
CA1170090020	USNAVY POINT LOMA NAVAL COMPLEX	SAN DIEGO	734.17	3.00	.00
CA6170024289	USNAVY SAN DIEGO	SAN DIEGO	8,116.68	35.00	.00
CA0170024491	USNAVY WEAPONS STATION	SEAL BEACH	93.24	101.00	.00
CA7170024528	USNAVY WEAPONS STATION CONCORD	CONCORD	103.12	.00	.00
CAD009150194	USS POSCO INDUSTRIES	PITTSBURG	13,229.69	.00	.00
CA7690390037	USW COAST GUARD SUPPORT CENTER ALAM	ALAMEDA	114.71	.00	.00
CAD000086686	VACCO INDUSTRIES	SOUTH EL MONTE	156.96	.00	.00
CAD009693904	VAGA INDUSTRIES	SOUTH EL MONTE	38.64	.00	.00
CAD981418429	VAL CIRCUITS, INC.	SANTA ANA	101.00	.00	.00
CAD983619818	VALENCE TECHNOLOGY, INC.	SAN JOSE	5.76	945.00	.00

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CAR000007385	VALLEY CIRCUITS, INC	PACOIMA	18.40	.00	.00
CAD008371676	VALLEY PLATING WORKS	LOS ANGELES	107.00	.00	.00
CAT080014103	VALLEY TODECO INC.	SYLMAR	106.39	.00	.00
CAD076063312	VAN CAN COMPANY	FONTANA	111.04	.00	.00
CAD008387060	VAN NUY PLATING INC.	VAN NUYS	21.00	.00	.00
CAT000615013	VAN NUYS TERMINAL-CHEVRON RETAIL MA	VAN NUYS	706.49	.00	.00
CAD009230244	VAN WATERS & ROGERS INC.	LOS ANGELES	112.73	.00	.00
CAD010925576	VAN WATERS & WATERS INC.	SAN JOSE	148.45	73,950.00	.00
CAD041656851	VAN WATERS & WATERS INC.	WEST SACRAMENTO	168.60	.00	.00
CAD009120817	VARIAN ASSOCIATES INC	PALO ALTO	62.85	126.00	.00
CAD981626757	VARIAN SAMPLE PREPARATION PRODUCTS	HARBOR CITY	115.54	.00	.00
CAD980816763	VELIE CIRCUITS, INC.	COSTA MESA	285.05	.00	.00
CAD982001208	VERIFLO CORPORATION	RICHMOND	107.80	.00	.00
CAD983616392	VERNON TERMINAL	VERNON	21.46	.00	.00
CA0000043927	VICEROY GOLD CORPORATION	IVANPAH	32.36	.00	.00
CAD008330862	VICKERS INC.	LOS ANGELES	22.34	.00	.00
CAD051606135	VIKING FREIGHT SYSTEM, INC.	SANTA CLARA	21.00	.00	.00
CAD980893184	VIKTRON L.P. LIKA CALIFORNIA DIVISI	STOCKTON	938.84	.00	.00
CAD980891261	VITESSE SEMICONDUCTOR CORP.	CAMARILLO	31.63	.00	.00
CAD980737936	VLSI TECHNOLOGY, INC.	SAN JOSE	130.18	.00	.00
CAD981399348	WALT DISNEY PICTURES & TELEVISION	BURBANK	52.48	.00	.00
CAD981454739	WARNER BROS. STUDIO FACILITIES	BURBANK	92.35	.00	.00
CAD061623229	WATKINS-JOHNSON COMPANY	PALO ALTO	114.25	.00	.00
CAD106931488	WATSON LABORATORIES, BUILDING 1	CORONA	14.72	20.00	.00
CAD982403396	WELCH'S OVERALL CLEANING CO.	VERNON	106.50	.00	.00
CAD008245714	WESCAL INDUSTRIES	RANCHO DOMINGUE	47.20	.00	.00
CAR000004713	WESCO METAL FABRICATOR'S INC.	CHATSWORTH	36.67	.00	.00
CAD000107268	WESGO, INC.	BELMONT	105.90	.00	.00
CAD009686874	WESLOCK NATIONAL, INC.	LOS ANGELES	103.54	.00	.00
CAD081448961	WEST COAST CIRCUITS, INC.	WATSONVILLE	360.54	.00	.00
CAD983656851	WEST COAST COMPOSITES	CARLSBAD	17.82	.00	.00
CAD982504466	WEST COAST JEWELRY CENTER	LOS ANGELES	230.00	.00	.00
CAD983586157	WEST COAST PIPE INSPECTION INC.	SHAFTER	112.20	.00	.00
CAD059498428	WESTAK	SUNNYVALE	313.80	.00	.00
CAD076945559	WESTERN FUEL OIL	SAN PEDRO	400.40	.00	.00
CAD008261125	WESTERN METAL DECORATING	RANCHO CUCAMONG	118.10	.00	.00
CAD009176850	WESTERN ROTO ENGRAVERS INC.	BERKELEY	90.57	.00	.00
CAD001864081	WESTINGHOUSE ELECTRIC CORPORATION	SUNNYVALE	32.00	.00	.00
CAD056458573	WHITCOMB PLATING	CITY OF INDUSTR	78.79	.00	.00
CAD041837659	WHITE CAP INC.	HAYWARD	369.05	.00	.00
CAD000626036	WICKLAND OIL LOS ANGELES TERMINAL	WILMINGTON	35.00	.00	.00
CAD066562455	WICKLAND OIL MARTINEZ	MARTINEZ	218.70	.00	.00
CAD982443517	WINONICS (BREA)	BREA	150.83	.00	.00
CAD008363962	WINONICS INC.	FULLERTON	116.70	.00	.00
CAD002904886	WITCO CORP GOLDEN BEAR PROD OILDALE	OILDALE	19.30	.00	.00
CAT080030901	XEROX CORPORATION	EL JEEUNDO	42.43	.00	.00
CAD076296813	XEROX PALO ALTO RESEARCH CENTER	PALO ALTO	133.55	22.00	.00
CAD981462484	XICOR, INC.	MILPITAS	54.32	.00	.00
CA8170090023	YERMO MCLB BARSTOW	BARSTOW	1,007.51	.00	.00
CAD009523887	YOUNG ELECTRONICS	NORTH HOLLYWOOD	37.40	.00	.00
CAD080709553	ZENECA INC.	RICHMOND	87.67	.00	.00
CAD982520421	ZYCON CORPORATION	SANTA CLARA	3,988.07	.00	.00
CAD982328551	ZYNOLYTE PRODUCT CO.	CARSON	21.90	.00	.00
CAD982441503	3 BOYS AUTO WRECKING/PICK A PART	MADERA	50.77	.00	.00
CAD084160407	3M DENTAL PRODUCTS DIVISION	IRVINE	32.12	.00	.00

Note: Please refer to the introduction for an explanation of this list.

CALIFORNIA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
CAD990667099	3M MONROVIA - TMD	MONROVIA	29.86	.00	.00
CAD982403966	3M ONTARIO	ONTARIO	33.87	.00	.00
CAT080033368	3M PETALUMA	PETALUMA	15.33	.00	.00
CAD050807122	3M PHARMACEUTICALS	NORTHRIDGE,	107.55	870.00	.00
CAD008256356	3M UNITEK CORPORATION	MONROVIA	37.23	.00	.00
CAD080079601	3M-DATA STORAGE TAPE TECH DIVISION	CAMARILLO	3,070.10	.00	.00
CAD980881676	76 PRODUCTS CO LAR CARSON PLANT	CARSON	152.67	.00	.00
CAD008237679	76 PRODUCTS COMPANY-LAR WILMINGTON	WILMINGTON	5,377.67	.00	.00
CAT080034234	915 DEGUIGNE DRIVE	SUNNYVALE	110.46	.00	.00

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CALIFORNIA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
CAD980892509	ACCURATE ENGINEERING	SUN VALLEY	12.16	.00	.00
CAD982336018	ACCURATE METAL FABRICATORS, INC.	LONG BEACH	3.37	.00	.00
CAD982360562	ACME PACKAGING CORP. - PITTSBURG EA	PITTSBURG	1.19	.00	.00
CAD980812978	ACTION CLEANING CORPORATION	SAN DIEGO	6.42	.00	.00
CAD981376346	ACUSON CORPORATION	MOUNTAIN VIEW	2.72	.00	.00
CAD982516619	ACUSON CORPORATION	MOUNTAIN VIEW	6.21	.00	.00
CAD981449739	ACUSON-CANOGA PARK FACILITY	CANOGA PARK	4.73	.00	.00
CAD982345449	ADVANCE CIRCUIT SERVICES	SANTA CLARA	11.89	.00	.00
CAD041326216	AEROCHEM, INC.	ORANGE	3.55	.00	.00
CAD981461767	AGFA DIVISION OF BAYER	BURBANK	3.61	.00	.00
CAD982491490	ALASKA AIRLINES- OAKLAND	OAKLAND	10.72	.00	.00
CAD981369218	ALDILA, INC.	SAN DIEGO	10.89	.00	.00
CAD982360992	ALLERGAN MEDICAL OPTICS, IRWINDALE	IRWINDALE	8.67	.00	.00
CAD981391220	ALLIED PACIFIC METAL STAMPING	ANAHEIM	1.64	.00	.00
CAD008325334	ALLIEDSIGNAL AEROSPACE EQUIP SYS N.	NORTH HOLLYWOOD	3.85	.00	.00
CAD049337553	ALLIEDSIGNAL AEROSPACE EQUIP SYS R.	RANCHO DOMINGUE	7.41	.00	.00
CAT080010663	ALLIEDSIGNAL AEROSPACE EQUIP SYS SI	TORRANCE	9.76	.00	.00
CAD094725215	ALPS ELECTRIC U.S.A INC.	GARDEN GROVE	9.81	.00	.00
CAD066145640	ALUMAX MILL PRODUCTS, INC.	RIVERSIDE	5.25	.00	.00
CAD981379100	ALUMIN-ART PLATING CO.	ONTARIO	10.00	.00	.00
CAD983646621	ALZA CORPORATION (M4)	MOUNTAIN VIEW	1.73	.00	.00
CAD061622783	ALZA CORPORATION (N/R)	PALO ALTO	9.45	.00	.00
CAD053811386	AMADA MFG AMERICA INC.	LA MIRADA	6.50	.00	.00
CAD076205053	AMERICAN AIRLINES, INC.	LOS ANGELES	5.10	.00	.00
CAD020163671	AMERICAN NATIONAL CAN CO.	CHATSWORTH	6.35	.00	.00
CAD048489306	AMERICAN POLYSTYRENE CORPORATION	TORRANCE	6.45	.00	.00
CAD008301947	AMERICAN UNITED PRODUCTS	DOWNEY	5.97	.00	.00
CA0000204289	AMP INCORPORATED	ONTARIO	11.72	.00	.00
CAD980892491	ANALOG DEVICES, INC.	SUNNYVALE	2.50	.00	.00
CAD009151663	ANCHOR GLASS CONTAINER CORP.	ANTIOCH	10.34	.00	.00
CA0000124354	ANDPAK-EMA, INC	SAN JOSE	11.47	.00	.00
CAD008271942	ANGELUS SANITARY CAN MACHINE COMPAN	LOS ANGELES	4.13	.00	.00
CAR000004457	APPLE COMPUTER INC. SACRAMENTO	ELK GROVE	9.97	.00	.00
CAD009189069	APPLIED AEROSPACE STRUCTURES CORP.	STOCKTON	11.05	.00	.00
CAD087579892	ARAMARK UNIFORM SERVICES	SAN DIEGO	7.46	.00	.00
CAD980736490	ARCO PIPE LINE CO., BERTH 121	LONG BEACH	5.92	.00	.00
CAD000628420	ARCO PIPE LINE CO., WEST HYNES	LONG BEACH	1.23	.00	.00
CAD000632406	ARCO PRODUCTS COMPANY	BLOOMINGTON	2.90	.00	.00
CAD000633271	ARCO PRODUCTS COMPANY-SAN DIEGO TER	SAN DIEGO	9.50	.00	.00
CAD982030660	ARCTURUS MANUFACTURING	OXNARD	7.50	.00	.00
CA6572026296	AREA B,LOS ANGELES AIR FORCE BASE	EL SEGUNDO	8.71	.00	.00
CAD088387741	ARMSTRONG WORLD INDUSTRIES INC	SOUTH GATE	5.16	.00	.00
CAD021064258	ASTRO PAK CORP.	DOWNEY	2.15	.00	.00
CAD046446654	ATCHISON TOPEKA & SANTA FE RY - HOB	VERNON	6.64	.00	.00
CAD981412604	AVALON GLASS & MIRROR CO.	CARSON	5.75	.00	.00
CAD983610304	B.A.S. PRECISION SHEET METAL	MORGAN HILL	9.47	.00	.00
CAD074644659	BARON BLAKESLEE	NEWARK	7.42	.00	.00
CAD009688185	BARRY AVENUE PLATING CO., INC.	LOS ANGELES	3.94	.00	.00
CAD983645953	BASF CORPORATION	SANTA ANA	8.60	.00	.00
CAD983579467	BAXTER M. CORPORATION	IRVINE	2.67	.00	.00
CAT080012263	BAYDAY CHEMICAL	SANTA CLARA	4.88	.00	.00
CAD028872711	BECKMAN INSTRUMENTS, INC.	PALO ALTO	12.84	.00	.00
CAT080030661	BECKMAN INSTRUMENTS, INC.	BREA	4.65	5.00	.00
CAD981973472	BELL INDUSTRIES	MOUNTAIN VIEW	5.96	.00	.00
CAT080012974	BETZ LABORATORIES INC	BAKERSFIELD	5.12	.00	.00

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CALIFORNIA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
CAD981400559	BFGOODRICH - CARBON PRODUCTS	SANTA FE SPRING	6.06	.00	.00
CAD981991276	BIO-RAD LABORATORIES	HERCULES	7.11	.00	.00
CAD981390693	BLOMBERG WINDOW SYSTEMS	SACRAMENTO	12.17	.00	.00
CAD006910954	BLUE DIAMOND GROWERS	SACRAMENTO	11.46	.00	.00
CAD008255754	BOURNS, INC.	RIVERSIDE	2.72	.00	.00
CAD040505331	BRILES RIVET CORPORATION	OCEANSIDE	5.17	.00	.00
CAD980813356	BROTHERS UNION INT'L	SANTA CLARA	6.81	.00	.00
CAD098321326	C.B.R. CIRCUITS, INC.	MILPITAS	12.64	.00	.00
CAD981973134	C&I PHOTOGRAPHY	SUNNYVALE	10.28	.00	.00
CAD981372477	CABMRO MANUFACTURING CO.	HUNTINGTON BEAC	3.18	.00	.00
CAD981159494	CAL FLEX, INC.	ANAHEIM	5.32	.00	.00
CAD040366486	CAL STATE POLYTECHNIC UNIVERSITY PO	POMONA	12.18	.00	.00
CAD000041863	CALGON CORPORATION	CITY OF INDUSTR	5.32	.00	.00
CAD982510497	CALIFORNIA ENERGY CO., INC.	COSO JUNCTION	2.78	.00	.00
CAD981653553	CALIFORNIA INSTITUTION FOR MEN	CHINO	8.19	.00	.00
CAD981419351	CALIFORNIA MENS COLONY	SAN LUIS OBISPO	7.86	.00	.00
CAD010938165	CALIFORNIA MICRO DEVICES	MILPITAS	10.43	.00	.00
CAD009105768	CALIFORNIA OILS CORPORATION	RICHMOND	7.56	.00	.00
CAT080033731	CALIFORNIA STATE UNIVERSITY BAKERSF	BAKERSFIELD	5.14	10.00	.00
CAD066697590	CALIFORNIA STATE UNIVERSITY, LOS AN	LOS ANGELES	6.12	17.00	.00
CAD990667628	CAPSTAN PACIFIC	LOS ANGELES	1.25	.00	.00
CAD047791421	CARPENTER TECHNOLOGY CORPORATION -	EL CAJON	5.88	.00	.00
CAD981448210	CELITE CORPORATION	LOMPOC	8.62	.00	.00
CAD981399728	CENSTOR CORPORATION	SAN JOSE	8.74	.00	.00
CAT000623975	CENTRAL PLANTS, INC./DOUGLAS	HUNTINGTON BEAC	1.34	.00	.00
CAD983643396	CHEMTRAK INC.	SUNNYVALE	11.31	5.00	.00
CAD981429731	CHEVRON PARK	SAN RAMON	8.15	.00	.00
CAT080011992	CHEVRON PRODUCTION - SANTA BARBARA	VENTURA	5.29	.00	.00
CAD981423676	CHEVRON PRODUCTION-GAVIOTA OIL & GA	GOLETA	5.80	.00	.00
CAD981429574	CHIRON VISION CORPORATION	CLAREMONT	7.29	10.00	.00
CAD982482226	CITY & CO. OF SF - PIER 46B	SAN FRANCISCO	6.98	.00	.00
CAD981414469	CITY OF FULLERTON/BASQUE YARD	FULLERTON	4.53	.00	.00
CAD981633860	CITY OF VERNON	VERNON	2.70	.00	.00
CAD981667264	COGNIS, INC.	SANTA ROSA	4.78	.00	.00
CA0000976084	COGNIS, INC.	SANTA ROSA	5.33	.00	.00
CAD076055326	CONTAINER CORPORATION OF AMERICA	IRVINE	11.88	.00	.00
CA4170090613	CONTINENTAL MARITIME SAN DIEGO	SAN DIEGO	9.68	.00	.00
CAT080011489	CONTRA COSTA POWER PLANT	ANTIOCH	6.42	.00	.00
CAD083912824	CORONET MANUFACTURING CO, INC.	GARDENA	5.15	.00	.00
CAD077173920	CORRECTIONAL TRAINING FACILITY	SOLEDAD	2.40	.00	.00
CAR000002881	COSTCO WHOLESALE #121	EL CENTRO	5.73	.00	.00
CAR000003087	COSTCO WHOLESALE #124	VISTA	9.82	.00	.00
CAR000004911	COSTCO WHOLESALE #28	LAGUNA NIGUEL	6.38	.00	.00
CA0000382960	COUNTY OF ORANGE, EMA, KATELLA YARD	ANAHEIM	2.91	.00	.00
CAD008256315	CPCC MOJAVE PLANT	MOJAVE	2.48	.00	.00
CAD088388673	CRAIN INDUSTRIES, INC.	COMPTON	8.44	.00	.00
CAD073568180	CSDOC, PLANT NO. 1	FOUNTAIN VALLEY	4.16	.00	.00
CAD981450026	CSDOC, PLANT NO. 2	HUNTINGTON BEAC	7.05	.00	.00
CAD009657776	CUSHION CUT INC.	TORRANCE	3.33	.00	.00
CAD042234013	DAICO INDUSTRIES, INC	RANCHO DOMINGUE	3.01	.00	.00
CAD982029837	DE ANZA COLLEGE	CUPERTINO	9.23	.00	.00
CAD008270043	DECRATREND	CITY OF INDUSTR	5.39	.00	.00
CAD983673567	DEGUSSA CORPORATION	LONG BEACH	2.52	.00	.00
CAD983608183	DELRAN, INC.	SANTA ANA	12.46	.00	.00
CAD982317075	DEUEL VOCATIONAL INSTITUTION	TRACY	8.24	.00	.00

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CALIFORNIA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
CAD009604075	DEUTSCH METAL COMPONENTS	GARDENA	10.02	.00	.00
CAD038139143	DEVCO METAL FINISHING, INC.	SANTA CLARA	7.00	.00	.00
CAD983660861	DOMENIGONI VLY	HEMET	1.64	.00	.00
CAD028489045	DOWNEY GLASS COMPANY	LOS ANGELES	11.07	.00	.00
CAD008503112	DOWTY AEROSPACE LOS ANGELES	DUARTE	10.38	.00	.00
CAD983567512	E. I. DU PONT DE NEMOURS & CO.	POMONA	5.49	.00	.00
CAD096108725	E. R. CARPENTER CO., INC.	RIVERSIDE	4.28	.00	.00
CAD982510083	E-SYSTEMS/GOLETA DIVISION	GOLETA	8.81	.00	.00
CAD981425416	EAGLE MOUNTAIN PUMPING PL	DESERT CENTER	4.61	.00	.00
CAD982017733	EATON CORPORATION	EL SEGUNDO	4.87	.00	.00
CAD091432153	EDOCO	LONG BEACH	6.97	.00	.00
CAD981577083	EEMCO DIV. DATRON INC.	LOS ANGELES	4.86	.00	.00
CAD980893242	EKC TECHNOLOGY, INC.	HAYWARD	11.79	.00	.00
CAD981655178	ELCAJON FORD	EL CAJON	7.93	.00	.00
CAD990665903	ELECTRO PLATING SPECIALTIES, INC.	HAYWARD	4.27	.00	.00
CAD063045314	ELECTROGLAS, INC.	SANTA CLARA	8.44	.00	.00
CAT080029465	ELECTRON PLATING	GARDEN GROVE	3.17	.00	.00
CAD982524886	ENTHONE-OMI INC.	LONG BEACH	4.17	.00	.00
CAD980887418	EVERGREEN OIL, INCORPORATED	NEWARK	2.63	.00	.00
CAD983614405	EXXON COMPANY, U.S.A.	GOLETA	13.00	.00	.00
CAD009523515	FADAL ENGINEERING	CHATSWORTH	7.09	.00	.00
CAD982480287	FERRO CORPORATION - EMD	SAN MARCOS	7.36	.00	.00
CAD050808369	FIBER-RESIN CORPORATION	CHATSWORTH	3.75	.00	.00
CAD983672940	FISHER SCIENTIFIC CO.	SANTA CLARA	2.05	2.00	.00
CA7170024288	FLEET AND INDUSTRY SUPPLY CENTER	SAN DIEGO	3.22	.00	.00
CAD981383631	FLEETWOOD ENTERPRISES, INC.	RIVERSIDE	2.41	.00	.00
CAD981384092	FLEETWOOD TRAVEL TRAILERS OF CA	RIALTO	5.40	.00	.00
CAD008330185	FLINT INK CORPORATION	CITY OF INDUSTR	4.80	.00	.00
CAT000613455	FMC CORPORATION F.P.S.D.	MADERA	12.20	.00	.00
CAD008352361	FOAMEX	ORANGE	3.79	.00	.00
CAD000646190	FOAMEX INTERNATIONAL INC.	SAN BERNARDINO	7.19	.00	.00
CAD000630061	FORMER LOCKHEED PLANT B-6	BURBANK	1.20	.00	.00
CAR000015404	FOSTER WHEELER MARTINEZ	MARTINEZ	3.37	8.00	.00
CAD982499600	FUJI PHOTO FILM U.S.A., INC.	CYPRESS	7.80	.00	.00
CAD983637638	FUJITSU COMPUTER PACKAGING TECH., I	SAN JOSE	7.75	.00	.00
CAD008330797	GANS INK & SUPPLY CO.	LOS ANGELES	8.83	.00	.00
CAD054855366	GATX SAN PEDRO TERMINAL	SAN PEDRO	12.55	.00	.00
CAD981434657	GAVIOTA PAPCO	GAVIOTA	1.77	.00	.00
CAD981375124	GE ENGINE SERVICES - TEST CELL FACI	ONTARIO	7.02	.00	.00
CAD981166051	GELMAN SCIENCES	PLEASANTON	3.44	.00	.00
CAD981425531	GENE/INTAKE	PARKER DAM	7.19	.00	.00
CAD055698815	GENERAL AMERICAN TRANSPORTATION	COLTON	7.47	.00	.00
CAD030584502	GENERAL ELECTRIC CO	ANAHEIM	9.12	.00	.00
CAD009208075	GENERAL ELECTRIC COMPANY	OAKLAND	2.56	.00	.00
CAD981689862	GENERAL ELECTRIC COMPANY, FLIGHT TE	MOJAVE	2.39	.00	.00
CAD982485054	GEO EAST MESA GENERATING FACILITY	HOLTVILLE	5.67	.00	.00
CAD009221003	GEORGIA-PACIFIC WEST INC.	MARTELL	4.77	.00	.00
CAD982462103	GILEAD SCIENCES	FOSTER CITY	10.64	.00	.00
CAD095991253	GREAT WESTERN CHEMICAL CO.	MILPITAS	2.17	.00	.00
CAD981382443	GREAT WESTERN CHEMICAL CO.	STOCKTON	1.48	.00	.00
CAD983613688	GREAT WESTERN CHEMICAL CO.	ARLETA	4.60	.00	.00
CA0000483438	GSS/ARRAY TECHNOLOGY, INC.	SAN JOSE	10.86	.00	.00
CAD064580434	GTE DIRECTORIES CORPORATION - LAPP	LOS ANGELES	3.66	.00	.00
CAD008237109	GULTON-STATHAM TRANSDUCERS, INC.	COSTA MESA	7.54	.00	.00
CAD044433613	HAMILTON STANDARD	LONG BEACH	3.07	.00	.00

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CALIFORNIA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
CAD000415661	HARBOR UNIVERSAL	SAN LEANDRO	12.76	.00	.00
CAD982446437	HAWTHORNE MACHINERY CO	SAN DIEGO	4.80	.00	.00
CAD008489452	HENRY COMPANY	HUNTINGTON PARK	10.95	.00	.00
CAD076314640	HEWLETT PACKARD CALIF. ANALYTICAL D	PALO ALTO	11.35	.00	.00
CAD049231319	HEWLETT PACKARD COMPANY	SANTA CLARA	9.90	.00	.00
CAD009122557	HEWLETT-PACKARD - PAFC	PALO ALTO	5.33	.00	.00
CAT000617266	HEWLETT-PACKARD COMPANY	PALO ALTO	11.45	.00	.00
CAT000646174	HEWLETT-PACKARD COMPANY	ROCKLIN	7.79	.00	.00
CAT080014483	HEWLETT-PACKARD COMPANY	ROSEVILLE	7.96	.00	.00
CAD983622606	HITEST - LOGISTIX	MILPITAS	8.86	.00	.00
CAD048802748	HMT TECHNOLOGY CORP.	FREMONT	2.43	.00	.00
CAD981573827	HOLT BROS.	LOS BANOS	2.12	.00	.00
CAD981684053	HOLT BROS.	STOCKTON	9.34	.00	.00
CAD041162330	HR TEXTRON INC., PACOIMA FACILITY	PACOIMA	8.52	.00	.00
CAD981657778	HUNTINGTON MECHANICAL LABS, INC.	MOUNTAIN VIEW	4.40	.00	.00
CAD983672643	HYPER CORPORATION	HUNTINGTON BEAC	10.60	.00	.00
CAD983579061	INDUSTRIAL MOLDING CORPORATION	RANCHO DOMINGUE	9.02	.00	.00
CAT000646182	INDY ELECTRONICS DBA ALPHATEC	MANTECA	6.86	.00	.00
CAD982464356	INTEGRATED DEVICE TECHNOLOGY INC.	SANTA CLARA	5.07	.00	.00
CAD981425655	IRON MOUNTAIN	EARP	1.36	.00	.00
CAD030841597	IVAX INDUSTRIES/CAMCO	CITY OF INDUSTR	3.77	.00	.00
CAD069138899	J & B ENTERPRISES	SANTA CLARA	3.46	.00	.00
CAD981391360	J & H DEBURRING, INC.	ANAHEIM	5.07	.00	.00
CAD008306482	J & M ANODIZING	BURBANK	11.38	.00	.00
CAD982033557	JEFFERSON SMURFIT CORPORATION	SANTA CLARA	2.61	.00	.00
CAD981424997	JG BOSWELL COMPANY - DAIRY AVE SHOP	CORCORAN	10.37	.00	.00
CAD008352205	JONES CHEMICALS, INC.	TORRANCE	2.86	.00	.00
CAD990724858	JONES CHEMICALS, INC.	MILPITAS	9.75	.00	.00
CAD029379104	JOSLYN ELECTRONIC SYSTEMS	GOLETA	9.56	.00	.00
CAD983600339	KAISER BIOMEDICAL ENGINEERING	BERKELEY	12.03	.00	.00
CAD066154345	KAISER ELECTOPRECISION	IRVINE	4.86	.00	.00
CAD074647017	KAISER FOUNDATION HOSPITAL	SAN FRANCISCO	9.44	.00	.00
CAD981427131	KAISER FOUNDATION HOSPITAL OAKLAND	OAKLAND	1.11	.00	.00
CAD981429715	KEARNEY-KPF	STOCKTON	3.10	.00	.00
CAD982492175	KERN INDUSTRIES	CITY OF INDUSTR	5.69	.00	.00
CAD981690506	L.A. CITY STREET MAINT.,VALLEY WARE	NORTH HOLLYWOOD	1.58	.00	.00
CAD982357337	L.A. TERMINALS, INC.	WILMINGTON	3.76	.00	.00
CAD981425358	LAKE MATHEWS	RIVERSIDE	1.86	.00	.00
CAR000001099	LIGAND PHARMACEUTICALS, INC.	SAN DIEGO	9.10	7.00	.00
CAD047787205	LINFINITY MICROELECTRONICS INC.	GARDEN GROVE	12.57	.00	.00
CAD009578337	LITTON G/CS - NEWBURY PARK FACILITY	NEWBURY PARK	6.71	.00	.00
CAT000625392	LITTON SOLID STATE DIVISION	SANTA CLARA	4.62	.00	.00
CAD981630296	LOCKHEED MARTIN AIRCRAFT SERVICES-C	CHINO	1.67	.00	.00
CAT080030877	LOMA LINDA UNIVERSITY	LOMA LINDA	12.25	.00	.00
CAD055766422	LONZA INC.	CARSON	7.58	.00	.00
CA0000197988	LORAL AERONUTRONIC (NPB)	NEWPORT BEACH	5.24	.00	.00
CAD980817811	LORAL ELECTRO-OPTICAL SYS	PASADENA	4.07	.00	.00
CAD980817878	LORAL ELECTRO-OPTICAL SYSTEMS	POMONA CA 91767	6.29	.00	.00
CAD981576432	LOS ANGELES CITY STREET MAINTENANCE	NORTH HOLLYWOOD	1.17	.00	.00
CAD981675911	LOS ANGELES INTERNATIONAL AIRPORT	LOS ANGELES	3.72	.00	.00
CAD981446701	LSI LOGIC CORPORATION	FREMONT	9.00	.00	.00
CAD981452568	LSI LOGIC CORPORATION	SANTA CLARA	3.65	.00	.00
CAD981690019	LUBECO, INC	LONG BEACH	6.56	.00	.00
CAD981383573	LUCKY STORES - BUENA PARK	BUENA PARK	9.66	.00	.00
CAD983662958	MAGMA OPERATING CO. ADMN	CALIPATRIA	7.55	.00	.00

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CALIFORNIA

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- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
CAT080011612	MARTINEZ POWER PLANT	MARTINEZ	2.43	.00	.00
CAD981980808	MAXWELL LABORATORIES, INC.	SAN DIEGO	3.27	.00	.00
CAD982333981	MC DONNELL DOUGLAS AEROSPACE	MONROVIA	3.41	.00	.00
CAD982014763	MCDONNELL DOUGLAS	TORRANCE	4.27	.00	.00
CAD008255333	MCP INDUSTRIAL FOOD PRODUCTS	ANAHEIM	2.01	.00	.00
CAD047781463	MEAD PACKAGING	BUENA PARK	6.35	.00	.00
CAD980895791	MICROLINEAR CORPORATION	SAN JOSE	2.79	.00	.00
CAD004295572	MID WEST FABRICATING COMPANY	SANTA FE SPRING	10.50	.00	.00
CAD000629295	MIDWAY STATION	TAFT	11.08	.00	.00
CAD008380040	MODERN FAUCET MFG. COMPANY	LOS ANGELES	8.67	.00	.00
CAD008253247	MODINE WESTERN, INC.	LOS ANGELES	6.13	.00	.00
CAR000003111	MYDRIN, INC.	COMMERCE	5.25	.00	.00
CA7800020391	NASA/JPL GOLDSTONE TRACKING STATION	FT. IREIN NTC	8.43	.00	.00
CA3170090614	NATIONAL STEEL SHIPBUILDING CO.	SAN DIEGO	4.62	.00	.00
CA4170024414	NAVAL PETROLEUM RESERVE NO. 1	TUPMAN	5.19	.00	.00
CA1170090194	NAVAL POSTGRADUATE SCHOOL	MONTEREY	1.83	.00	.00
CAR000000539	NCCOSC RDTE DIV.	CAMPO	3.82	.00	.00
CA0000066373	NISE WEST	SAN DIEGO	12.71	.00	.00
CA6170024388	NISE WEST	SAN DIEGO	3.69	.00	.00
CAT000614669	NORTHAM STATION	LA MIRADA	1.65	.00	.00
CAD058013178	NORTHROP GRUMMAN CORPORATION	HAWTHORNE	4.24	.00	.00
CAD000627695	NORTHROP GRUMMAN CORPORATION-MASD(A	HAWTHORNE	3.06	.00	.00
CAD980880959	NORTHROP GRUMMAN CORPORATION-MASD(A	HAWTHORNE	7.22	.00	.00
CAD066658808	NORTHROP GRUMMAN CORPORATION-MASD(D	COMPTON	9.65	.00	.00
CAD000627224	NORTHROP GRUMMAN CORPORATION-MASD(K	TORRANCE	9.47	.00	.00
CAD008289498	NORTHROP GRUMMAN CORPORATION-MASD(N	NEWBURY PARK	4.02	.00	.00
CAD008259558	NT QUALITY HARDWARE	HAWTHORNE	6.67	.00	.00
CAD009110768	OPTICAL COATING LABORATORY, INC	SANTA ROSA	12.81	.00	.00
CAD981392418	ORMCO/SYBRON CORPORATION	GLENDORA	1.13	.00	.00
CAD009149485	OWENS CORNING	SANTA CLARA	1.11	.00	.00
CAD009146929	OWENS-ILLINOIS GLASS CONTAINER	TRACY	12.03	.00	.00
CAD983647520	PACESETTER, INC.	SYLMAR	12.15	.00	.00
CAT080011570	PACIFIC GAS & ELETRIC COMPANY	SAN FRANCISCO	3.62	.00	.00
CAD053854451	PACIFIC SHIP REPAIR & FAB.	SAN DIEGO	9.43	.00	.00
CAD983668526	PACIFIC SHIPREPAIR & FAB.	SAN DIEGO	4.11	.00	.00
CAT000604017	PALO ALTO MUNICIPAL SERVICE CENTER	PALO ALTO	4.44	.00	.00
CAD982408171	PANTRONIX CORPORATION	SAN JOSE	11.09	.00	.00
CAD083589838	PATTON STATE HOSPITAL	PATTON	3.22	.00	.00
CAD096001615	PETROLITE CORPORATION BAKERSFIELD,	BAKERSFIELD	7.95	.00	.00
CAD981387855	PG & E - OAKLAND SERVICE CENTER	OAKLAND	9.80	.00	.00
CAD981578156	PG & E - SAN RAFAEL SERVICE CENTER	SAN RAFAEL	5.80	.00	.00
CAD980886568	PG & E ANGELS CAMP SERVICE CENTER	ANGELS CAMP	4.36	.00	.00
CAD981390263	PG & E AUBURN SERVICE CENTER	AUBURN	4.55	.00	.00
CAD981391030	PG & E BELMONT SERVICE CENTER	BELMONT	3.99	.00	.00
CAD981412620	PG AND E - DAVIS SERVICE CENTER	DAVIS	10.86	.00	.00
CAD981430317	PG AND E - FREMONT MATERIALS FACILI	FREMONT	2.82	.00	.00
CAD981389950	PG AND E - FRESNO SERVICE CENTER	FRESNO	12.95	.00	.00
CAD981457880	PG AND E - GENERAL OFFICE	SAN FRANCISCO	5.80	.00	.00
CAD981450315	PG AND E - GRASS VALLEY SERVICE CEN	GRASS VALLEY	2.97	.00	.00
CAD981372709	PG+E ANTIOCH DIST. MAINT.	ANTIOCH	1.90	.00	.00
CAT080011604	PG+E KETTLEMAN COMPR. STN	AVENAL	2.70	.00	.00
CAT080011562	PG&E HUMBOLDT BAY POWER PLANT	EUREKA	7.49	.00	.00
CAT080011646	PG&E MORRO BAY POWER PLANT	MORRO BAY	3.71	.00	.00
CAT080011653	PG&E MOSS LANDING POWER PLANT	MOSS LANDING	4.35	.00	.00
CAD981408685	PHILIPS SEMICONDUCTORS	SUNNYVALE	4.10	.00	.00

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CALIFORNIA

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
CAT000614073	PHILIPS SEMICONDUCTORS	SUNNYVALE	8.77	.00	.00
CAD041834011	PHYSICS INTERNATIONAL	SAN LEANDRO	4.14	.00	.00
CA0570090555	PILLAR POINT AIR FORCE STATION	PRINCETON-BY-TH	1.57	.00	.00
CAT080013345	PIRELLI CABLE CORPORATION	COLUSA	8.63	.00	.00
CAT080011695	PITTSBURG POWER PLANT	PITTSBURG	10.51	.00	.00
CAD002909414	PRAXAIR SURFACE TECHNOLOGIES, INC.	LOS ANGELES	1.15	.00	.00
CAD981583404	PRECISION TUBE BENDING	SANTA FE SPRING	2.82	.00	.00
CAD059495549	PRICE CLUB #423	SUNNYVALE	4.32	.00	.00
CAR000005603	PRICE CLUB #429	SAN JUAN CAPIST	5.25	.00	.00
CAR000005595	PRICE CLUB #432	CORONA	2.81	.00	.00
CAR000005579	PRICE CLUB #441	PALM DESERT	8.43	.00	.00
CAD072263494	PROCTER AND GAMBLE PAPER PRODUCTS,O	OXNARD	4.45	.00	.00
CAD000087718	PUREGRO 0771110	BLYTHE	2.70	.00	.00
CAD028019149	PUREX POOL SYSTEMS	CITY OF INDUSTR	7.32	.00	.00
CAD980895106	QUALA SYSTEMS, INC.	HAYWARD	4.96	.00	.00
CAD006493613	RANTEC MICROWAVE & ELECTRONICS, INC	CALABASAS	5.05	.00	.00
CAT000617464	RAYCHEM CORPORATION-CHEMELEX SITE	REDWOOD CITY	2.82	10.00	.00
CAT000617449	RAYCHEM CORPORATION-ICD/MEDICAL SIT	MENLO PARK	6.58	.00	.00
CAD051706042	RAYCHEM CORPORATION-WIRE & CABLE SI	REDWOOD CITY	8.59	.00	.00
CAD008484719	REMO INC	N. HOLLYWOOD	6.72	.00	.00
CAD981375041	REPUBLIC TOOL & MANUFACTURING CORP.	CARLSBAD	11.07	.00	.00
CAD074957580	RESIN TECHNOLOGY COMPANY	ONTARIO	5.71	.00	.00
CAD980881064	REULAND ELECTRIC COMPANY	CITY OF INDUSTR	5.11	.00	.00
CAD010981165	REYNOLDS METALS COMPANY	ROCKLIN	10.17	.00	.00
CAD050674506	REYNOLDS METALS COMPANY - S.F. PLAN	HAYWARD	2.00	.00	.00
CAD981690274	RIVERSIDE TRANSIT AGENCY	RIVERSIDE	5.90	.00	.00
CAD982433229	ROCKWELL CORPORATION	DOWNEY	4.10	.00	.00
CAD021065586	RUBBER URETHANES INC.	AZUSA	6.04	.00	.00
CAD981981426	S. J. VALLEY PLATING	SANTA CLARA	13.11	.00	.00
CAR000006270	SAN ANTONIO CREEK WASTEWATER FACILI	EMERYVILLE	2.29	.00	.00
CAD982472201	SACRAMENTO REGIONAL TRANSIT DISTRIC	SACRAMENTO	7.99	.00	.00
CAT000613927	SAFETY KLEEN CORP	HIGHLAND	3.39	.00	.00
CAD108148958	SAINT JOSEPH MEDICAL CENTER	BURBANK	5.46	.00	.00
CAD980636682	SAN DIEGO GAS & ELECTRIC	SAN DIEGO	12.04	.00	.00
CAT080033822	SAN FRANCISCO INTERNATIONAL AIRPORT	SAN FRANCISCO	5.70	.00	.00
CAD981164320	SAN JOSE CREEK LABORATORY	WHITTIER	6.52	.00	.00
CAT080031206	SAN JOSE STATE UNIVERSITY	SAN JOSE	11.79	.00	.00
CA7170090206	SAN NICOLAS ISLAND	POINT MUGU	5.78	.00	.00
CAD008287674	SANDBERG FURNITURE	LOS ANGELES	5.06	.00	.00
CAD981425580	SANFORD METAL PROCESSING, INC.	MENLO PARK	8.85	.00	.00
CAD983648098	SANMINA - PLANT #8	SAN JOSE	3.50	.00	.00
CAD982443152	SANMINA BACKPANEL DIV.	MILPITAS	3.10	.00	.00
CAD077191039	SANTA CLARA PLATING CO. INC.	SANTA CLARA	5.35	.00	.00
CAD008322737	SARGENT FLETCHER INC.	EL MONTE	6.66	.00	.00
CAD010705671	SAYBOLT, INC.	WILMINGTON	8.54	.00	.00
CAD000630004	SCHULLER INTERNATIONAL, INC.	CORONA	4.66	.00	.00
CAD981990765	SCIENTIFIC PLATERS OF NO. CALIF., I	OAKLAND	8.06	.00	.00
CAD982009136	SDCTY - POLICE WESTERN FACILITY	SAN DIEGO	4.05	.00	.00
CAD981687221	SEA WORLD OF CALIFORNIA	SAN DIEGO	10.57	.00	.00
CAD980884837	SEAGATE MAGNETICS	SAN JOSE	3.21	.00	.00
CAD982408999	SEAGATE TECHNOLOGY, INC.	MILPITAS	10.24	.00	.00
CAD126622760	SEARS UNIT # 1548 AND 8278	LAGUNA HILLS	2.83	.00	.00
CAD983595216	SEARS UNIT # 1788	RICHMOND	1.80	.00	.00
CAD980892186	SEARS UNIT #8338	CHATSWORTH	2.09	.00	.00
CAT080011240	SFPP, L.P.	STOCKTON	10.29	.00	.00

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CAT080011109	SFPP, L.P. - BRISBANE TERMINAL	BRISBANE	3.80	.00	.00
CA0000724674	SHAMBAN PTG	NEWBURY PARK	3.13	.00	.00
CAD000631382	SHELL OIL COMPANY	SAN JOSE	2.79	.00	.00
CAD066676123	SHELL OIL COMPANY	CARSON	12.43	15.00	.00
CAD980888218	SHELL OIL COMPANY	HUNTINGTON PARK	8.82	.00	.00
CAD981401318	SHELL OIL COMPANY	SAN FRANCISCO	8.50	.00	.00
CAD981402472	SHELL OIL COMPANY	WALNUT	12.50	.00	.00
CAD981402662	SHELL OIL COMPANY	SAN LEANDRO	5.75	.00	.00
CAD981403025	SHELL OIL COMPANY	UNION CITY	9.00	.00	.00
CAD981403108	SHELL OIL COMPANY	OAKLAND	1.38	.00	.00
CAD981460538	SHELL OIL COMPANY	BUENA PARK	5.50	.00	.00
CAT000617480	SHELL OIL COMPANY	WILMINGTON	11.62	.00	.00
CAD982042681	SHULZE MANUFACTURING	BURLINGAME	1.54	.00	.00
CAD008480626	SHUR-LOK CORP	IRVINE	9.86	.00	.00
CAD982507766	SIEMENS MEDICAL SYSTEMS, INC.	CONCORD	8.53	.00	.00
CAD050519040	SIEMENS ROLM COMMUNICATIONS INC	SANTA CLARA	1.80	.00	.00
CA0000381269	SIGMA CIRCUITS, INC. FLEX DIVISION	SANTA CLARA	4.25	.00	.00
CAD008380982	SIKA CORPORATION	SANTA FE SPRING	3.32	.00	.00
CAD982368482	SILGAN CONTAINERS CORP. CITY OF IND	CITY OF INDUSTR	9.46	.00	.00
CAD009548942	SIZE CONTROL PLATING CO., INC.	LA PUENTE	10.22	.00	.00
CA0000806844	SMUD - FRESH POND	POLLOCK PINES	4.43	.00	.00
CAD982508426	SONOMA STATE UNIVERSITY	ROHNERT PARK	12.70	.00	.00
CAD004967550	SORIN BIOMEDICAL, INC.	IRVINE	5.53	.00	.00
CAD000630913	SOUTHERN CALIFORNIA EDISON	OXNARD	3.26	.00	.00
CAD000630962	SOUTHERN CALIFORNIA EDISON	EL SEGUNDO	9.20	.00	.00
CAD000631028	SOUTHERN CALIFORNIA EDISON	COLTON	2.75	.00	.00
CAD000631036	SOUTHERN CALIFORNIA EDISON	OXNARD	6.45	.00	.00
CAD000631085	SOUTHERN CALIFORNIA EDISON	HUNTINGTON BEAC	1.21	.00	.00
CAD000631143	SOUTHERN CALIFORNIA EDISON	LONG BEACH	1.15	.00	.00
CAD000631150	SOUTHERN CALIFORNIA EDISON	SAN BERNADINO	1.47	.00	.00
CAD009694795	SOUTHERN CALIFORNIA EDISON	LONG BEACH	1.34	.00	.00
CAD045530821	SOUTHERN CALIFORNIA EDISON	ALHAMBRA	2.63	.00	.00
CAD980816466	SOUTHERN CALIFORNIA EDISON	VISALIA	7.81	.00	.00
CAD981446909	SOUTHERN CALIFORNIA EDISON	RIALTO	2.69	.00	.00
CAD981681125	SOUTHERN CALIFORNIA EDISON	COMPTON	2.68	.00	.00
CAD981681554	SOUTHERN CALIFORNIA EDISON	ROSEMEAD	1.43	.00	.00
CAD981681604	SOUTHERN CALIFORNIA EDISON	ONTARIO	2.39	.00	.00
CAD981684749	SOUTHERN CALIFORNIA EDISON	BIG CREEK	1.13	.00	.00
CAD981684806	SOUTHERN CALIFORNIA EDISON	BIG CREEK	2.72	.00	.00
CAD981693765	SOUTHERN CALIFORNIA EDISON	RICHGROVE	1.20	.00	.00
CAD981693849	SOUTHERN CALIFORNIA EDISON	VENTURA	2.77	.00	.00
CAD981693948	SOUTHERN CALIFORNIA EDISON	IRVINE	2.47	.00	.00
CAD981694037	SOUTHERN CALIFORNIA EDISON	CERRITOS	1.46	.00	.00
CAD981694128	SOUTHERN CALIFORNIA EDISON	LA PUENTE	4.85	.00	.00
CAD981694185	SOUTHERN CALIFORNIA EDISON	GRAND TERRACE	2.25	.00	.00
CAD981694243	SOUTHERN CALIFORNIA EDISON	PALM SPRINGS	2.11	.00	.00
CAD983649872	SOUTHERN CALIFORNIA EDISON	BIG CREEK	8.55	.00	.00
CAR000002261	SOUTHERN CALIFORNIA EDISON	BIG CREEK	4.08	.00	.00
CA1170090616	SOUTHWEST MARINE INC.	SAN DIEGO	9.42	.00	.00
CAD982316523	SPEC-ELECTROPLATING	SAN RAFAEL	6.55	.00	.00
CAD982442881	SPECTROL ELECTRONICS CORPORATION	ONTARIO	5.15	.00	.00
CA6572890519	STOCKTON C.S.M.S.	STOCKTON	9.49	.00	.00
CAD981412828	SUNKIST GROWERS, INC.	ONTARIO	7.89	.00	.00
CAT080013683	SUPERIOR INDUSTRIES INTERNATIONAL I	VAN NUYS	5.22	.00	.00
CAD982445280	SUPERIOR METAL SHAPES	ONTARIO	10.24	.00	.00

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CAD982018939	SWIFT METAL FINISHING	SANTA CLARA	6.66	.00	.00
CAT080031628	SYSTECH ENVIRONMENTAL LOS ROBLES	LEBEC	2.47	.00	.00
CAD981982788	TABLE MOUNTIAN SUBSTATION	OROVILLE	2.72	.00	.00
CAD981635261	TAYLOR DUNN	ANAHEIM	6.43	.00	.00
CAD059277137	TECHALLOY CO INC	PERRIS	4.68	.00	.00
CAD106854177	TED LEVINE DRUM CO	SOUTH EL MONTE	11.61	.00	.00
CAD075301390	TELEDYNE CASTING SERVICE-PICCO	INDUSTRY	6.40	.00	.00
CAD980665723	TELEDYNE ELECTRONIC TECHNOLOGIES-MT	MOUNTAIN VIEW	12.70	.00	.00
CAD990833014	TELEDYNE RYAN ELECTRONICS	SAN DIEGO	13.17	.00	.00
CAD981449820	TEXACO E&P, INC. - KERN RIVER	BAKERSFIELD	7.19	.00	.00
CAD043237494	TEXACO REFINING AND MARKETING, INC.	RICHMOND	3.60	.00	.00
CAD009553637	THE AEROSPACE CORPORATION	EL SEGUNDO	4.25	.00	.00
CAD008390379	THE GEON COMPANY	CARSON	10.41	.00	.00
CAD980737837	THE SACRAMENTO BEE	SACRAMENTO	9.22	.00	.00
CAD009219684	THOMAS LIGHTING (GARDCO MFG)	SAN LEANDRO	3.71	.00	.00
CAD981389695	TOBAR INDUSTRIES	MOUNTAIN VIEW	7.30	.00	.00
CAD982476434	TOYOTA LOGISTICS SERVICES, INC.	LONG BEACH	3.52	.00	.00
CAD009447111	TRACOR AEROSPACE	SAN RAMON	4.55	.00	.00
CAD980886998	TRACY SERVICE CENTER	TRACY	3.08	.00	.00
CAD077234763	TRANS WORLD AIRLINES, INC.	LOS ANGELES	5.01	.00	.00
CAD982038622	TRANSAMERICAN PLASTICS CORP.	ONTARIO	5.85	.00	.00
CAD062091467	TREASURE CHEST ADVERTISING COMPANY	INDUSTRY	2.17	.00	.00
CAR000003954	TREASURE CHEST ADVERTISING INC.	WEST SACRAMENTO	8.53	.00	.00
CAD981655293	TREDEGAR FILM PRODUCTS	FREMONT	3.16	.00	.00
CAD054835913	TRI-STAR ENGINEERED PRODUCTS	BREA	7.33	.00	.00
CAD982464372	TRM COPY CENTERS-LA	WHITILER	8.43	.00	.00
CAD983587171	TRM COPY CTRS	HAYWARD	11.64	.00	.00
CAD981574171	TRW SPACE & ELECTRONICS REDONDO BEA	REDONDO BEACH	4.70	.00	.00
CAD981367691	TURLOCK IRRIGATION DISTRICT	TURLOCK	4.19	.00	.00
CAD008323255	U.S. BORAX INC.	BORON	6.05	.00	.00
CAD982495970	UCSD GRAPHICS	SAN DIEGO	4.09	.00	.00
CAD981421332	UCSD NIMITZ MARINE FACILITY	SAN DIEGO	1.96	.00	.00
CAR000001313	UCSF/SAN FRANCISCO GENERAL HOSPITAL	SAN FRANCISCO	8.74	.00	.00
CAD981449549	UDT SENSORS, INC.	HAWTHORNE	7.66	.00	.00
CAD009863424	UNION PACIFIC RAILROAD	LOS ANGELES	2.28	.00	.00
CAD982516213	UNITED TECHNOLOGIES CORPORATION	SAN JOSE	2.56	.00	.00
CA0000303172	UNIVERSITY OF CALIFORNIA, BERKELEY,	BERKELEY	8.34	.00	.00
CAD000626135	UNOCAL AGRICULTURAL PRODUCTS	WEST SACRAMENTO	2.77	.00	.00
CAD980694459	UNOCAL GEOTHERMAL, SALTON SEA, CALI	CALIPATRIA	2.10	.00	.00
CAD983654419	UPPER RESERVATION (GAFFEY) LAAFB	SAN PEDRO	4.94	.00	.00
CAD068859594	UPRIGHT INC.	SELMA	8.61	.00	.00
CA6690390418	US COAST GUARD	SAN FRANCISCO	4.19	.00	.00
CA9690308730	USCG SUPPORT CENTER SAN PEDRO	SAN PEDRO	2.79	.00	.00
CAD067658864	VALENTEC INTERNATIONAL CORPORATION	COSTA MESA	5.40	.00	.00
CAD072940307	VALLEY PRESBYTERIAN HOSPITAL	VAN NUYS	8.87	.00	.00
CAD009448382	VARIAN ASSOCIATES, WALNUT CREEK	WALNUT CREEK	4.18	.00	.00
CAD982493587	VENTRITEX	SUNNYVALE	8.68	.00	.00
CAD050515022	VERBATIM CORPORATION	SUNNYVALE	5.45	.00	.00
CAD009178815	WATKINS-JOHNSON COMPANY, SCOTTS VAL	SCOTTS VALLEY	10.80	.00	.00
CAD983665944	WATSON LABORATORIES, BUILDING 4	CORONA	11.27	.00	.00
CAT000614495	WATSON TERMINAL	CARSON	3.78	.00	.00
CAD009608894	WEBER AIRCRAFT, INC.	FULLERTON	9.98	.00	.00
CAD041844002	WEST COUNTY LANDFILL, INC.	RICHMOND	7.90	.00	.00
CAD981383904	WESTERN DIGITAL SANTA CLARA	SANTA CLARA	8.30	.00	.00
CAD983654401	WHITES POINT, LOS ANGELES AIR FORCE	SAN PEDRO	5.70	.00	.00

Note: Please refer to the introduction for an explanation of this list.

CALIFORNIA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
CAD028210920	WILBUR-ELLIS COMPANY	FRESNI	11.06	.00	.00
CAD981450737	WILLOWS SERVICE CENTER	WILLOWS	2.98	.00	.00
CAD981369739	WINDOWMASTER PRODUCTS	EL CAJON	9.27	.00	.00
CAD981373137	WOODLAND SERVICE CENTER	WOODLAND	1.83	.00	.00
CAD982401622	WOODS EQUIPMENT CO.	LA MIRADA	3.09	.00	.00
CAD983570284	WYLE LABORATORIES / ELECTRONIC ENCL	EL SEGUNDO	11.42	.00	.00
CAD983650169	XEROX COLORGRAFX SYSTEMS	SAN JOSE	11.63	.00	.00
CAD983630781	YOSEMITE CONCESSION SERVICES CORP.	YOSEMITE	9.22	.00	.00
CAD981401151	3M SURGICAL PRODUCTS	IRVINE	4.38	.00	.00
CAD983673823	90478 CHEVRON STATION	OJAI	2.03	.00	.00
CAD981439714	91556 CHEVRON STATION	NORWALK	4.94	.00	.00

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CALIFORNIA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO CANNOT BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- LESS THAN 1.1 TONS RCRA HAZARDOUS WASTE, AND
- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
CAD981463615	ARCO CALIFORNIA	LONG BEACH	.00	.00	.00
CAD008233462	BUCK KNIVES, INC.	EL CAJON	.70	.00	.00
CAD008372336	CAL-STYLE FURNITURE MFG. CO	COMPTON	.69	.00	.00
CA0000928523	CALABASAS LANDFILL	AGOURA	.00	.00	.00
CAD078140068	CANON BUSINESS MACHINES INC	COSTA MESA	1.05	.00	.00
CAD980884183	CHEMICAL WASTE MANAGEMENT INC	RANCHO CORDOVA	.00	.00	.00
CAD981381437	CORPORATION YARD	HUNTINGTON BEAC	1.05	.00	.00
CAD020161642	DETREX CORP	LOS ANGELES	.00	.00	.00
CAD983659327	ETIWANDA POWER PLANT FACI	RANCHO CUCAMONG	.20	.00	.00
CAD982444481	FILTER RECYCLING SERVICES, INC.	RIALTO	.50	.00	.00
CA0000002337	FLEET NUMERICAL OCEANOGRAPHY CENTER	MONTEREY	.01	.00	.00
CAD982053084	FLEX-O-LITE, INC.	LA MIRADA	.85	.00	.00
CAD981451024	GREAT WESTERN CHEMICAL CO.	SAN DIEGO	.00	.00	.00
CAD982474975	HINDS PUMPING PLANT	DESERT CENTER	.61	.00	.00
CAD981388408	HOAG HOSPITOL	NEWPORT BEACH	.71	.00	.00
CA0001019694	HUNTER'S POINT SHIPYARD SAN FRANCIS	SAN FRANCISCO	.00	.00	.00
CA6170090421	HUNTER'S POINT SHIPYARD SAN FRANCIS	SAN FRANCISCO	.00	.00	.00
CAD001216548	JOSLYN JENNINGS CORP	SAN JOSE	.00	.00	.00
CAD000184804	LOCKHEED CORP CATS	VAN NUYS	.65	.00	.00
CAR000002667	MARINE POLLUTION STUDIES LAB	MONTEREY	.26	1.00	.00
CAD063237341	NAPP SYSTEMS, INC.	SAN MARCOS	.50	.00	.00
CAD981422017	OLYMPIC PCB STORAGE FACILITY	LOS ANGELES	.00	.00	.00
CAD981390479	PACIFIC OFFSHORE PIPELINE COMPANY	GOLETA	.28	.00	.00
CAT000625137	PICO RIVERA STORAGE FACILITY	PICO RIVERA	.00	.00	.00
CAD983570938	PUENTE HILLS LANDFILL	WHITTIER	.00	.00	.00
CA1800090010	ROCKWELL INTL ROCKETDYNE SSFL NASA	SIMI HILLS	.00	.00	.00
CA3890090001	ROCKWELL ROCKETDYNE SSFL RMHF	SIMI HILLS	.39	.00	.00
CAD066113465	SAFETY KLEEN	FRESNO	.16	.00	.00
CAT000613950	SAFETY KLEEN	RANCHO CORDOVA	.04	.00	.00
CAT000613976	SAFETY KLEEN	SANTA ANA	.00	.00	.00
CAD053044053	SAFETY KLEEN CORP	OAKLAND	.21	.00	.00
CAT000613893	SAFETY KLEEN CORP	EL MONTE	.00	.00	.00
CAT000613935	SAFETY KLEEN CORP	LOS ANGELES	.00	.00	.00
CAT000613943	SAFETY KLEEN CORP	ROHNERT PARK	.24	.00	.00
CAT000613968	SAFETY KLENN	SALIDA	.00	.00	.00
CAD080916968	SAFETY-KLEEN CORP	SAN DIEGO	.00	.00	.00
CAD981374077	SAFETY-KLEEN CORP.	SANTA BARBARA	.04	.00	.00
CA0000927426	SCHOLL CANYON LANDFILL	GLENDALE	.00	.00	.00
CAT000625111	SFPP, L.P.	ORANGE	1.06	.00	.00
CAD981425473	SOTO STREET	LOS ANGELES	1.04	.00	.00
CAD000630905	SOUTHERN CALIFORNIA EDISON	DAGGETT	.59	.00	.00
CAD020153912	SOUTHERN CALIFORNIA EDISON	MONROVIA	.02	.00	.00
CAD980694392	SOUTHERN CALIFORNIA EDISON	COMPTON	.75	.00	.00
CAD980881775	SOUTHERN CALIFORNIA EDISON	MONTEREY PARK	.69	.00	.00
CAD981681240	SOUTHERN CALIFORNIA EDISON	FULLERTON	.00	.00	.00
CAD981681257	SOUTHERN CALIFORNIA EDISON	BARSTOW	.23	.00	.00
CAD981681422	SOUTHERN CALIFORNIA EDISON	LONG BEACH	.04	.00	.00
CAD981681430	SOUTHERN CALIFORNIA EDISON	LONG BEACH	.27	.00	.00
CAD981681489	SOUTHERN CALIFORNIA EDISON	LOS ANGELES	.91	.00	.00
CAD981681497	SOUTHERN CALIFORNIA EDISON	REDLANDS	.83	.00	.00
CAD981681547	SOUTHERN CALIFORNIA EDISON	ROMOLAND	.09	.00	.00
CAD981681612	SOUTHERN CALIFORNIA EDISON	SAN DIMAS	.45	.00	.00
CAD981681661	SOUTHERN CALIFORNIA EDISON	TULARE	.14	.00	.00
CAD981681679	SOUTHERN CALIFORNIA EDISON	GOLETA	.25	.00	.00
CAD981681737	SOUTHERN CALIFORNIA EDISON	THOUSAND OAKS	.31	.00	.00

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CALIFORNIA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO CANNOT BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- LESS THAN 1.1 TONS RCRA HAZARDOUS WASTE, AND
- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
CAD981681786	SOUTHERN CALIFORNIA EDISON	TORRANCE	.80	.00	.00
CAD981681794	SOUTHERN CALIFORNIA EDISON	SANTA CLARITA	.04	.00	.00
CAD981681851	SOUTHERN CALIFORNIA EDISON	WOFFORD HEIGHTS	.52	.00	.00
CAD981681901	SOUTHERN CALIFORNIA EDISON	WESTMINSTER	.01	.00	.00
CAD981694367	SOUTHERN CALIFORNIA EDISON	CHINO	.45	.00	.00
CAD981694698	SOUTHERN CALIFORNIA EDISON	HESPERIA	.95	.00	.00
CAD981975097	SOUTHERN CALIFORNIA EDISON	VICTORVILLE	.91	.00	.00
CAD982027237	SOUTHERN CALIFORNIA EDISON	IRVINE	.81	.00	.00
CAD983615667	SOUTHERN CALIFORNIA EDISON	SANTA CLARITA	.20	.00	.00
CA0000138339	SOUTHERN CALIFORNIA EDISON	ROSEMEAD	.61	.00	.00
CA0000149245	SOUTHERN CALIFORNIA EDISON	SANTA ANA	.98	.00	.00
CA0000235689	SOUTHERN CALIFORNIA EDISON	SANTA FE SPRING	.00	.00	.00
CA0000552067	SOUTHERN CALIFORNIA EDISON	COMPTON	.00	.00	.00
CA0000562140	SOUTHERN CALIFORNIA EDISON	SANTA MONICA	.07	.00	.00
CA0000562165	SOUTHERN CALIFORNIA EDISON	CATHEDRAL CITY	1.06	.00	.00
CA0000562215	SOUTHERN CALIFORNIA EDISON	VENTURA	.88	.00	.00
CAD000607705	SPADRA LANDFILL	WALNUT	.00	.00	.00
CAD048752117	SPARKLETTS DRINKING WATER	SAN DIEGO	.27	.00	.00
CAD077233658	ST & I INC.	PARAMOUNT	.00	.00	.00
CAD089176606	THE GLIDDEN COMPANY	SAN FRANCISCO	.73	.00	.00
CAD068856491	THE VENDO COMPANY	FRESNO	.93	.00	.00
CAD983629866	TRUS JOIST MACMILLAN	CHINO	.20	.00	.00
CAD981397649	UNIVERSITY OF CALIFORNIA, SAN FRANC	SAN FRANCISCO	1.06	.00	.00
CAD000633255	UNOCAL/76 PRODUCTS CO.	LOS ANGELES	.40	.00	.00
CAD047856505	WITCO CORPORATION KENDALL DIVISION	RICHMOND	.72	.00	.00

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COLORADO

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
COD059256651	A T & T CORP	WESTMINSTER	39.08	.00	.00
COD983801564	AMGEN INC	BOULDER	19.91	2.00	.00
COD983777731	AMI INDUSTRIES, INC.	COLORADO SPRING	15.43	.00	.00
COD081474710	ATMEL CORPORATION	COLORADO SPRING	1,735.47	.00	.00
COD980635841	AXELSON INC/DBA DRESSER OIL TOOLS	COLORADO SPRING	104.77	.00	.00
COD982647570	BALL AEROSPACE AND COMMUNICATIONS	WESTMINSTER	8.13	395.00	.00
COD085270270	BALL AEROSPACE AND TECHNOLOGIES COR	BOULDER	32.78	.00	.00
COD000694869	BOULDER SCIENTIFIC COMPANY	MEAD	1,519.56	.00	.00
COD007063290	BOYLES GALVANIZING COMPANY	COMMERCE CITY	314.59	.00	.00
COD007073901	CAI TECHNOLOGIES	DENVER	24.01	.00	.00
CO0000024828	CDOT CONST PROJ #NHDA025-2(255)	DENVER	48.04	.00	.00
COD980952097	CDOT TRANSPORTATION HQ	DENVER	4,108.81	.00	.00
COD105694947	CENTRAL PRODUCTS COMPANY	BRIGHTON	20.61	.00	.00
COD007057961	CF&I STEEL LP PUEBLO PLANT	PUEBLO	14,262.38	.00	.00
COD076459601	CHASE TERMINAL COMPANY	AURORA	225.80	.00	.00
COD078362837	CHEMICAL & METAL INDUSTRIES	DENVER	49.56	.00	.00
CO7571590036	CHEYENNE MOUNTAIN AIR STATION	CHEYENNE MTN AI	17.07	.00	.00
COD983799677	CHRONOPOL/GOLDEN TECHNOLOGIES	GOLDEN	33.15	.00	.00
COD022664429	CIRCUIT IMAGES CO	BOULDER	29.42	.00	.00
COD073407421	CLIMAX MOLYBDENUM COMPANY	CLIMAX	46.39	120.00	.00
COD000716555	COBE LABORATORIES INC	ARVADA	15.53	.00	.00
COD007069057	COLORADO PAINT COMPANY	DENVER	19.04	.00	.00
COD000109975	COLORADO REFINING CO (FORMERLY ASA	COMMERCE CITY	18,334.14	.00	.00
COD069712792	COLORADO STATE UNIVERSITY (STORAGE)	FORT COLLINS	27.00	121.00	.00
COD060627189	CONOCO INC.	COMMERCE CITY	133.99	.00	.00
COD054929989	COORS BREWING CO GOLDEN	GOLDEN	14.21	.00	.00
COD000818179	COORS CERAMICS ELECTRONICS DIV	GOLDEN	28.68	50.00	.00
COD983770561	CORTECH INC	DENVER	28.93	.00	.00
COD000855064	DANA CORP - COLO PISTON PLANT	PUEBLO	15.49	.00	.00
COD007058035	DENVER METAL FINISHING	DENVER	53.18	.00	.00
COD031970510	DENVER RADIATOR & SHUTTER SER	DENVER	27.30	.00	.00
COD000695007	DENVER-ARAPAHOE CHEM WASTE PROCESS	AURORA	16.44	.00	.00
COD048126726	EAGLE PICHER INDUSTRIES INC	COLORADO SPRING	121.03	.00	.00
COD075754663	ENSIGN-BICKFORD COMPANY	LOUVIERS	22.36	.00	.00
CO2210020150	FORT CARSON HEADQUARTERS	FORT CARSON	101.76	4,442.00	.00
COD007061617	GATES RUBBER COMPANY THE	DENVER	25.71	.00	.00
COD062753702	GENERAL ELECTRIC COMPANY	DENVER	237.90	.00	.00
COD005387188	GENEVA PHARMACEUTICAL INC	BROOMFIELD	44.88	1.30	.00
COD102545621	GOLDEN ALUMINUM CO	FORT LUPTON	21.50	.00	.00
COD983802877	GOLDEN PHOTON/GOLDEN TECHNOLOGIES	GOLDEN	14.66	.00	.00
COD076445303	GRAPHIC PACKAGING CORPORATION	BOULDER	126.45	.00	.00
COD007060577	GREAT WESTERN INORGANICS	ARVADA	17.11	.00	.00
COD005286679	HACH COMPANY	LOVELAND	36.11	195.00	.00
COD982599318	HAUSER CHEMICAL RESEARCH	BOULDER	73.70	.22	.00
COD983777541	HAUSER CHEMICAL RESEARCH	BOULDER	353.57	.00	.00
CO0000059758	HAUSER CHEMICAL RESEARCH INC.	LONGMONT	64.17	.00	.00
COD048742175	HAZEN RESEARCH INC	GOLDEN	3.30	36.00	.00
COD041099086	HEWLETT-PACKARD	COLORADO SPRING	20.22	.00	.00
COD080395007	HEWLETT-PACKARD (FT COLLINS)	FORT COLLINS	41.97	.00	.00
COD056562085	HEWLETT-PACKARD (LOVELAND)	LOVELAND	730.08	.00	.00
COD991300484	HIGHWAY 36 LAND DEVELOPMENT CORP	DEER TRAIL	64,421.75	89,554,295.00	.00
COD981543804	K B P COIL COATERS INC	DENVER	70.06	.00	.00
COD078341658	KODAK COLORADO DIVISION	WINDSOR	413.12	469,240.00	.00
COD007077175	KOPPERS (BEAZER EAST INC)	DENVER	50.75	.00	.00
COD983775123	LEXMARK INTERNATIONAL INC	BOULDER	239.02	.00	.00

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COLORADO

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
COD001704790	LOCKHEED MARTIN CORPORATION-ASTRONA	WATERTON	170.12	229.00	179.00
COD980953723	LOWRY GROUND WATER TREATMENT FACILI	AURORA	17.50	.00	.00
COR000002816	MERIX CORP - LOVELAND OPERATION	LOVELAND	145.24	.00	.00
COD078353901	MICROSEMI CORP COLORADO	BROOMFIELD	56.89	.00	.00
COD056562713	MOBILE TOOL INTERNATIONAL INC	WESTMINSTER	20.65	.00	.00
COD097147987	NTI - DIVISION OF COLO SPRNGS CIRCU	COLORADO SPRING	607.64	.00	.00
COD005127279	OEA INC	AURORA	102.86	163.00	.00
COD062746623	OPTIMA BATTERIES INC	DENVER	30.73	.00	.00
COD000706853	PHILLIPS PIPE LINE COMPANY	LA JUNTA	1,316.62	.00	.00
COT000644153	PHILLIPS PIPE LINE COMPANY-DENVER T	COMMERCE CITY	182.79	.00	.00
COD041094285	PLATTE CHEMICAL CO	GREELEY	8.55	17,103.00	.00
COD007060999	POWER ENGINEERING COMPANY	DENVER	42.94	.00	.00
COD983799974	PRICE CLUB #440	WESTMINSTER	14.98	.00	.00
COD000694810	PSCO FORT ST VRAIN	PLATTEVILLE	13.79	.00	.00
COD983798513	PUBLIC SERVICE CO OF COLO	DENVER	396.45	.00	.00
CO8213820725	PUEBLO DEPOT ACTIVITY	PUEBLO	623.55	16.00	.00
COD981540222	QUANTERRA ENVIRONMENTAL	ARVADA	23.29	.00	.00
COD983798703	QUANTUM PERIPHERALS COLORADO INC	LOUISVILLE	32.55	.00	.00
COD007068646	RAYTHEON AIRCRAFT COMPANY	BOULDER	102.31	.00	.00
COD982581837	RICON RESINS INC	GRAND JUNCTION	98.21	.00	.00
CO5210020769	ROCKY MOUNTAIN ARSENAL	COMMERCE CITY	18,871.51	35,701,194.00	.00
COD028459220	ROSEMONT PHARMACEUTICAL CORP	DENVER	12.78	6,618.80	.00
COD982586844	RTD - DISTRICT SHOPS MAINTENANCE	DENVER	36.95	.00	.00
COD058158775	SAE CIRCUITS COLO INC	BOULDER	123.77	.00	.00
COD007058167	SAMSONITE CORPORATION	DENVER	26.41	.00	.00
COD981549413	SAS CIRCUITS INC	LITTLETON	97.50	.00	.00
COD082657420	SCHLAGE LOCK COMPANY	SECURITY	135.74	.00	.00
CO0000855130	SHELDAHL INC MICRO PRODUCTS	LONGMONT	48.31	.00	.00
COD983790932	SOUTHERN PACIFIC RR	DENVER	46.89	.00	.00
COD981547797	ST CHARLES ACQUISITION LP	AURORA	66.05	.00	.00
COD051222065	STORAGE TECHNOLOGY CORPORATION	LOUISVILLE	34.80	.00	.00
COD007057995	SUNDSTRAND AEROSPACE	DENVER	219.46	.00	.00
COD097665558	SYMBOIS LOGIC INC	FORT COLLINS	28.78	.00	.00
COD980667059	SYMBOIS LOGIC INC	COLORADO SPRING	103.80	.00	.00
COD076470525	SYNTEX CHEMICALS INC	BOULDER	2,245.37	.00	.00
COD095158572	SYNTHES USA	MONUMENT	127.61	.00	.00
CO7890010526	U S DEPARTMENT OF ENERGY	GOLDEN	33,040.93	429.50	.00
COD098283740	UNICIRCUITS INC	ENGLEWOOD	16.42	.00	.00
COD981547771	UNITED PARCEL SERVICE	COMMERCE CITY	2.46	4,916.00	.00
COD041096314	UNIV OF COLO HEALTH SCIENCES CENTER	DENVER	19.50	77.00	.00
COD121409775	UNIVERSAL FOREST PRODDUCTS INC	WINDSOR	249.45	.00	.00
COD007431505	UNIVERSITY OF COLORADO	BOULDER	62.94	.00	.00
COD980718902	UNOCAL PARACHUTE CREEK SHALE OIL	PARACHUTE	348.50	.00	.00
CO1680090031	US EPA - NEIC	LAKEWOOD	1.61	333.00	.00
CO3141190014	US GEOLOGICAL SURVEY	ARVADA	222.38	.00	.00
CO8572924928	USAF ACADEMY	USAF ACADEMY	20.94	1,308.00	.00
COD177307311	VELIE CIRCUITS OF COLORADO INC	BROOMFIELD	142.47	.00	.00
COD040726978	WAGNER EQUIPMENT CO	AURORA	15.32	.00	.00
COD007092513	WESTERN FORGE CORPORATION	COLORADO SPRING	108.57	.00	.00
COD007061294	WILKERSON CORPORATION	ENGLEWOOD	30.66	.00	.00
COD007070055	WOODWARD GOVERNOR COMPANY	FORT COLLINS	65.05	.00	.00
COD007056252	WRIGHT & MCGILL CO	DENVER	106.33	.00	.00

Note: Please refer to the introduction for an explanation of this list.

COLORADO

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
COD007063530	ASARCO INCORPORATED GLOBE PLANT	DENVER	9.64	.00	.00
COD039115316	BAND-IT-INDEXING	DENVER	3.96	.00	.00
COR000003012	CHAFFEE COUNTY	SALIDA	6.81	.00	.00
COD000716563	COBE LABORATORIES INC	LAKEWOOD	5.94	.00	.00
COD006915466	CONTINENTAL AIRLINES	DENVER	5.51	.00	.00
CO0000127936	DIAMOND SHAMROCK	COLORADO SPRING	1.61	.00	.00
COD007060981	E I DUPONT DE NEMOURS & CO INC	LOUVIERS	4.50	.00	.00
CO0000479238	GREAT WESTERN CHEMICAL COMPANY	GOLDEN	1.35	.00	.00
COD041517343	HENDERSON MINE	EMPIRE	7.05	25.35	.00
COD007059439	IMI NORGREN	LITTLETON	12.97	.00	.00
COD001883164	INTERNATIONAL BUSINESS MACHINES COR	BOULDER	2.10	.00	.00
COR000001768	KN ENERGY INC	GLENWOOD SPRING	1.62	.00	.00
COD980954812	LORAL CORPORATION	PUEBLO	12.55	.00	.00
COD980962088	MAXCOR MFG INC	COLORADO SPRING	4.66	.00	.00
COD076448794	MOLYCORP INC-UNION OIL CO	LOUVIERS	.83	15.00	.00
COD983794132	NEXSTAR PHARMACEUTICALS INC	BOULDER	11.86	.00	.00
COR000004077	OPTIMA BATTERIES INC	AURORA	2.69	.00	.00
CO9571924191	PETERSON AIR FORCE BASE	PETERSON	8.35	.00	.00
COD983799966	PRICE CLUB #439	AURORA	12.62	.00	.00
CO0000103895	PRICE CLUB #443	LITTLETON	12.55	.00	.00
COR000000125	PUBLIC SERVICE CO - RIFLE GAS PLANT	RIFLE	1.50	.00	.00
COD133896134	PUBLIC SERVICE CO 7TH AVE SERVICE	DENVER	3.24	.00	.00
COD982591240	RAMTRON INT'L CORP	COLORADO SPRING	1.12	.00	.00
COD000716597	ROCKWELL SEMICONDUCTOR SYSTEMS INC	COLORADO SPRING	4.55	.00	.00
COD040716458	ROCKY MOUNTAIN BOTTLE COMPANY	WHEAT RIDGE	10.67	.00	.00
COD000716621	SAFETY-KLEEN CORP 0-007-41	ENGLEWOOD	12.85	.00	.00
COT090010851	SAFETY-KLEEN CORP. 605201	GRAND JUNCTION	1.16	.00	.00
COD000716639	SAFETY-KLEEN CORP. 605204	PUEBLO	2.33	.00	.00
COD152662086	SENECA MINE - SENECA COAL CO	HAYDEN	8.58	.00	.00
CO0000939751	SMITH ROAD JAIL SITE	DENVER	3.75	.00	.00
COD007084973	STERLING STAINLESS TUBE CORP	ENGLEWOOD	11.77	.00	.00
COD983799420	SUNDSTRAND AEROSPACE	DENVER	8.17	.00	.00
CO0000591669	SUPERMARKET INFORMATION SYSTEMS INC	AURORA	3.60	.00	.00
COD085150928	TRI-STATE GENERATION & TRANSMISSION	CRAIG	11.29	.00	.00
COD982581290	U S WEST BUSINESS RESOURCES MRC	DENVER	8.89	.00	.00
COD000971945	UNION PACIFIC RAILROAD	COMMERCE CITY	2.65	.00	.00
COD001028398	UNION PACIFIC RAILROAD	EADS	2.22	.00	.00
COD980716989	UNIVERSITY OF COLORADO - EAST CAMPU	BOULDER	3.86	.00	.00
COD982588485	W. R. GRACE CO	LITTLETON	2.69	.00	.00
COD032035792	WEAVER ELECTRIC	DENVER	6.25	.00	.00
COD981542756	WESTMINSTER - CITY OF, PUBLIC WORKS	WESTMINSTER	5.14	.00	.00

Note: Please refer to the introduction for an explanation of this list.

COLORADO

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO CANNOT BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- LESS THAN 1.1 TONS RCRA HAZARDOUS WASTE, AND
- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
COD980591184	CHEMICAL WASTE MANAGEMENT, INC.	HENDERSON	.00	.00	.00
COD000694893	CHEVRON PIPELINE CO	RANGELY	.20	.00	.00
COD983778366	COLORADO INDUSTRIAL RAIL CIR CO	STERLING	.00	.00	.00
CO2210020333	FITZSIMONS ARMY MEDICAL CENTER	AURORA	.02	.00	.00
COD177932241	JACKSONS AUTOMOTIVE	NORTHGLENN	.76	.00	.00
COD039146931	NEOPLAN USA CORP	LAMAR	.00	.00	.00
COD043801802	UNION OIL CO OF CALIFORNIA	DENVER	.00	.00	.00
CO7142390114	USBOR - LEADVILLE TREATMENT PLANT	LEADVILLE	.13	.00	.00

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CONNECTICUT

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
CTD001145317	ACCURATE FORGING CORP.	BRISTOL	308.49	.00	.00
CTD982200933	ACME PACKAGING	NEW BRITAIN	24.45	.00	.00
CTD983866781	AETNA	WINDSOR	21.38	.00	.00
CTD175748383	ALCAD INC	NORTH HAVEN	14.28	.00	.00
CTD080849797	ALINABAL INC.	MILFORD	38.77	.00	.00
CTD980916597	ALLIED SIGNAL AEROSPACE CO.	CHESHIRE	37.14	.00	.00
CTD001181502	ALLIEDSIGNAL AEROSPACE	STRATFORD	251.41	29.00	.00
CTD060668548	ALPHA PLATING & FINISHING CO	PLAINCVILE	64.38	.00	.00
CTD069263424	AMERADA HESS CORP.	GROTON	57.60	.00	.00
CTD005933551	AMERICAN SPRING WIRE CT., INC	FORESTVILLE	19.87	.00	.00
CTD981073364	AMPHENOL CORP. DAMBURY PLT	DANBURY	16.08	.00	.00
CTD144922382	AMPLEX CORP THE NORTON CO.	BLOOMFIELD	35.01	.00	.00
CTD001141233	ANCHOR GLASS CONTAINER CORP	DAYVILLE	72.95	.00	.00
CTD983876749	ANOCOIL COPRP.	ENFIELD	32.43	.00	.00
CTD060005766	ANSONIA COPPER & BRASS, INC.	ANSONIA	147.97	.00	.00
CTD981889538	ARMOLOY OF CT, INC	BRISTOL	153.27	.00	.00
CTD001161181	ATLANTIC WIRE CO.	BRANFORD	4,069.20	.00	.00
CTD064832611	AUTO SWAGE PRODUCTS INC	SHELTON	69.68	100.00	.00
CTD001162304	AUTOMATIC PLATING OF BRIDGEPORT, IN	BRIDGEPORT	360.01	.00	.00
CTD001147438	B F GOODRICH AEROPSACE I P S DIV	MIDDLETOWN	9.50	810.00	.00
CTD980906804	B S T SYSTEMS INC	PLAINFIELD	52.96	1.00	.00
CTD001163732	BARDEN CORP THE	DANBURY	52.46	.00	.00
CTD001145671	BASS PLATING CO THE	BLOOMFIELD	91.25	.00	.00
CTD001183300	BASSETT W E CO INC THE	DERBY	211.80	.00	.00
CTD002592020	BEAVER BROOK CIRCUITS, INC.	BETHEL	219.38	.00	.00
CTD064828726	BEDOUKIAN RESEARCH INC	DANBURY	109.90	.00	.00
CTD001166586	BIC CORP	MILFORD	203.93	.00	.00
CTD052544624	BICC BRAND-REX COMPANY	WILLIMANTIC	38.41	.00	.00
CTD001144062	BIRKEN MANUFACTURING CO	BLOOMFIELD	16.43	.00	.00
CTD097730709	BOEHRINGER INGELHEIM PHARM INC	RIDGEFIELD	63.00	99.00	.00
CTD991288788	BONDED TECH INC	CROMWELL,	405.35	.00	.00
CTD001179316	BOVANO IND INC	CHESHIRE	48.27	.00	.00
CTD060008307	BRASS CENTER LTD.	WATERBURY	739.87	335.00	.00
CTD001180728	BRIDGEPORT FITTINGS INC	STRATFORD	14,045.53	.00	.00
CTD072134927	BRIDGEPORT MACHINES INC	BRIDGEPORT	112.70	.00	.00
CTD001181478	BRIDGEPORT METAL GOODS	BRIDGEPORT	36.81	.00	.00
CTD981212814	BRISTOL MYERS SQUIBB PRI	WALLINGFORD	57.13	19.00	.00
CTD001980911	BRUNSWICK GOLF BRUNSWICK CORP.	TORRINGTON	187.77	.00	.00
CTD055103402	BYK CHEMIE U S A	WALLINGFORD	75.03	.00	.00
CTD061749644	CAMETOID TECH INC	MANCHESTER	26.09	.00	.00
CTD983871898	CARTEN CONTROLS INC	MIDDLEBURY	932.73	.00	.00
CTD010137511	CASCO PRODUCTS CORP	BRIDGEPORT	56.08	.00	.00
CTD004944625	CHAMBERS M S & SONS INC	BALTIC	501.75	.00	.00
CTD058507740	CHANDLER EVANS CONTROL SYSTEMS DIV.	WEST HARTFORD	407.08	.00	.00
CTD001181932	CHROMIUM PROCESS CO INC	SHELTON	55.82	.00	.00
CTD095536181	CIBA GEIGY CORP	FARMINGTON	6.62	30.00	.00
CTD001183763	CIRCUIT-WISE, INC.	NORTH HAVEN	2,253.72	.00	.00
CTD983870460	CITGO PETROLEUM CORP	ROCKY HILL	40.73	.00	.00
CTD000604488	CLEAN HARBORS OF CONNECTICUT, INC	BRISTOL	5,746.20	9,061,216.90	.00
CT5000001735	COATING SCIENCES INC	WINDSOR	78.50	.00	.00
CTD000844258	COLTS M F G CO INC	WEST HARTFORD	44.64	.00	.00
CTD004533485	CONARL CORP THE	GLASTONBURY	137.92	.00	.00
CTD052541695	CORBIN RUSSWIN, INC.	BERLIN	110.44	.00	.00
CTR000002618	COSCO WHOLESALE 312	MILFORD	19.27	.00	.00
CT5000000000	COSTCO WHOLESALE # 304	BROOKFIELD	42.49	.00	.00

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CONNECTICUT

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GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
CTD134204916	COYNE TEXTILE SERVICES INC	WATERBURY	610.30	.00	.00
CT0572826873	CT AIR NATIONAL GUARD BRADLEY BASE	EAST GRANBY	23.00	.00	.00
CTD980522940	CT CORRECTIONAL IND	SOMERS	6.58	55.00	.00
CTD046233003	CT GALVANIZING CORP	GLASTONBURY	595.30	.00	.00
CTD980668198	CT MILITARY DEPT CT AVERD	GROTON	134.80	.00	.00
CTD001143007	CT SPRING STAMPING CORP	FARMINGTON	29.99	.00	.00
CTD045104858	CUNO, INC.	MERIDEN	30.06	260.02	.00
CTD065536062	CUNO, INC.	TALCOTTVILLE	15.22	.00	.00
CTD983871690	CURTIS PACKAGING CORP.	NEWTON	46.77	.00	.00
CTD097226377	CUSTOM DESIGN SERVICE INC	DANBURY	36.73	.00	.00
CTD059831107	CUSTOM METAL CRAFTERS	NEWINGTON	170.83	.00	.00
CTD001173467	CYTEC IND INC WALLINFORD	WALLINGFORD	1,415.43	400.00	.00
CTD001864024	CYTEC INDUSTRIES INC	STAMFORD	693.06	.00	.00
CTD046238630	DELTA RUBBER CO. THE	DANIELSON	51.29	.00	.00
CTD041204611	DEVON PRESITION IND, INC.	WOLCOTT	31.82	.00	.00
CTD983871914	DEXTER NONWOVENS DIV. MAIN PLT	WINDSOR LOCKS	15.41	.00	.00
CTD001450006	DONHAM CRAFIC, INC	NAUGATUCK	111.37	.00	.00
CTD001159730	DOW CHEMICAL CO. ALLYS POINT PLT	GALES FERRY	1,179.65	.00	.00
CTD057794984	DOW UNIDED TECHNOLOGIES COMPOSSTE P	WALLINGFORD	19.17	.00	.00
CTD001452572	DRAWN METAL TUBE CO.	THOMASTON	18.34	.00	.00
CTD001840974	DRESSER IND IDUSTRIAL INSTRUMENT	STRATFORD	250.94	.00	.00
CTD001184324	DUPONT PHOTOMASKS, INC.	DANBURY	21.24	.00	.00
CTD001452077	DURHAM MFG CO.	DURHAM	1,067.94	.00	.00
CTD024539967	EASCO ALUMINUM	BERLIN	339.42	.00	.00
CTD103961298	ELCO INDUSTRIES	BRISTOL	273.30	.00	.00
CTD001147842	ELECTRIC BOAT CORPORATION	GROTON	328.98	128.00	.00
CTD018668269	ELECTRIC BOAT CORPORATION	GROTON	113.27	.00	.00
CTD001148527	ELECTRO FLEX HEAT INC	BLOOMFIELD	25.49	.00	.00
CTD018811455	ELECTROCAL INC	SOUTH WINDSOR	53.24	.00	.00
CTD001169010	ENTHONE-OMI INC	WEST HAVEN	6,448.24	.00	.00
CTD983884164	ENTHONE-OMI INC	WEST HAVEN	32.22	.00	.00
CTD072138969	ENVIRONMENTAL WASTE RESOURCES	WATERBURY	8,525.15	14,183.54	.00
CTD001171628	EYELEMATIC MFG	WATERTOWN	18.14	.00	.00
CTD980912026	FAIRPRENE INDUSTRIES PROD CO	FAIRFIELD	28.62	.00	.00
CTD981895931	FARREL CORP.	ANSONIA	24.60	.00	.00
CTD043029644	FENN MFG CO	NEWINGTON	33.20	.00	.00
CTD980673057	FIBERCOTE IND INC	WATERBURY	83.42	.00	.00
CTD980670608	FLEXCON CO INC	NORTH BRANFORD	42.98	.00	.00
CTD001152545	FORESTVILLE IND PLATING CO INC	SOUTHINGTON	161.74	.00	.00
CTD983884206	FORESTVILLE MACHINE CO INC	FORESTVILLE	15.54	.00	.00
CTD983870924	FRABRICATED METAL PRODUCTS INC	NAUGATUCK	466.96	.00	.00
CTD001170703	FURON NEW HAVEN FACILITY	NEW HAVEN	75.52	.00	.00
CTD095233433	G & O MFG. CO.	NEW HAVEN	15.06	.00	.00
CTD058516733	GAS TURBINE CORP	EAST GRANBY	30.01	.00	.00
CTD000842500	GENERAL ELECTRIC CO DED N PLNT.	PLAINVILLE	95.01	.00	.00
CTD018625632	GENERAL MOTORS CORP.	BRISTOL	3.22	117.85	.00
CTD001185164	GIERING METAL FINISHING INC	HAMDEN	23.36	.00	.00
CTD004531919	GUARDSMAN PRODUCTS INC	ROCKY HILL	141.38	.00	.00
CTD057794034	H.B.IVES A DIVISION OF HARROW PRODU	NEW HAVEN	212.87	.00	.00
CTD001863968	H.O. PENN MACHINERY CO, INC	NEWINGTON	13.71	.00	.00
CTD983866955	HAMILTON STANDARD	EAST WINDSOR	91.44	361.00	.00
CTD001145341	HAMILTON STANDARD DIV OF UTC	WINDSOR LOCKS	367.79	.00	.00
CTD075133835	HAMPFORD RESEARCH, INC.	STRATFORD	799.36	.00	.00
CTD018656819	HANDY & HARMAN - FAIRFIELD	FAIRFIELD	17.83	25.00	.00
CTD001139096	HAR CONN CHROME CO THE	WEST HARTFORD	49.93	.00	.00

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CONNECTICUT

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
CTD001451392	HEMINWAY & BARTLETT MFG CO THE	WATERTOWN	41.22	.00	.00
CTD001170331	HICKS & OTIS PRINTS INC	NORWALK	41.35	.00	.00
CTD075406579	HOSPITAL OF ST RAPHAEL INC	NEW HAVEN	3.27	97.16	.00
CTD980668487	HOWMET TURBINE COMPONENTS CORP	WINSTED	29.25	.00	.00
CTD055310759	HUBBARD HALL INC	WATERBURY	63.68	.00	.00
CTD067068759	HUBBELL HARVEY INC WIRING DEVICE DI	BRIDGEPORT	72.28	.00	.00
CTD001173392	HUMPHREY CHEMICAL CO INC.	NORTH HAVEN	60.04	.00	.00
CTD001168137	IDEAL MFG.	BEACON FALLS	98,768.17	.00	.00
CTD980909899	IEA, INC	MONROE	38.16	.00	.00
CTD059831479	INCO ENGINEERED PRODUCTS INC	FARMINGTON	101.45	.00	.00
CTD001163237	INCO ENGINEERED PRODUCTS INC IVORY	IVORYTON	137.82	.00	.00
CTD041054602	INSULATING MATERIALS INCORPORATED	NEW HAVEN	31.18	.00	.00
CTD099762015	INTERMAGNETICS GENERAL CORP.	WATERBURY	26.51	.00	.00
CTD083343269	ISELI CO.	TERRYVILLE	60.57	.00	.00
CTD001604420	ITT CANNON RF PRDUCTS	NEW BRITAIN	81.99	.00	.00
CTD001139047	JACOBS VEHICLE EQUIPMENT CO.	BLOOMFIELD	35.74	.00	.00
CTD001155225	KAMAN AEROSPACE CORP.	BLOOMFIELD	69.56	.00	.00
CTD065529158	KAMAN AEROSPACE CORP.	MOOSUP	224.11	.00	.00
CTD052536141	KAMAN AEROSPACE-REO	MIDDLETOWN	8.78	75.00	.00
CTD062204573	KAMATICS CORP.	BLOOMFIELD	15.36	.00	.00
CTD001449602	KANTHAL CORP.	BETHEL	294.33	.00	.00
CTD982756314	KARO MANUFACTURING, INC.	NAUGATUCK	51.70	.00	.00
CTD001164888	KEELER & LONG, INC.	WATERTOWN	66.71	.00	.00
CTD001155159	KEENEY MFG CO. THE	NEWINGTON	294.01	.00	.00
CTD042279513	KING INDUSTRIES, INC.	NORWALK	702.08	5.00	.00
CTD983895608	LAMBERT KAY	WINSTED	24.61	.00	.00
CTD001162395	LEE CO THE	WESTBROOK	20.98	.00	.00
CTD001162460	LIGHT METALS COLORING CO INC	SOUTHINGTON	41,760.49	.00	.00
CTD001139617	LOCTITE CORP	NEWINGTON	40.12	.00	.00
CTD004534657	LOOS & CO INC	POMFRET	74.77	.00	.00
CTD983896317	LOUIS DREYFUS ENERGY	NORWICH	58.71	.00	.00
CTD052538733	M Q S INSPECTION INC	HARTFORD	62.42	.00	.00
CTD001164599	MACDERMID INC	WATERBURY	226.57	.00	.00
CTD001175181	MAGNETEK UNIVERSAL	BRIDGEPORT	51.74	.00	.00
CTD982715526	MAHALE INC CYLINDER DIVISION	BRIDGEPORT	176.78	.00	.00
CTD063389225	MARJAN INC	WATERBIRY	14.89	.00	.00
CTD053705810	MARVEL SCREW MACHINE PRODUCTS	WATERBURY	19.42	.00	.00
CTD052541224	MATLACK INC	NORWICH	16.60	.00	.00
CTD001154558	METAL FINISHING TECHNOLOGIES, INC.	FORESTVILLE	296.83	260.00	.00
CTD001183052	METROPOLITAN METAL FINISHING CO	HAMDEN	17,060.93	16,146,955.80	.00
CTD054476973	MICROTECH INC	CHESHIRE	37.78	.00	.00
CTD001147974	MILLER CO THE	MERIDEN	193.82	.00	.00
CTD000845198	MILLSTONE NUCLEAR POWER STATION	WATERFORD	24.29	.00	.00
CTD001166263	MIRROR POLISHING & PLATING INC	WATERBURY	219.82	.00	.00
CTD001180686	MOORE TOOL CO INC	BRIDGEPORT	14.72	.00	.00
CTD001162809	MORTON INTERNATIONAL	STAMFORD	649.74	.00	.00
CTD001454701	MOSSBERG O F & SONS INC	NORTH HAVEN	26.42	.00	.00
CTD001150739	MOTT METALLURGICAL CORP	FARMINGTON	16.03	.00	.00
CTD001160811	NATIONAL CHROMIUM CO. INC.	PUTNAM	25.74	.00	.00
CTD001170257	NATL INTEGRATED	WATERBURY	56.58	.00	.00
CTD001147875	NAVAL PRODUCTS	UNCASVILLE	2,501.70	.00	.00
CTD075407031	NEW HAVEN TERMINAL	NEW HAVEN	442.21	.00	.00
CTD000652206	NORTH AMERICAN PRINTED CIRCUITS	STAFFORDVILLE	319.84	.00	.00
CTD001176486	NORTHEAST ELECTRONICS CORP.	MILFORD	79.13	.00	.00
CTD064827942	NORTHEAST PETROLEUM DIVISION OF CA	NEW HAVEN	55.47	.00	.00

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CONNECTICUT

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

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- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
CTD044121259	NORTHEAST STEEL & MACHINE PRODUCTS	FORESVILLE	23.22	.00	.00
CTD052543980	NORTHEAST UTILITIES BERLIN COMPLEX	BERLIN	629.41	.00	.00
CTD001156793	NUTMEG CHROME CORP.	WEST HARTFORD	43.50	.00	.00
CTD001145465	O.Z. GEDNEY	TERRYVILLE	142.08	.00	.00
CTD047551593	OCE-IMAGING SUPPLIES	GUILFORD	50.30	.00	.00
CTD980916779	OLIN CORP CHEM GRP RESEARCH CENTER	CHESHIRE	15.97	10.00	.00
CTD053704110	OLIN CORP SOMERS THIN STRIP BRASS	WATERBURY	61.36	.00	.00
CTD001451004	OLIN CORP.	NEW HAVEN	45.22	.00	.00
CTD060022944	OSRAM SYSVANIA INC.	WATERTOWN,	90.76	.00	.00
CTD052708641	OWENS BROCKWAY CLOSURE SPECIALTY	WATERBURY	102.42	.00	.00
CTD055513717	P M P CORP.	AVON	61.80	.00	.00
CTD001451863	PALLADIN PRECISION PRODUCTS	WATERBURY	24.05	.00	.00
CTD001152271	PAPE ELECTROPLATING CO. INC.	NEW BRITAIN	61.96	.00	.00
CTD064829021	PEASE METAL FABRICATING	MILFORD	31.33	.00	.00
CTR000002642	PEK ELECTRONICS, INC.	WEST HAVEN	770.67	.00	.00
CTD046422887	PERKIN ELMER	NORWALK	29.03	.00	.00
CTD981063431	PFALTZ BAUER, INC.	WATERBURY	38.19	94.20	.00
CTD001147495	PFIZER INC.	GROTON	38,957.73	4,280.00	.00
CTD061358792	PHILIPS TECH. AUTOMATIC ELECTRONIC	CHESHIRE	50.22	.00	.00
CT5000001107	PHOENIX ENVIRONMENTAL LAB INC.	MANCHESTER	14.77	675.00	.00
CTE001161793	PITNEY BOWES INC	STAMFORD	77.65	.00	.00
CTD001149459	PLAINVILLE ELECTRO PLATING COMPANY	PLAINVILLE	17.02	.00	.00
CTD041205949	PORCELEN LIMITED	HAMDEN	31.30	.00	.00
CTD000844407	PRATT & WHITNEY	ROCKY HILL	49.45	.00	.00
CTD001149277	PRATT & WHITNEY	SOUTHINGTON	168.64	.00	.00
CTD001449511	PRATT & WHITNEY	NORTH HAVEN	650.63	.00	.00
CTD003935905	PRATT & WHITNEY	MIDDLETOWN	156.68	.00	.00
CTD990672081	PRATT & WHITNEY	EAST HARTFORD	542.75	.00	.00
CTD983871831	PRATT & WHITNEY - ORC	CHESHIRE	59.89	.00	.00
CTD000844399	PRATT & WHITNEY AIRCRAFT	EAST HARTFORD	329.92	.00	.00
CTD000845131	PRATT AND WHITNEY WILLGOOS LABORATO	EAST HARTFORD	230.77	.00	.00
CTD001152750	QUALITY NAME PLATE INC	EAST GLASTONBUR	107.11	.00	.00
CTD001162122	R B C HEIM	FAIRFIELD	101.10	.00	.00
CTD085068047	RAYCO METAL FINISHING INC	MIDDLETOWN	28.11	.00	.00
CTD001454032	RELIABLE PLATING & POLISHING CO.	BRIDGEPORT	44.29	.00	.00
CTD001450287	REMINGTON PROD	BRIDGEPORT	57.58	.00	.00
CTD058862194	RISDON CORP	THOMASTON	100.61	.00	.00
CTD001168558	RISDON CORPORATION	DANBURY	115.99	100.00	.00
CTD095529954	ROCKBESTOS THE CO	EAST GRANBY	20.84	.00	.00
CTD001141167	ROGERS CORP.	ROGERS	42.73	.00	.00
CTD069247948	ROLLPRINT PACKAGING PRODUCTS INC.	BLOOMFIELD	25.30	.00	.00
CTD010174613	S T S KLOCK	MANCHESTER	90.96	.00	.00
CTD000845982	SAFETY-KLEEN CORP	WEST HARTFORD	167.00	.00	.00
CTD001153840	SANITARY DASH MFG CO INC	NORTH GROSVENOR	184.81	.00	.00
CTD056748205	SARGENT MFG COMPANY	NEW HAVEN	193.75	.00	.00
CTD001152180	SCHARR INDS INC	BLOOMFIELD	80.73	.00	.00
CTD058863507	SEABOARD METAL FINISHING	WEST HAVEN	96.04	.00	.00
CTD000635953	SIKORSKY AIRCRAFT CORP	STRATFORD	31.82	.00	.00
CTD000845255	SIKORSKY AIRCRAFT CORP	WEST HAVEN	16.68	.00	.00
CTD001449735	SIKORSKY AIRCRAFT CORP	BRIDGEPORT	211.46	.00	.00
CTD001449784	SIKORSKY AIRCRAFT CORP	STRATFORD	2,271.75	.00	.00
CTD980669352	SIKORSKY AIRCRAFT CORP	SHELTON	230.62	.00	.00
CTD982547168	SIKORSKY AIRCRAFT CORP	BRIDGEPORT	62.21	.00	.00
CTD001174580	SPECIFICATIONS PLATING INC	BRIDGEPORT	18.91	.00	.00
CTD001140862	SPIROL INTERNATIONAL	DAYVILLE	380.66	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
CTD001453216	SPORTING GOODS PROPERTIES INC	BRIDGEPORT	940.27	.00	.00
CTD001144237	STANADYNE AUTOMOTIVE CORP.	WINDSOR	97.83	.00	.00
CTD018631952	STANLEY BOSTITCH	CLINTON	6,079.82	.00	.00
CTD010170363	STANLEY HARDWARE	NEW BRITAIN	580.53	.00	.00
CTD983871260	STANLEY LABORATORY	NEW BRITAIN	10.33	1,530.00	.00
CTD983870577	STANLEY TOOLS	NEW BRITAIN	65.36	.00	.00
CTD002496909	SUMMIT CORP OF AMERICA	THOMASTON	1,089.84	1,050.00	.00
CTD001145267	SUPERIOR ELECTRIC CO THE	BRISTOL	48.72	.00	.00
CTD001166826	SUPERIOR PLATING CO	SOUTHPORT	146.81	.00	.00
CTD077311785	SUPREME LAKE MFG INC	PLANTSVILLE	18.35	.00	.00
CTD983896200	SWAN COLOR GRAPHIC	BRIDGEPORT	18.75	.00	.00
CTD001179688	SYNTHETIC PROD CO DIV OF COOKSON	STRATFORD	34.39	.00	.00
CTD000844365	SYNTHETIC PROD CO DIV OF PLASTIC	STRATFORD	332.84	.00	.00
CTD001144419	TECHNICAL COATINGS LAB	AVON	29.82	.00	.00
CTD053707741	TEKNICIRCUITS INC	DANBURY	51.61	.00	.00
CTD046232633	TEXACO/STAR ENRERPRISE SALE TERMINA	EAST HARTFORD	25.85	.00	.00
CT5000000521	THE ADVANCED PRODUCTS COMPANY	NORTH HAVEN	94.51	.00	.00
CTD001168533	THE UPJOHN COMPANY N.HAVEN OPERATIO	NORTH HAVEN	15.25	.00	.00
CTD039275722	TORRINGTON CO ABU	NEWINGTON	710.24	.00	.00
CTD001148717	TORRINGTON CO THE STAND ARD PLT	TORRINGTON	576.04	.00	.00
CTD000845156	TORRINGTON CO. THE BROAD ST.PLT	TORRINGTON	87.88	.00	.00
CTD004532990	TRIANGLE WIRE & CABLE INC	JEWETT CITY	97.03	.00	.00
CTD001451855	TUCK A J CO.	BROOKFIELD	48.19	.00	.00
CTD001140854	TURBINE ENGINE COMPONENTS/TEXTRON	NEWINGTON	95.49	576.00	.00
CTD001148758	TURNER & SEYMOUR MFG CO THE	TORRINGTON	69.93	.00	.00
CTD065521304	TYCO ENGINEERED SYSTEMS	MANCHESTER	154.38	50.00	.00
CTD043036995	TYCO/NORTH AMERICAN PRINTED CIRCUIT	STAFFORD	222.60	.00	.00
CTD037510377	U.S. CHROME CORP OF CT	STRATFORD	1,949.79	.00	.00
CTD983869918	U.S. REPEATING ARMS COMPANY	NEW HAVEN	61.63	.00	.00
CT5000000943	U.S. REPEATING ARMS COMPANY	NEW HAVEN	38.76	.00	.00
CTD063397285	ULBRICH WIRE INC	NORTH HAVEN	52.19	.00	.00
CTD000118612	UNIROYAL CHEMICAL CO INC	MIDDLEBURY	27.60	165.00	.00
CTD001449826	UNIROYAL CHEMICAL COMPANY, INC.	NAUGATUCK	1,495.85	60.00	.00
CTD043211747	UNITED ILLUMINATING STEEL POINT STA	BRIDGEPORT	23.21	.00	.00
CTD057044745	UNITED STATES SURGICAL CORP	NORTH HAVEN	42.77	.00	.00
CTD044680650	UNITED STATES SURGICAL CORP.	NORWALK	63.61	.00	.00
CTD095532131	UNITED TECHNOLOGIES RESEARCH CTR	EAST HARTFORD	6.90	52.00	.00
CTD983884305	UNIVERSITY OF CONNECTICUT	STORRS	67.98	1,119.00	.00
CTD072116387	URETEK INC	NEW HAVEN	31.83	.00	.00
CT6890113792	US ENERGY DEPT KNOLLS ATOMIC POWER	WINDSOR	9.48	894.00	.00
CT4170022020	US NAVAL SUBMARINE BASE	GROTON	1,335.25	346.97	.00
CTD001181205	VANDERBILT CHEMICAL CORP	BETHEL	1,185.76	.00	.00
CTD001141662	VARDNEY TECHNICAL PRODUCTS INC.	PAWCATUCK	118.00	254.00	.00
CTD001186212	VITRAMON, INCORPORATED	MONROE	1,717.61	.00	.00
CTD001164672	WALTEC AMERICAN FORGING INC	WATERBURY	65.47	.00	.00
CTD052704335	WARNER LAMBERT CO	MILFORD	13.66	.00	.00
CTD001165695	WATERBURY CO INC	WATERBURY	42.92	.00	.00
CTD001171719	WATERBURY PLATING CO	WATERBURY	140.67	.00	.00
CTD001164607	WATERBURY ROLLING MILLS INC	WATERBURY	33.02	.00	.00
CTD054873229	WEB TECHNOLOGIES INC,.	OAKVILLE	37.05	.00	.00
CTD001450154	WHYCO CHROMIUM CO INC	THOMASTON	1,952.76	.00	.00
CTD983875576	WILLINGTON NAMEPLATE, INC	STAFFORD SPRING	14.45	.00	.00
CTD983883901	WINCHESTER ELECTRONIS	WATERTOWN	50.46	.00	.00
CTD002590461	WYE WYND	JEWETT CITY	44.13	.00	.00
CTD001141829	WYMAN GORDAN INVESTMENT CASTINGS	GROTON	120.02	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
CTD043207562	YALE UNIVERSITY	NEW HAVEN	14.14	4,477.00	.00
CTD983902602	YALE UNIVERSITY	NEW HAVEN	47.01	179.00	.00

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CTD980910061	A A R ENGINE COMPONENT SERVICES	WINDSOR	2.98	.00	.00
CTD001141803	A G C INC	MERIDEN	9.43	.00	.00
CTD001180207	ACME UNITED CO	BRIDGEPORT	1.23	.00	.00
CTD983873001	AERO GEAR INC	WINDSOR	4.77	.00	.00
CTD065514606	ALGONQUIN GAS TRANSMISSION CO.	CROMWELL	7.46	.00	.00
CTD983895475	ALPINE POLYVISION, INC.	WALLINGFORD	1.33	.00	.00
CT9999999999	ALUMINUM CO OF AMERICA	NORTH HAVEN	7.53	.00	.00
CTD069862506	AMERICAN NATIONAL CAN CO.	DANBURY	8.33	.00	.00
CTD018800458	ANO COIL CORP.	ROCKVILLE	4.94	.00	.00
CTD981069438	ANO COIL CORP.	SOMERS	3.20	.00	.00
CTD983876764	B M I INC	THOMASTON	4.13	.00	.00
CTD000791772	B/E AEROSPACE, INC.	LITCHFIELD	3.02	.00	.00
CTD080848666	BATES SUSAN INC	CHESTER	2.78	.00	.00
CTD058515750	BATTISTON'S OF AVON INC	AVON	4.73	.00	.00
CTD983867151	BRISTOL BABCOCK INC	WATERTOWN	10.15	.00	.00
CTD981204472	C C L LABEL ANCO DIV	SHELTON	9.13	.00	.00
CTD045175726	CARBOLABS INC	BETHANY	8.94	.00	.00
CTD063392955	CASCO PRODUCTS CORP	BRIDGEPORT, CT	9.06	.00	.00
CTD001161538	CHROMALLOY CONNECTICUT	WALLINGFORD	12.53	.00	.00
CTD983873035	COLT REFINING INC	EAST HAVEN	11.92	.00	.00
CTD001159557	COMBUSTION ENGINEERING INC	WINDSOR	4.19	10.00	.00
CTD983876814	COMPONENT TECH INC	NEWINGTON	12.77	.00	.00
CTD980515290	CONNECTICUT TREATMENT CORP	BRISTOL	10.47	.00	.00
CT5000000513	CORNING CLINCAL LABORATORIES	WALLINGFORD	8.31	.00	.00
CTD001162114	CRAMER CORP CRAMER DIV	OLD SAYBROOK	6.37	.00	.00
CTD000845230	CT LIGHT & POWER MDLT STA	MIDDLETOWN	1.96	.00	.00
CTD001139294	CT NATURAL GAS CORP	HARTFORD	5.16	.00	.00
CTD981893159	CT NATURAL GAS CORP	ROCKY HILL	9.16	.00	.00
CTD983873712	CT TRANSIT	HARTFORD	8.90	.00	.00
CTD042306720	CT YANKEE HADDAM NECK PLANT	HADDAM NECK	2.00	1.00	.00
CTD982191488	DAHILL F J CO. INC.	NEW HAVEN	6.96	.00	.00
CTD051597896	DANBURY PHARMACAL, INC.	DANBURY	4.06	.00	.00
CTD001169853	DONNELLEY R R & SONS CO.	CLD SAYBROOK	9.38	.00	.00
CTD001141498	DONWELL CO INC. THE	MANCHESTER	2.68	.00	.00
CTD001163708	EATON PRESSURE SENSORS DIV	BETHEL	7.81	.00	.00
CTD001143551	EMHART GLASS MACHINERY (US) INC.	WINDSOR	5.47	.00	.00
CTD980911960	ENTHONE-OMI INC	ORANGE	1.78	.00	.00
CTD001454214	EPAC CO	WATERBURY	10.09	.00	.00
CTD981215718	EXXON CO. USA	ROCKY HILL	1.40	.00	.00
CTD001171594	EYELET TOOLMAKERS INC	WATERTOWN	8.42	.00	.00
CTD981895865	FARREL CORP	DERBY	6.36	.00	.00
CT5000002311	FARRELL PRECISION METALCRAFT CORP	NEW MILFORD	4.23	.00	.00
CTD064834914	GAR ELECTROFORMING DIV. ELECTRO. IN	DANBURY	6.90	10.00	.00
CTD001453711	GENERAL ELECTRIC	BRIDGEPORT	4.51	.00	.00
CTD001162775	GILGERT & BENNETT MFG CORP	GEORGETOWN	8.50	.00	.00
CTD064842495	GUILFORD GRAVURE INC	GUILFORD	4.49	.00	.00
CTD982191553	H & M LAUNDRY SERVICE INC	OAKVILLE	7.20	.00	.00
CTD041116807	HAMILTON STANDARD	FARMINGTON	8.50	.00	.00
CTD001184894	HANDY AND HARMAN	WATERBURY	4.01	.00	.00
CT5000000463	HATHAWAY CO THE	SEYMOUR	5.17	.00	.00
CTD001164334	HOLGARTH MEDICAL TECHNOLOGIES	CHESHIRE	9.43	.00	.00
CTD001139997	HOLO KROME CO	WEST HARTFORD	4.55	.00	.00
CTD001149582	HONEYWELL SKINNER VALVE DIV	NEW BRITAIN	9.33	.00	.00
CTD001162858	HOWE FURNITURE CORP	NORWALK	3.98	.00	.00
CTD001154954	IDEAL FORGING CORP.	SOUTHINGTON	6.09	.00	.00

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CTD010166791	INTL FUEL CELLS	SOUTH WINDSOR	2.48	1.00	.00
CTD000841171	INTL MARINE IND. INC.	GUILFORD	10.49	.00	.00
CTD001157429	J H METAL FINISHING, INC	NEW BRITAIN	7.56	.00	.00
CTD981887946	JENERIC PENTRON INC	WALLINFORD	3.53	.00	.00
CTD085065027	JOHNSON & JOHNSON MEDICAL, INC.	SOUTHINGTON	10.50	.00	.00
CTD001453299	KIMBERLY CLARK CORP. NEW MILFORD MI	NEW MILFORD	10.79	.00	.00
CT5000001123	LOCTITE CORP.	ROCKY HILL	4.06	.00	.00
CTD981062854	MACDERMID INC	WATERBURY	12.85	.00	.00
CTD981212657	MILLER STEPHENSON CHEMICAL CO	DANBURY	8.58	.00	.00
CTD072124878	MULTIMETAL MFG CO INC	WATERBUTY	10.73	.00	.00
CTD089623318	N S I UNITED TECHNOLOGIES	NORWALK	10.35	.00	.00
CTD001147982	NAPIER CO. THE	MERIDEN	11.43	.00	.00
CTD001161116	NASH ENGINEERING CO.	SO NORWALK	4.31	.00	.00
CTD001186451	NAUGATUCK GLASS CO.	CHURCH & BRIDGE	2.33	.00	.00
CT2170022188	NAVAL UNDERSEA WARFARE CENTER DETAC	NEW LONDON	8.51	1.00	.00
CTD001170877	NEW HAVEN MFG CORP.	NEW HAVEN	12.81	.00	.00
CTD006917868	NEW HAVEN TERM, INC.	NEW HAVEN	2.18	.00	.00
CTD001169945	NEWTON NEW HAVEN COMPANY	NORTH HAVEV	6.21	.00	.00
CTD051320372	NORTH & JUDD, INC.	MIDDLETOWN	7.51	.00	.00
CTD046422812	OLIN CORP METALS RESEARCH LAB	NEW HAVEN	8.96	19.00	.00
CTD001453273	PERKIN ELMER CORP.	WILTON	3.90	.00	.00
CTD001158633	PHILBRICK BOOTH & SPENCER, INC	HARTFORD	4.16	.00	.00
CTD981207715	PHILIPS TECHNOLOGIES	CHESHIRE	1.33	.00	.00
CTD001161207	PLATT & LA BONIA CO	NORTH HAVEN	7.57	.00	.00
CTD000844332	PRATT & WHITNEY	SOUTHINGTON	13.12	.00	.00
CTD042279539	PRAXAIR SURFACE TECHNOLOGIES	NORTH HAVEN	12.31	.00	.00
CTD051316313	PRECISION PLATING CORP.	VERNON	2.27	.00	.00
CTD001141407	PURDY CORP THE	MANCHESTER	10.55	.00	.00
CTD983875550	R S A CORP	DANBURY	7.80	.00	.00
CTD001339464	RAPID POWER TECHNOLOGIES	BROOKFIELD	3.40	.00	.00
CTD018884833	ROGERS CORP E P G W	SOUTH WINDHAM	5.75	.00	.00
CTD082662289	S V G LITHOGRAPHY	WILTON	12.68	.00	.00
CT5000002139	SPEC PLATING INC	BRIDGEPORT	6.01	.00	.00
CTD047711346	STANCHEM INC	EAST BERLIN	10.57	.00	.00
CTD981207384	STEPHENS AUTO MALL CTR.	BRISTOL	1.25	.00	.00
CTD983874280	TEXACO STATION	WEST HARTFORD	4.54	.00	.00
CTD001141555	THE HITCHCOCK CHAIR CO. LTD	RIVERTON	6.48	.00	.00
CT5000001453	U I WESTERN SERVICES CENTER	SHELTON	3.81	.00	.00
CTO690307871	U.S. COAST GUARD ACADEMY	NEW LONDON	6.39	.00	.00
CTD001162171	ULBRICH SPECILATY STRIP MILL	WEALLINGFORD	6.02	.00	.00
CTD000638627	UNITED ILLUMINATING BRIDGPORT HAR.	BRIDGEPORT	6.75	.00	.00
CTD000841122	UNITED LILLUMINATING CO ENGLISH STA	NEW HAVEN	2.19	.00	.00
CTD001141852	UNITED TOOL AND DIE CO.	WEST HARTFORD	12.78	.00	.00
CT5000000786	WESTINGHOUSE NORDEN SYSTEMS	NORWALK	11.55	.00	.00
CTD108963257	WILSHIRE CORP.	TORRINGTON	8.29	.00	.00
CTD001148303	WINDSOR MFG BARNES GROUP INC	WINDSOR	4.75	.00	.00
CTD001442425	WINSLOW AUTOMATICS INC	NEW BRITAIN	5.53	.00	.00
CTD001145143	WIREMOLD CO THE	WEST HARTFORD	4.49	.00	.00
CTD983870593	YALE UNIVERSITY RADIATION SAFETY DE	NEW HAVEN	.43	8.30	.00

Note: Please refer to the introduction for an explanation of this list.

CONNECTICUT

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO CANNOT BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- LESS THAN 1.1 TONS RCRA HAZARDOUS WASTE, AND
- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
CTD001173004	ALUMINUM FINISHING CO. INC	BRIDGEPORT	.27	.00	.00
CTD002593887	BRIDGEPORT UNITED RECYCLING INC	BRIDGEPORT	.00	.00	.00
CTD001157106	COLT MFG INC.	HARTFORD	.40	.00	.00
CTD107252272	CT TRANSIT	NEW HAVEN	.49	.00	.00
CTD000790972	DEKNATEL INC.	COMVENTRY	.00	.00	.00
CTD982715351	E D O CORP BARNES ENGINEERING DIV	SHELTON	.66	.00	.00
CTD089631956	EAST COAST ENVIRONMENTAL SERVICES	NEW HAVEN	.00	.00	.00
CTD001151752	FRISMAR INC	CLINTON	.36	.00	.00
CTD001168624	KERITE CO. THE	SEYMOUR	.67	.00	.00
CTD983896341	LOGANO TRANSPORTATION CO INC	PORTALND	.00	.00	.00
CTD000845180	PERKIN ELMER CORP.	DIDGEFIELD	.79	.00	.00
CTD001156009	SAFETY KLEEN CORP	PLAINFIELD	.00	.00	.00
CTD980667927	SAFETY-KLEEN CORP	BRANFORD	.00	.00	.00
CTD983896135	SIKORSKY AIRCRAFT CORP	SHELTON	.60	.00	.00

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DELAWARE

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
DED980827919	ALLOY SURFACES COMPANY, INC	WILMINGTON	130.53	.00	.00
DED981042724	AMTRAK BEAR COMPLEX	BEAR	32.97	.00	.00
DED060058062	AMTRAK WILMINGTON MAINT FACILITY	WILMINGTON	17.65	.00	.00
DED980551261	ARLON INCORPORATED	BEAR	17.83	.00	.00
DED011028438	ATLANTIC AVIATION CORP	NEW CASTLE	57.70	.00	.00
DED980537781	CAMDEL METALS CORP	CAMDEN	73.93	.00	.00
DED984066118	CHROME DEPOSIT CORPORATION	NEWARK	27.86	.00	.00
DED002357408	CHRYSLER CORPORATION	NEWARK	543.15	.00	.00
DED980830400	CIBA-GEIGY CORP, PIGMENTS DEPT	NEWPORT	3,078.24	1,640.00	604.00
DED002276764	CITISTEEL USA INC	CLAYMONT	5,041.78	.00	.00
DED081881724	COOPER BEARINGS INC	DAGSBORO	16.20	.00	.00
DED131873853	DANA CONTAINER CO.	WILMINGTON	48.60	.00	.00
DEP000001224	DELAWARE SAND & GRAVEL	NEW CASTLE	1,941.18	.00	.00
DE8570024010	DOVER AIR FORCE BASE	DOVER	80.81	.00	.00
DED000621417	DP&L - EDGEMOOR	WILMINGTON	13.95	.00	.00
DED003930799	DUPONT - CHESTNUT RUN	WILMINGTON	16.05	.00	.00
DED000800284	DUPONT - EDGEMOOR	EDGEMOOR	24.28	.00	.00
DED001315704	DUPONT - ENG. TEST CENTER	NEWARK	43.50	18,000.00	.00
DED042263764	DUPONT - GLASGOW BC	GLASGOW	23.53	77.50	.00
DED002348845	DUPONT - SEAFORD PLANT	SEAFORD	27.60	.00	.00
DED064370992	DUPONT - STINE-HASKELL	NEWARK	108.38	44,858.00	.00
DED003930807	DUPONT EXPERIMENTAL STATION	WILMINGTON	806.37	3,496.60	.00
DED984071068	DUPONT MERCK PHARM CO.	WILMINGTON	198.92	190.00	.00
DED984074914	ECOCHEM	NEWPORT	13.97	.00	.00
DED984071365	EXXON CO. USA #20624	NEW CASTLE	17.10	.00	.00
DED154576698	GENERAL CHEMICAL	CLAYMONT	107.37	8.00	.00
DED002369205	GM ASSEMBLY DIVISION	WILMINGTON	1,071.56	.00	.00
DED002366854	HARPER THIEL INC	WILMINGTON	20.24	.00	.00
DED053304770	HERCULES INC	MIDDLETOWN	57.00	.00	.00
DED001315647	HERCULES RESEARCH CENTER	WILMINGTON	91.93	.00	.00
DED981113681	ICI - ACRYLICS	NEWPORT	15.30	.00	.00
DED002342020	ICI AMERICAS - ATLAS POINT SITE	NEW CASTLE	1,456.84	.00	.00
DED069876795	JAMES RIVER CORPORATION	NEW CASTLE	219.68	.00	.00
DED002353092	JOHNSON CONTROLS GLOBE BATTERY	MIDDLETOWN	342.26	.00	.00
DED981743065	L.D. CAULK CO W. MILFORD	MILFORD	37.65	.00	.00
DED083235549	L.D. CAULK CO.	MILFORD	17.29	.00	.00
DED984071282	MEDAL	NEWPORT	51.24	.00	.00
DED021957444	MFG JUSTIN TANKS	GEORGETOWN	28.10	.00	.00
DED054719851	NANTICOKE HOMES INC	GREENWOOD	19.20	.00	.00
DED085693646	NORAMCO	WILMINGTON	335.09	.00	.00
DED003913266	OCCIDENTAL CHEMICAL CORPORATION	DELAWARE CITY	591.22	.00	.00
DED040835795	PLAYTEX FAMILY PRODUCTS	DOVER	62.78	.00	.00
DED984075929	RITE OFF INC	SEAFORD	31.69	.00	.00
DED982676595	ROCKLAND TECHNOLOGIES	NEWPORT	52.19	.00	.00
DED041212473	STANDARD CHLORINE OF DE	DELAWARE CITY	2,599.72	.00	.00
DED002329738	STAR ENTERPRISE	DELAWARE CITY	2,430.22	.00	.00
DED000820704	UNIVERSITY OF DELAWARE	NEWARK	17.77	.00	.00
DED002331536	W. L. GORE & ASSOCIATES	NEWARK	19.97	.00	.00
DED984076265	ZENECA - CHEM. ENG. LAB.	NEW CASTLE	53.04	200.00	.00
DED000820399	ZENECA INC.	WILMINGTON	45.82	306.00	.00

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DELAWARE

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

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- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
DED981109317	AMP/AKZO ELECTRONICS CENTER	NEWARK	3.32	.00	.00
DED000621409	DP&L - DELAWARE CITY	DELAWARE CITY	2.87	.00	.00
DED980918668	DP&L - NDGO	NEWARK	6.38	.00	.00
DED980555122	DUPONT - HOLLY RUN	NEWPORT	12.20	.00	.00
DED984071076	DUPONT - MERCK S/H	NEWARK	9.08	.00	.00
DED047321617	DUPONT - PENCADER	NEWARK	10.68	.00	.00
DE0000980920	DUPONT - WALKER MILL	WILMINGTON	3.60	.00	.00
DED110010378	EI DUPONT	WILMINGTON	4.99	.00	.00
DED004321212	INSTEEL WIRE PRODUCTS	WILMINGTON	5.11	.00	.00
DED981730880	MERIT OIL CORP. (DE-NC)	NEW CASTLE	3.71	.00	.00
DED060074291	PAF	DOVER	4.93	.00	.00
DED011001476	REICHHOLD CHEMICALS INC	CHESWOLD	9.22	.00	.00
DED000757021	SPI POLYOLS, INC.	NEW CASTLE	8.98	.00	.00

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DELAWARE

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
DED981945421	DP&L - MLK	WILMINGTON	.94	.00	.00

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DISTRICT OF COLUMBIA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
DC4141707162	ARCHITECT OF THE CAPITOL	WASHINGTON	24.92	.00	.00
DC9570090036	BOLLING AIR FORCE BASE	WASHINGTON	19.26	.00	.00
DCR000000315	EXXON CO USA 27988	WASHINGTON	135.90	.00	.00
DC8470000086	FOOD & DRUG ADMINISTRATION FB 8	WASHINGTON	11.54	16,946.00	.00
DCD049515844	GEORGETOWN UNIVERSITY	WASHINGTON	14.52	389.38	.00
DC8170024311	NAVAL RESEARCH LABORATORY	WASHINGTON	11.45	195.00	.00
DCD000819516	PEPCO BENNING ROAD GENERATING STATI	WASHINGTON	100.45	353.00	.00
DC2200907812	U S BUREAU OF ENGRAVING AND PRINTIN	WASHINGTON	259.97	23,170.00	.00
DC1960000908	US WASHINGTON ADUEDUCT DIVISION	WASHINGTON	25.22	.00	.00
DC4210021156	WALTER REED ARMY MEDICAL CENTER	WASHINGTON	23.10	21.00	.00
DCD077797793	WASHINGTON GAS LIGHT CO	WASHINGTON	38.40	.00	.00
DCD003245768	WASHINGTON POST NEWSPAPER THE	WASHINGTON	18.70	.00	.00
DCD003238193	WASHINGTON POST NEWSPAPER-SOUTHEAST	WASHINGTON	29.38	.00	.00
DCD981737422	WMATA BRENTWOOD	WASHINGTON	15.48	.00	.00

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DISTRICT OF COLUMBIA

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
DC4040005031	U S GOVERNMENT PRINTING OFFICE	WASHINGTON	10.09	.00	.00
DC4170000901	U S NAVAL DISTRICT WASH ANACOSTIA	WASHINGTON	11.21	.00	.00
DCD980555643	WMATA BLADENSBURG	WASHINGTON	10.96	.00	.00
DCD983969981	WMATA BLAIR RD	WASHINGTON	3.02	.00	.00

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FLORIDA

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
FLD982101933	AAR LANDING GEAR CENTER	MIAMI	48.89	.00	.00
FLD080182744	ACRO THRUST CORP.	MIAMI	23.89	.00	.00
FLD053105821	ADCOM WIRE COMPANY	JACKSONVILLE	406.01	.00	.00
FLD065912966	ADVANCED QUICK CIRCUITS, L.P.	MELBOURNE	784.18	.00	.00
FLD004073177	AERO CORP.	LAKE CITY	136.33	458.72	.00
FLT950052563	AIR PARK ROAD - HSA CLEANUP	EDGEWATER	59.30	.00	.00
FLT950051904	AIR PARK ROAD CLEANUP	EDGEWATER	19.40	.00	.00
FLD004145140	AIRCO PLATING CO., INC.	MIAMI	79.83	.00	.00
FLD001926161	ALLIANT DES INC.	CLEARWATER,	17.44	.00	.00
FLD984168138	ALLIED COMMERCIAL AVIONICS	POMPANO BEACH	79.49	.00	.00
FLD980840870	ALLWASTE CONTAINER SERVICES	JACKSONVILLE	51.20	.00	.00
FLD041495441	ALPHA/OWENS-CORNING	LAKELAND	19.54	.00	.00
FLD098917149	ALUMAX ENTRUSIONS INC.	PLANT CITY	233.98	.00	.00
FLD000792762	AMERADA HESS CORP. JACKSONVILLE TER	JACKSONVILLE	546.46	.00	.00
FLD088776588	AMERADA HESS CORP. TAMPA	TAMPA	435.38	.00	.00
FLD010425932	AMERDA HESS CORP.	FT. LAUDERDALE	276.63	.00	.00
FLD039677810	AMERICAN TECHNICAL SQUARE BLVD.	JACKSONVILLE	20.57	.00	.00
FLD982099954	AMETEK U.S. GAUGE	BARTOW	33.90	.00	.00
FLD981920929	APALACHEE POLE COMPANY, INC.	BRISTOL	48.80	.00	.00
FLD982106775	APOGEE PLASTIC TECHNOLOGIES, INC	DAYTONA BEACH	127.43	.00	.00
FLD004065926	ARIZONA CHEMICAL	PANAMA CITY	4,692.36	112.00	.00
FLD984171611	ARIZONA CHEMICAL COMPANY	PENSACOLA	560.11	.00	.00
FLD059861344	ASHLAND CHEMICAL	MIAMI	63.83	.00	.00
FLD000649095	ASHLAND CHEMICAL CO.	TAMPA	121.49	.00	.00
FLD067230771	ASHLAND CHEMICAL CO.	TAMPA	27.13	.00	.00
FLD980845010	AT&T ORLANDO	ORLANDO	70.27	.00	.00
FLD050765684	ATLANTIC DRY DOCK	JACKSONVILLE	23.60	.00	.00
FLD064675978	AVESTA SHEFFIELD PIPE CO.	WILDWOOD	706.49	.00	.00
FLD982145500	BAUSCH & LOMB PHARM	TAMPA	19.73	.00	.00
FLD000825133	BEAR ARCHERY INC.	GAINESVILLE	34.72	.00	.00
FLD981030448	BENADA ALUMINUM OF FLORIDA, INC.	MEDLEY	269.79	.00	.00
FLD004061099	BENJAMIN MOORE PAINTS	JACKSONVILLE	37.57	.00	.00
FLD099068710	BERTRAM YACHT,INC.	MIAMI	29.91	.00	.00
FLD984219873	BETHESDA MEMORIAL HOSPITAL	BOYONTON BEACH	31.78	.00	.00
FLD991279928	BFGOODRICH AEROSPACE LANDING GEAR S	MIAMI	95.72	.00	.00
FLD984219576	BFI MEDICAL WASTE SYSTEMS (SOUTHEAS	APOPKA	207.92	.00	.00
FLD094611043	BIC CORPORATION	CLEARWATER	44.93	.00	.00
FLD032771180	BILL CURRIE FORD INC.	TAMPA	14.60	.00	.00
FLD984181032	BOCA RATON COMMUNITY HOSPITAL	BOCA RATON	68.99	.00	.00
FLD063288245	BREED AUTOMOTIVE	LAKELAND	91.70	56,216.00	.00
FLD984187963	BRONZ-GLOW SOUTHEAST INC.	JACKSONVILLE	60.74	.00	.00
FLD004073516	BUSH BOAKE ALLEN INC	JACKSONVILLE	38.82	.00	.00
FL2800016121	CAPE CANAVERAL AIR STATION	PATRICK, AFB	502.48	5,511.50	189,033.93
FLD084723337	CENTRAL FLORIDA CIRCUITS INC.	ORLANDO	26.72	.00	.00
FLD078319308	CENTRAL FLORIDA PIPELINE	ORLANDO	334.68	.00	.00
FLD984166207	CENTURY BOAT CO.	PANAMA CITY	23.49	.00	.00
FLD000612044	CHEVRON USA # 1289736	TAMPA	233.52	.00	.00
FLD000611905	CHEVRON USA, #1289726	JACKSONVILLE	31.68	.00	.00
FLD131777104	CHRIS CRAFT BOATS	SARASOTA	27.19	.00	.00
FLD980842173	CHROMALLY CASTING	TAMPA	44.42	.00	.00
FLD981022759	CIRCUIT CONCEPTS, INC.	CLEARWATER	55.32	.00	.00
FLD069660561	CITGO PETROLEUM CORP.	TAMPA	42.33	.00	.00
FLD000608026	COASTAL FUELS MARKETING - CAPE CANA	CAPE CANAVERAL	339.66	.00	.00
FLD064683410	COASTAL FUELS MARKETING - PORT MANA	PALMETTO	23.33	.00	.00
FLD051336535	COASTAL FUELS MARKETING-PORT EVERGL	FORT LAUDERDALE	183.61	.00	.00

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FLORIDA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
FLD981019656	COASTAL FUELS MARKETING, INC.	JACKSONVILLE	679.64	.00	.00
FL8170023792	COASTAL SYSTEMS STATION, DAHLGREN D	PANAMA CITY	15.23	171.00	.00
FLD981857840	COMCAR MAINTENANCE SERVICES	AUBURNDALE	13.23	.00	.00
FLD115388332	COMPUFAB, INC.	TAMPA	26.80	.00	.00
FLD982081994	CONSOLIDATED STAINLESS INC.	AUBURNDALE	320.60	.00	.00
FLD980837744	CONTINENTAL CIRCUITS, INC	CASSELBERRY	418.69	.00	.00
FLD980711378	COOK COMPOSITES & POLYMERS	ORLANDO	33.96	.00	.00
FLD082400441	CORONADO PAINT COMPANY	EDGEWATER	293.83	.00	.00
FLD032334518	COULTER CORPORATION	HIALEAH	2.99	195.00	.00
FLD982078370	COULTER CORPORATION	MIAMI LAKES	161.45	.00	.00
FLD984257097	COULTER CORPORATION	MIAMI	10.26	220.00	.00
FLD073521684	CRANE CAMS INC	DAYTONA BEACH	47.96	350.00	.00
FLD047970512	CROWN CORK + SEAL CO, INC.	PLYMOUTH	162.35	.00	.00
FLD057231821	CYTEC INDUSTRIES INC. SANTA ROSA PL	MILTON	20.73	.00	.00
FLD007854359	DADE INTERNATIONAL INC.	MIAMI	4.56	35.00	.00
FLD004069183	DELTA LABORATORIES	OCALA	24.19	.00	.00
FLD982168197	DELTA METAL FINISHING INC.	ST. PETERBURG	16.07	.00	.00
FLD087332433	DICTAPHONE CORP.	MELBOURNE	14.55	.00	.00
FLD004062048	DOZIER & GAY PAINT CO.	JACKSONVILLE	105.44	.00	.00
FLD092713403	DRILTECH INC., PLANT #3	WILLISTON	18.72	.00	.00
FLD004100152	E - SYSTEMS, INC. ECI DIV.	ST. PETERBURG	26.54	20.00	.00
FLD020982856	E.I. DUPONT DE NEMOURS & CO.	JACKSONVILLE	22.22	.00	.00
FLD093846897	EATON CORPORATION OF FLORIDA	SARASOTA	19.37	.00	.00
FLT950052803	EDISON COMM COLLEGE	FORT MEYERS	1.42	160.00	.00
FL8570024366	EGLIN AIR FORCE BASE AFDTC/EM	EGLIN AFB	159.34	9,382.00	.00
FLD045981057	ELECTROMATE ENCLOSURES	JACKSONVILLE	21.26	.00	.00
FLD059397448	ESSILOR OF AMERICA, MFG. DIV.	ST. PETERSBURG	110.01	.00	.00
FLD043860451	EVEREADY BATTERY COMPANY, INC.	ALACHUA	1,344.74	.00	.00
FLD084186600	F.P. SPIRALKOTE, INC.	ORLANDO	64.29	.00	.00
FLD980838569	FAR RESEARCH INC.	PALM BAY	114.19	.00	.00
FLD980840227	FARCHAN LABORATORIES, INC.	GAINESVILLE	16.84	.00	.00
FLD982096687	FL DEP, BER, TEMP STORAGE	WEST PALM BEACH	20.70	400.00	.00
FLT950052092	FL. AGRICUL/CONSUMER SERVICES	WAUCHULA	19.59	.00	.00
FLT950052100	FL. AGRICULTURE/CONSUMER AFFAIRS	IMMOKALEE	38.91	.00	.00
FLT950052084	FL. AGRICULTURE/CONSUMER SERVICES.	WAVERLY	30.67	.00	.00
FL0000124784	FLA. DEP. BER	TALLAHASSEE	92.97	.00	.00
FLD008161341	FLORIDA DRUM COMPANY	PENSACOLA	77.12	.00	.00
FLD004055810	FLORIDA FURNITURE INDUSTRIES	PALATKA	62.05	.00	.00
FLD982167702	FLORIDA PAINTING/ROYAL STORE	MIAMI	44.17	.00	.00
FLD000807461	FLORIDA POWER & LIGHT CO. MARTIN PL	INDIAN TOWN	53.58	1,009.17	.00
FLD000807305	FLORIDA POWER AND LIGHT, FT.MYERS P	FT. MYERS	13.94	.00	.00
FLD980600308	FLORIDA PRODUCTION ENGINEERING, INC	DAYTONA BEACH	67.69	.00	.00
FL0001039536	FLORIDA PRODUCTION ENGINEERING, INC	ORMOND BEACH	47.72	.00	.00
FLD000608125	FLORIDA STATE UNIVERSITY	TALLAHASSEE	26.95	325.00	.00
FLD083812537	FLORIDA STEEL CORP.	JACKSONVILLE	14.29	.00	.00
FLD004059085	FLORUDA SOLITE CO.	GREEN COVE SPRI	15.16	.00	.00
FLD004099552	FLR PAINTS	BRADENTON	13.69	.00	.00
FLD000645481	FMC CORPORATION	JACKSONVILLE	127.81	219,338.00	.00
FLD980729016	FMC CORPORATION	ORLANDO	33.85	.00	.00
FLD000733683	FPL TURKEY POINT PLANT	FLORIDA CITY	28.90	10,155.96	.00
FLD981014145	FUTURA CIRCUITS CORP.	ST. PETERSBURG	274.80	.00	.00
FLD000608182	GATX TERMINAL CORPORATION	FT. LAUDERDALE	174.44	.00	.00
FLD073216863	GATX TERMINALS CORP.	TAMPA	1,171.61	.00	.00
FLD984175836	GELMAN SCIENCES, INC.	PENSACOLA	129.10	.00	.00
FLD004088258	GENERAL COMPONENTS, INC.	LARGO,	33.97	50.00	.00

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FLORIDA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
FLD046779856	GRAPHIC PRODUCTS, INC.	FT. LAUDERDALE	67.34	.00	.00
FLD984258632	GREENWICH AIR SERVICES, INC.	MIAMI	287.52	.00	.00
FLD980602114	GRIMES AEROSPACE COMPANY	OCALA	18.64	.00	.00
FLD043117522	GRUMMAN AEROSPACE CORPORATION	STUART	55.48	.00	.00
FLD046771952	GRUMMAN ST. AUGUSTINE	ST. AUGUSTINE	105.42	.00	.00
FLD984169524	GRUMMAN ST. AUGUSTINE (NORTH)	ST. AUGUSTINE	15.76	.00	.00
FLD980602080	GUILFORD GRAVURE	GREEN COVE SPRI	27.68	.00	.00
FLD004092839	GULF COAST RECYCLING, INC.	TAMPA	29,562.97	.00	.00
FLD000822981	GULF POWER COMPANY	PENSACOLA	25.75	.00	.00
FLD984229716	H.P. REID CO., INC	PALM COAST	69.36	.00	.00
FLD050455278	HARRIS ELECTRONIC SYSTEMS SECTOR	PALM BAY	46.72	40.00	.00
FLD000602334	HARRIS SEMICONDUCTOR	PALM BAY	1,396.76	60.00	.00
FLD980844930	HIGH PERFORMANCE SYSTEMS	WINTER HAVEN	129.52	.00	.00
FLD021716816	HILLSBOROUGH AREA REGIONAL TRANSIT	TAMPA	18.26	.00	.00
FLD002561751	HOMAC MFG. COMPANY	ORMOND BEACH	28.79	.00	.00
FLD004105904	HONEYCOMB CO. OF AMERICA, INC	SARASOTA	23.47	.00	.00
FLD982097354	HONEYWELL, INC.	ST. PETERSBURG	14.31	.00	.00
FLD054880216	HUDSON TOOL & DIE CO.	ORMOND BEACH	46.79	.00	.00
FLD094593431	HUNTER MARINE CORP.	ALACHUA	31.50	.00	.00
FLD099348625	HYDRO ALUMINUM ROCKLEDGE	ROCKLEDGE	66.81	.00	.00
FLD000770420	IMC-AGRICO CO, NORALYN	BARTOW	81.77	.00	.00
FLD000770453	IMC-AGRICO COMPANY, KINGSFORD	BRADLEY JUNCTIO	15.11	.00	.00
FLD981928484	INDUSTRIAL WATER SERVICES	JACKSONVILLE	43.50	.00	.00
FLD984209312	INDUSTRRIAL SERVICES	PLANT CITY	164.52	.00	.00
FLD058449752	ITD INDUSTRIES, INC.	ST. PETERSBURG	178.51	.00	.00
FLD077584423	JACKSONVILLE TRANSPORTATION AUTHORI	JACKSONVILLE	16.25	.00	.00
FLD000120782	JEFFERSON SMURFIT CORPORATION	JACKSONVILLE	13.35	.00	.00
FLD004090452	JOHNSON CONTROLS BATTERY GROUP	TAMPA	63.30	.00	.00
FLD063634505	K.P.C. SOUTHERN INDUSTRIES	POMPANO BEACH	24.98	.00	.00
FLD004106811	KAISER ALUMINUM & CHEMICAL CORP.	MULBERY	96,495.43	.00	.00
FLD043869296	KERR-MCGEE REFINING CORP.	JACKSONVILLE	182.92	.00	.00
FLD004057535	KOPPERS INDUSTRIES INC.	GAINESVILLE	176.17	.00	.00
FLD981474802	LAIDLAW ENVIRONMENTAL SERVICES (TS)	CLEARWATER	308.77	88,872.00	.00
FLD980729610	LAIDLAW ENVIRONMENTAL SERVICES OF B	BARTOW	4,526.65	.00	.00
FLT950050393	LAKE MONROE WATER TREATMENT PLANT	SANFORD	30.50	.00	.00
FLD000459081	LEHIGH FURNITURE	MARIANNA	27.43	.00	.00
FLD982163024	LILLY INDUSTRIES (USA) INC.	DAVIE	30.42	.00	.00
FLD002353308	LILLY INDUSTRIES (USA), INC.	TAMPA	39.97	.00	.00
FLD982135956	LIST INDUSTRIES INC.	DEERFIELD BEACH	101.24	.00	.00
FLD001690924	LOCKHEED MARTIN	DAYTONA BEACH	27.74	.00	.00
FLD060240207	LOCKHEED MARTIN ELECTRONICS & MISSI	ORLANDO	52.05	1,223.00	.00
FLD061993606	LOCKHEED MARTIN ELECTRONICS & MISSI	OCALA	217.94	40.00	.00
FLD980841746	LOCKHEED MARTIN INFORMATION SYSTEMS	ORLANDO	24.11	.00	.00
FLD000610113	LOUIS DREYFUS ENERGY	PENSACOLA	41.70	.00	.00
FLD063601207	LOUIS DREYFUS ENERGY	FT. LAUDERDALE	751.80	.00	.00
FLD073210072	LOUIS DREYFUS ENERGY	TAMPA	246.23	.00	.00
FLD981932924	LOWENSTEIN INC	POMPANO BEACH	21.27	.00	.00
FLD004057691	LUHRS CORPORATION.	ST. AUGUSTINE	31.39	.00	.00
FL2971590003	MACDILL AFB (DFSP-PT. TAMPA)	TAMPA	328.50	.00	.00
FL6570024582	MACDILL AIR FORCE BASE	MACDILL	259.12	76.00	.00
FLD982107229	MARK III INDUSTRIES, INC.	OCALA	63.64	.00	.00
FLD047966593	MARTIN ELECTRONICS, INC.	PERRY	104.84	.00	.00
FLD984167890	MARTIN MARIETTA SPACE LAUNCH SYSTEM	CAPE CANAVERAL	16.36	.00	.00
FLD982106429	MASTER PACKAGING, INC.	TAMPA	50.77	.00	.00
FLD064824030	MCDONNELL DOUGLAS	TITUSVILLE	590.23	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
FLT950051276	MEDX, INC.	MIAMI	42.70	.00	.00
FLD984262782	MERCURY TECHNOLOGIES INTERNATIONAL,	WEST MELBOURNE	15.76	.00	.00
FLD054061049	METAL CONTAINER CORPORATION	GAINESVILLE	19.49	.00	.00
FLD065885931	METAL CONTAINER CORPORATION	JACKSONVILLE	58.25	.00	.00
FLD161150446	METAL PLATE GALVANIZING, INC.	JACKSONVILLE	636.21	.00	.00
FLD982104739	METRIC SYSTEMS CORPORTATION	FT. WALTON BEAC	17.08	.00	.00
FLD106953763	MOLEX ETC, INC.	ST. PETERBURG	34.05	.00	.00
FLD071951966	MONSANTO COMPANY	GONZALEZ	146,765.04	125.00	.00
FLD061897054	MONTCO RESEARCH PRODUCTS, INC.	HOLLISTER	1,091.65	.00	.00
FLD056921471	MOTOROLA, INC	FT. LAUDERDALE	56.83	3,461.22	.00
FLD984241075	MUNTERS CORPORATION	FORT MYERS	24.13	.00	.00
FLD984187930	MURPHY OIL USA, INC.-	FREEPORT	64.78	.00	.00
FLD984187914	MURPHY OIL USA, INC.-ST. MARKS TERM	ST. MARKS	88.97	.00	.00
FLD981866460	MURPHY OIL USA, INC.-TAMPA TERMINAL	TAMPA	160.74	.00	.00
FL6800014585	NASA KENNEDY SPACE CENTER	KENNEDY SPACE C	700.98	233,357.22	55,521.87
FL5170022474	NAVAL AIR STATION CECIL FIELD	JACKSONVILLE	66.93	.00	.00
FL6170024412	NAVAL AIR STATION JACKSONVILLE	JACKSONVILLE	4,144.12	212,781.00	.00
FL2170023244	NAVAL AIR STATION, WHITING FIELD	MILTON	111.44	.00	.00
FL1170022650	NAVAL UNDERSEA WARFARE CENTER, USRD	ORLANDO	.59	132.00	.00
FL0000964973	NAVY PUBLIC WORKS CENTER CODE 900	PENSACOLA	193.84	.00	.00
FLD982093023	NEWTON ENTERPRISES	CLEARWATER	16.93	.00	.00
FLD982106635	NORTHROP GRUMMAN CORPORATION	MELBOURNE	27.34	.00	.00
FL0000545921	NOVEN PHARMACEUTICALS, INC.	MIAMI	33.44	.00	.00
FLD982171019	NOVEN PHARMACEUTICALS, INC-PARKSIDE	MIAMI	21.62	.00	.00
FLD006430581	NTU ELECTRONICS, INC.	LARGO	50.94	.00	.00
FLD000737312	OLDOVER CORPORATION	GREEN COVE SPRI	3,630.93	.00	.00
FLD047096524	OLIN CORPORATION	ST. MARKS	81.31	.00	.00
FLR000004556	ORANGE COUNTY ARTHROPOD CONTROL	ORLANDO	3.50	.00	7,000.00
FLR000004564	ORANGE COUNTY ARTHROPOD CONTROL	ORLANDO	1.99	.00	3,980.00
FL0000935718	OSCEOLA COGENERATION PROJECT	PAHOKEE	17.79	.00	.00
FLD061432266	OSHKOSH TRUCK	BRADENTON	36.31	.00	.00
FLD009708736	OWENS-BROCKWAY GLASS CONTAINER INC	LAKELAND	19.35	.00	.00
FLD002035723	PALL AEROPOWER CORP.	PINELLAS PARK	27.00	.00	.00
FL2570024404	PATRICK AIR FORCE BASE	PATRICK AFB	31.57	.00	.00
FLD050768548	PCR, INC. - HARRIS	GAINESVILLE,	428.91	.00	.00
FLD095558466	PEC VIKTRON	ORLANDO	1,408.64	.00	.00
FLD982104812	PENINSULA METAL FINISHING, INC.	ORLANDO	22.38	.00	.00
FLD980711071	PERMA - FIX OF FLORIDA, INC.	GAINESVILLE	3,390.65	.00	.00
FLD020982716	PETRO CHEMICAL PRODUCTS	JACKSONVILLE	129.72	.00	.00
FLD054446299	PNEUMATIC PRODUCTS CORP.	OCALA	17.07	.00	.00
FLD084723378	PORT CANAVERAL AND FOREIGN TRADE ZO	CAPE CANAVERAL	54.43	.00	.00
FLD096599774	PRINTED CKTS OF AMERICA	PINELLAS PARK	243.07	.00	.00
FLD984197285	PROGRESS ENVIRONMENTAL LABORATORIES	TAMPA	18.90	.00	.00
FLD982130379	PROGRESS RAIL SERVICES	GREEN COVE SPRI	107.48	.00	.00
FLD099707663	PUBLIX SUPER MARKET	LAKELAND	4.26	62.55	.00
FLD980839013	PURE COATINGS, INC	WEST PALM BEACH	35.97	.00	.00
FLD981003437	QMS CIRCUITS, INC.	FT. WALTON BEAC	75.00	.00	.00
FLD051727949	R. P. SCHERER NORTH AMERICA	ST. PETERSBURG	22.41	.00	.00
FL0000207449	RECYCLIGHTS, INC.	TALLAHASSEE	18.82	.00	.00
FLD004061529	REICHHOLD CHEMICALS	JACKSONVILLE	53.59	.00	.00
FLD095565206	REICHHOLD CHEMICALS, INC.	PENSACOLA	277.38	.00	.00
FLD002812089	RING POWER CORP.	JACKSONVILLE	26.57	.00	.00
FLD984170415	RINGHAVER EQUIPMENT CO.	RIVERVIEW	26.98	.00	.00
FLD980847271	SAFETY KLEEN	TAMPA	68.49	.00	.00
FLD980847214	SAFETY KLEEN CORP.	ORANGE PARK	28.67	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
FLD984167791	SAFETY KLEEN CORP.	BOYONTON BEACH	37.05	.00	.00
FLD984171694	SAFETY KLEEN CORP.	MEDLEY	18.27	.00	.00
FLD004089694	SCHNELLER INC., POLYPLASTEX DIV.	PINELLAS PARK	37.22	.00	.00
FLD049765811	SCM GLIDCO ORGANICS CORP	JACKSONVILLE	214.58	.00	.00
FLD064807159	SEA RAY BOATS, INC.	MERRITT ISLAND	17.93	.00	.00
FLD980842157	SEA RAY BOATS, INC.	PALM COAST	45.84	.00	.00
FLD000772194	SEMINOLE ELECTRIC COOP, INC.	PALATKA	14.69	.00	.00
FLD000776666	SERMATECH TECHNICAL SERVICES S E	BOYNTON BEACH	18.02	.00	.00
FLD058449927	SHELL CHEMICAL CO	LAKELAND	302.12	.00	.00
FLD000604637	SHELL OIL COMPANY	FT. LAUDERDALE	19.02	.00	.00
FLD043861392	SHERWOOD MEDICAL COMPANY	DELAND	94.46	2,175.00	.00
FLD982102295	SONIC AVIATION CORPORATION	MIAMI	32.79	.00	.00
FLD043049428	SONOCO PRODUCTS CO.	ORLANDO	38.47	.00	.00
FLD004053450	SOUTHERN WOOD PIEDMONT CO.	BALDWIN	374.00	.00	.00
FLD982121592	SPARKLE CORPORATION	TAMPA	31.78	.00	.00
FLD080106073	SPARTON ELECTRONICS FLORIDA, INC.	BROOKSVILLE	22.42	.00	.00
FLD981025281	STANADYNE AUTOMOTIVE CORP.	TALLAHASSEE	16.83	.00	.00
FLD001647015	STIMPSON COMPANY, INC.	POMPANO BEACH	58.80	.00	.00
FLD000830703	STORAGETEK PRINTER OPERATIONS	PALM BAY	46.22	.00	.00
FLD982111080	SUN-GLO PLATING CO.	PINELLAS PARK	20.38	.00	.00
FLD984238378	SUPERIOR PLATING, INC.	PINELLAS PARK	52.01	.00	.00
FL0000936807	SWFWMD-AGRI-TIMBER TRACT	PASCO COUNTY	1.35	2,700.00	.00
FLD980838791	S2 YACHTS PURSUIT DIV.	FT. PIERCE	22.66	.00	.00
FLD000654582	TAMPA ELEC GANNON STATION	TAMPA	14.80	.00	.00
FLD000654640	TAMPA ELECTRIC COMP BIG BEND	NORTH RUSKIN	95.05	.00	.00
FLD984166199	TELECTRONICS PACING SYSTEMS	MIAMI LAKES	21.12	.00	.00
FLD984174599	TEXACO SERVICE STATION	ST. CLOUD	65.27	.00	.00
FLD048863880	TEXACO/STAR ENTERPRISE SALES TERMIN	FT. LAUDERDALE	429.99	.00	.00
FLD004054284	THE NEW PIPER AIRCRAFT, INC.	VERO BEACH	47.93	.00	.00
FLD073206906	THOMPSON P.B.E. INC.	CLEARWATER	38.47	.00	.00
FLD984188953	TRANSITIONS OPTICAL, INC.	PINELLAS PARK	35.82	.00	.00
FL0000703066	TRIDENT EXPORT CORP.	JACKSONVILLE	13.97	.00	.00
FLD004100665	TROPICANA PRODUCTS	BRADENTON	32.64	.00	.00
FLD980838866	TURBINE ENGINE COMP. TEXTRON	ORLANDO	97.13	.00	.00
FL6890090008	U S DOE/ LOCKHEED MARTIN SPECIALTY	LARGO,	213.01	1,318.00	.00
FL8609310836	U.S. COAST GUARD STATION	ST. PETERBURG	18.22	.00	.00
FLD063604375	UNC AIRWORK MIAMI	MIAMI	37.37	.00	.00
FLD980601421	UNISON INDUSTRIES	JACKSONVILLE	23.44	.00	.00
FLD000654566	UNIVERSAL CIRCUITS, INC.	ALTOMONTE SPRIN	92.35	.00	.00
FLD000823393	UNIVERSITY OF FLORIDA	GAINESVILLE	74.61	.00	.00
FLD069687242	UNIVERSITY OF SOUTH FLORIDA	TAMPA	10.67	52.60	.00
FL7570024375	US AIR FORCE, HURLBURT FIELD FL	90053HURLBURT F	30.28	.00	.00
FL5690308338	US COAST GUARD	MIAMI BEACH	61.90	.00	.00
FL4120515602	US DEPT OF AGRICULTURE	GAINESVILLE	1.17	44.20	.00
FL6170022952	US NAVAL AIR STATION	KEY WEST	30.39	.00	.00
FL9170024260	US NAVAL STATION MAYPORT	JACKSONVILLE	157.51	.00	.00
FL4170090001	US NAVY AUTEC	ANDROS ISLAND B	30.23	.00	.00
FL9170024567	US NAVY PUBLIC WORKS CENTER	PENSACOLA	3,027.22	.00	.00
FL1570024124	USAF TYNDALL AIR FORCE BASE	TYNDALL AFB	77.15	.00	.00
FL7170023710	USMC BLOUNT ISLAND COMMAND	JACKSONVILLE	154.75	179.00	.00
FL4170023788	USNAS TRUMAN ANNEX	KEY WEST	1,396.00	.00	.00
FLD001447952	UTC, PRATT & WHITNEY	JUPITER	37,926.49	5,301.00	.00
FLD059859587	VISION-EASE	FT. LAUDERDALE	213.55	.00	.00
FLD004065470	WALT DISNEY WORLD CO.	LAKE BUENA VIST	247.02	.00	.00
FLD984208413	WALTER POWNELL SERVICE CENTER	LARGO	15.96	.00	.00

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FLD048174197	WELLCRAFT MARINE	SARASOTA	19.43	.00	.00
FLD984175737	WESTLAKE PVC CORP.	PACE	19.87	.00	.00
FLR000005587	WHISTLING PINES, INC.	DONA VISTA	.88	1,000.00	.00
FLD000604272	WOLVERINE GASKET CO.	LISBON	53.54	.00	.00

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FLORIDA

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GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
FLD099694572	ABB POWER T&D CO.	SANFORD	2.37	.00	.00
FLD005569405	ALLIEDSIGNAL COMMERCIAL AVIONICS	FT. LAUDERDALE	9.66	.00	.00
FLD050769090	AMERICAN CAN COMPANY	JACKSONVILLE	6.24	.00	.00
FLD000827386	AMOCO OIL COMPANY-PORT EVERGLADES	FT. LAUDERDALE	4.41	.00	.00
FLD004094009	ANHEUSER-BUSCH, INC.	TAMPA	2.80	.00	.00
FLD045986841	ANHEUSER-BUSCH, INC.	JACKSONVILLE	9.24	.00	.00
FL0000596866	APPERSON CHEMICALS INC.	JACKSONVILLE	4.63	.00	.00
FLD096661053	ASHLAND CCHEMICAL	ORLANDO	3.05	.00	.00
FLD000654251	ASHLAND CHEMICAL PLANT	BARTOW	1.18	.00	.00
FLD053497517	AT&T PARADYNE CORPORATION	LARGO	6.98	.00	.00
FL0170023790	ATLANTIC MARINE - MAYPORT DIV.	JACKSONVILLE	8.62	.00	.00
FLD002890994	ATLANTIC MARINE, INC.	JACKSONVILLE	10.99	.00	.00
FLT950050815	BILL KNAPP'S RESTAURANTS	SANFORD	1.51	.00	.00
FLT950053389	BLACKWELDER GROVES, INC.	HAINES CITY	3.66	.00	.00
FLD004057105	BUCKEYE FLORIDA LIMITED PARTNERSHIP	PERRY	10.85	.00	.00
FLD984254870	CAMP BLANDING TRAINING SITE	STARKE	13.02	.00	.00
FLD000827428	CARGILL FERTILIZER, INC.	FT MEADE	7.67	.00	.00
FLD032707374	CARLISLE FORD INC.	ST. PETERSBURG	11.06	.00	.00
FLD984262527	CEDAR BAY GENERATING CO., L.P.	JACKSONVILLE	2.33	.00	.00
FLD079856969	CENTER FOR APPLIED ENGINEERING, INC	ST. PETERSBURG	6.00	.00	.00
FLD000611863	CHEVRON USA # 1290175	FT. LAUDERDALE	11.04	.00	.00
FLD982091191	CHRIS CRAFT BOATS, PLANT 2	SARASOTA	2.72	.00	.00
FLD984194613	CHROMALLOY TALLAHASSEE MARIANNA	MARIANNA	9.82	.00	.00
FLD041180944	CHROMALLY CASTINGS	MIAMI	1.64	.00	.00
FLD097373542	CHROMALLY FLORIDA	FT. WALTON BEAC	4.53	.00	.00
FLD982144263	CITY OF TALLAHASSEE	TALLAHASSEE	1.95	.00	.00
FLD063524870	COASTAL LUMBER COMPANY	HAVANA	5.00	.00	.00
FLD004099966	COL MET,INC.	TAMPA	11.95	.00	.00
FLD004098372	COMSAT RSI EMS	LARGO	9.62	.00	.00
FLD984240903	CONTINENTAL AIRLINES	ORLANDO	12.40	.00	.00
FLD980838320	COULTER CORPORATION	HIALEAH	1.32	.00	.00
FLD982151326	CSX TRANSPORTATION	LAKELAND	3.05	.00	.00
FLD984168336	DADE COUNTY AVIATION DEPARTMENT	MIAMI	10.80	.00	.00
FLD101988012	DEFENSE RESEARCH, INC	NAPLES	4.45	.00	.00
FLT950052829	DISNEY VACATION VILLAS	LAKE BUENA VIST	1.73	.00	.00
FLD092718576	ENVIRONMENTAL RECOVERY, INC.	ATLANTIC BEACH	2.66	.00	.00
FLD064816424	FAR-MAC PLATING, INC.	MELBOURNE	6.49	.00	.00
FLD980799035	FDOT FT. LAUDERDALE MAINTENANCE YAR	FORT LAUDERDALE	9.48	.00	.00
FLD984261149	FL DEPT. ENV. PROT. NW DIST	JACKSONVILLE	4.22	.00	.00
FLT950052134	FL. AGRI/CONSUMER SERVICES	FT. PIERCE	8.09	.00	.00
FLD072566102	FLORIDA DEP HWCS OCALA PLATING	OCALA	8.48	.00	.00
FLD984260497	FLORIDA DEP ORLANDO	ORLANDO	6.30	.00	.00
FLD000807297	FLORIDA POWER & LIGHT	PARRISH	4.40	.00	.00
FLD000807784	FLORIDA POWER & LIGHT CO. SAMFORD	DEBARY	3.06	.00	.00
FLD040216764	FLORIDA POWER CORP.	CRYSTAL RIVER	7.76	.00	.00
FLD981867500	FLORIDA POWER CORP.	ST. PETERSBURG	11.01	.00	.00
FLD981019383	FLORIDA POWER CORP. INTERCESSION CI	INTERCESSION CI	8.44	.00	.00
FLD982083289	FLORIDA STEEL CORPORATION	TAMPA	6.22	.00	.00
FLD004092920	FMC CORP	LAKELAND	3.94	.00	.00
FLD004056248	GEORGIA-PACIFIC CORP.	PALATKA	5.50	.00	.00
FLD079201273	GMC ELECTRO-MOTIVE	JACKSONVILLE	4.71	.00	.00
FLD000649111	GROUP TECHNOLOGIES CORP.	TAMPA	3.41	.00	.00
FLT950051391	GULF POWER CO.	GULF BREEZE	3.52	.00	.00
FLD980840144	HARRIS ELECTRONIC SYSTEM SECTOR	MALABAR	7.35	.00	.00
FLD004104105	HONEYWELL, INC.	CLEARWATER	11.78	.00	.00

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FLORIDA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

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- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
FLD079810008	IBM BOCA ROTON	BOCA RATON	6.43	.00	.00
FLD991302308	IMC-AGRICO CO.	DUETTE	11.21	.00	.00
FL0000014555	INTERNATIONAL SHIP REPAR & MARINE	TAMPA	10.55	.00	.00
FLD063512107	LESCO, INC	SEBRING	2.71	.00	.00
FLD984167437	LOCKHEED MARTIN ELECTRONICS & MISSI	OCALA	4.19	.00	.00
FLD004100731	LORAL AMERICAN BERYLLIUM CORP.	TALLEVAST	3.30	.00	.00
FLD083200998	LORAL DATA SYSTEMS	SARASOTA	10.97	.00	.00
FLD004097184	LORAL DEFENSE SYSTEMS--EAGAN	OLDSMAR	7.97	.00	.00
FLD980540405	M. A. BRUDER & SONS, INC.	ORLANDO	12.90	.00	.00
FLD984262410	MAGNUM TANK SERVICE, INC.	POMPANO BEACH	5.54	.00	.00
FLD065919763	MARATHON OIL CO.	TAMPA	1.83	.00	.00
FLD004116737	MCDONALD CONSTRUCTION CORP.	LAKELAND	13.09	.00	.00
FLD984171306	MEMTEC AMERICA CORPORATION	DELAND	6.04	.00	.00
FLD008169708	METRIC SYSTEM CORPORATION	FT. WALTON BEAC	3.29	.00	.00
FLT950050500	MIKE LANGELY CITRUS	CLERMONT	3.58	.00	.00
FLD980799100	MOTOROLA, INC	BOYTON BEACH	9.17	.00	.00
FLD055384473	N. AMERICAN PLATING CORP.	FT. LAUDERDALE	7.65	.00	.00
FLD053033593	OKEELANTA CORPORATION	SOUTH BAY	10.85	9.90	.00
FLT950051953	ORANGE CO. BOARD OF COUNTY COMMISIO	ORLANDO	12.09	.00	.00
FLT950052282	ORLANDO TRUCK STOP	ORLANDO	8.58	.00	.00
FLD004122495	OSCEOLA FARMS CO.	PAHOKEE	9.29	.00	.00
FLT950052498	P.J. FOOD SERVICE, INC	ORLANDO	1.32	.00	.00
FLT950052399	P&C THOMPSON BROS. CONST. CO.	LEESBURG	3.24	.00	.00
FLT950051946	PALM CAY PLAZA - CRESTAR REAL EST.	MERRITT ISLAND	1.43	.00	.00
FLD000622548	PCS PHOSPHATE - WHITE SPRINGS	WHITE SPRINGS	10.76	.00	.00
FLD098372360	PCS PHOSPHATE - WHITE SPRINGS	WHITE SPRINGS	11.32	.00	.00
FLD980843163	PEOPLES GAS SYSTEM, INC	N. MIAMI BEACH	2.40	.00	.00
FLD078470267	PFIZER INC.	MIAMI	12.05	.00	.00
FLD053393898	PIEZO TECHNOLOGY, INC.	ORLANDO	10.61	.00	.00
FLD982134983	POMA CORPORATION	WEST PALM BEACH	4.14	.00	.00
FLD080949613	PPC PRODUCTS CORP.	RIVIERA BEACH	2.42	.00	.00
FLD092833151	PRAXAIR SURFACE TECHNOLOGIES, INC.	MIAMI	12.27	.00	.00
FLD982132268	PUBLIX SUPER MARKET	MIAMI	2.91	.00	.00
FLR000005280	PUBLIX SUPER MARKET	VENICE	2.68	.00	.00
FLD010426526	RACAL DATACOM	SUNRISE	10.24	.00	.00
FLD004058046	RAYONIER, INC.	BUNNELL	3.50	.00	.00
FLD049758725	REGAL MARINE INDUSTRIES, INC	ORLANDO	10.29	.00	.00
FLD982133159	SAFETY-KLEEN CORP.	TALLAHASSEE	9.89	.00	.00
FLD980729008	SCHOOL BOARD OF BROWARD COUNTY, FL	OAKLAND PARK, F	9.58	.00	.00
FLD004081964	SENTINEL COMMUNICATIONS CO.	ORLANDO	13.06	.00	.00
FLD984263178	SHAW AERO DEVICES, INC	FT.MYERS	12.98	.00	.00
FLD984242453	SHERWIN WILLIAMS	WINTER HAVEN	12.09	.00	.00
FLD058492166	SMI JOIST OF FLORIDA	STARKE	12.29	.00	.00
FLD040218679	SMITH AND NEPHEW UNITED, INC.	LARGO	9.56	.00	.00
FLD042398701	SPARTON ELECTRONICS FLORIDA, INC.	DELEON SPRINGS	4.21	.00	.00
FLD984194316	SUNBELT FOREST PRODUCTS CORP	BARTOW	11.89	.00	.00
FLD984176511	TALISMAN SUGAR CORP.	BELLE GLADE	3.63	.00	.00
FLD981477904	TAMPA ELECTRIC CO.	TAMPA	6.16	.00	.00
FLD085091932	TAMPA PRINTED CIRCUIT CORP.	TAMPA	12.07	.00	.00
FLD980602544	TECHNETICS CORPORATION	DELAND	10.30	.00	.00
FLD093854826	TECHNICAL PRODUCTS GROUP	DELAND	11.55	.00	.00
FLD984172700	TEXACO SERVICE STATION	KISSIMMEE	6.88	.00	.00
FLD984173302	TEXACO SERVICE STATION	ORLANDO	1.61	.00	.00
FLD984173682	TEXACO SERVICE STATION	POMPANO BEACH	1.15	.00	.00
FLD984174045	TEXACO SERVICE STATION	BOCA RATON	2.38	.00	.00

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FLORIDA

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
FLD984174276	TEXACO SERVICE STATION	INDIAN ROCKS BE	1.15	.00	.00
FLD984174532	TEXACO SERVICE STATION	NEW SYMRNA BEAC	1.38	.00	.00
FLD984180208	TEXACO SERVICE STATION	TAMPA	1.61	.00	.00
FLD984189753	TEXACO SERVICE STATION	PALM BAY	4.75	.00	.00
FLD984189944	TEXACO SERVICE STATION	ALTAMONTE SPRIN	2.37	.00	.00
FLD984189969	TEXACO SERVICE STATION	CASSELBERRY	1.38	.00	.00
FLD984190165	TEXACO SERVICE STATION	ORLANDO	2.11	.00	.00
FLD984190272	TEXACO SERVICE STATION	ORLANDO	1.73	.00	.00
FLD984190314	TEXACO SERVICE STATION	MERRIT ISLAND	3.06	.00	.00
FLD984190371	TEXACO SERVICE STATION	MELBOURNE	4.44	.00	.00
FLD984190975	TEXACO SERVICE STATION	WINTER GARDEN	2.29	.00	.00
FLD984191171	TEXACO SERVICE STATION	CASSELBERRY	1.36	.00	.00
FLD984191320	TEXACO SERVICE STATION	BOYONTON BEACH	1.38	.00	.00
FLD982113235	TRILECTRON INDUSTIES	PALMETTO	12.77	.00	.00
FLD981473606	TURBO COMBUSTOR TECHNOLOGY	STUART	5.65	.00	.00
FL1690314520	U.S. COAST GUARD BASE MAYPORT	MAYPORT	3.77	.00	.00
FLD982160228	UNIMAC	MARIANNA	1.48	.00	.00
FLD982125320	UNIVERSAL STUDIOS FLORIDA	ORLANDO	8.21	.00	.00
FLD981477664	VAC-CON, INC	GREEN COVE SPRI	12.52	.00	.00
FLD092980937	VAW OF AMERICA, INC	ST. AUGUSTINE	13.16	.00	.00
FLD097382592	VER-VAL ENTERPRISES INC.	FT. WALTON	3.25	.00	.00
FLD984166165	WALT DISNEY WORLD - FURNISHINGS	ORLANDO	11.36	.00	.00
FLD981747975	WELLCRAFT MARINE	SARASOTA	3.43	.00	.00
FLT950050989	WILDERNESS LODGE/CENTEX ROONEY	LAKE BUENA VIST	3.29	.00	.00

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FLORIDA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO CANNOT BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- LESS THAN 1.1 TONS RCRA HAZARDOUS WASTE, AND
- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
FLD130012032	ARISTECH CHEMICAL CORPORATION	BARTOW	.12	.00	.00
FLD980559728	CHEMICAL CONSERVATION CORP	ORLANDO	.00	.00	.00
FLD981932494	CITY ENVIRONMENTAL SERVICES (UNIVER	TAMPA	.00	.00	.00
FLD000776716	SAFETY -KLEEN CORP.	PORT CHARLOTTE	.00	.00	.00
FLD984171165	SAFETY KLEEN CORP.	SANFORD	.00	.00	.00

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GEORGIA

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- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
GAD003295144	ABB POWER T&D COM INC	ATHENS	28.02	.00	.00
GAD981245236	ABC COMPOUNDING CO INC	MORROW	147.33	.00	.00
GAD980709406	AEROQUIP CORPORATION	TOCCOA	24.10	.00	.00
GAD980847479	AIT ATLANTA INC	TUCKER	411.84	.00	.00
GAR000001909	ALBANY WATER GAS & LIGHT - TANK 2-D	ALBANY	63.70	.00	.00
GAD980708788	ALL-PAK INC	DECATUR	180.20	.00	.00
GAD092377589	ALLWASTE CONTAINER SERVICES	ATLANTA	32.86	.00	.00
GAO001040104	ALLWASTE CONTAINER SERVICES	CONLEY	48.88	.00	.00
GAD980803837	ALPHA METALS INC	ALPHARETTA	62.08	.00	.00
GAD033582461	ALTERNATE ENERGY RESOURCES INC	AUGUSTA	2,292.54	.00	.00
GAD981281231	AMC INTERNATIONAL INC	DALTON	20.23	.00	.00
GAR000004986	AMERADA HESS CORP - AUGUSTA STATION	AUGUSTA	26.54	.00	.00
GAD984318543	AMERADA HESS CORP - AUGUSTA STATION	AUGUSTA	18.93	.00	.00
GAD042973966	AMERADA HESS CORP - DORAVILLE TERMI	DORAVILLE	178.30	.00	.00
GAD008966400	AMERCORD INC	LUMBER CITY	3,358.00	.00	.00
GAD991289463	AMERICAN NATIONAL CAN CO	FOREST PARK	28.77	.00	.00
GAD981243777	AMERICAN WOODMARK CORP	EASTANOLLEE	14.71	.00	.00
GAD056238868	AMERICAN YARD PRODUCTS	MCRAE	33.58	.00	.00
GAD981270572	AMOCO POLYMERS INC	ALPHARETTA	14.43	.00	.00
GAD051010429	AMREP INC	MARIETTA	445.59	.00	.00
GAD065367781	ANCHOR GLASS CONTAINER	WARNER ROBINS	65.70	.00	.00
GAD051021285	APOLLO INDUSTRIES INC	SMYRNA	48.38	.00	.00
GAD981245921	ARROWHEAD ALTERNATOR INC	LOVEJOY	21.11	.00	.00
GAD041007063	ASHLAND CHEMICAL - SAVANNAH	SAVANNAH	73.51	.00	.00
GAD066465824	ASHLAND CHEMICAL COMPANY - DORAVILL	DORAVILLE	120.01	150.00	.00
GAD095854022	ASHLAND PETROLEUM COMPANY	DORAVILLE	43.82	.00	.00
GAD051022432	AT&T	NORCROSS	63.73	.00	.00
GAD093706844	ATLANTA FILM CONVERTING CO INC	ATLANTA	42.38	.00	.00
GAD030059182	ATLANTIC STEEL INDUSTRIES - CARTERS	CARTERSVILLE	14,850.90	.00	.00
GAD095815015	ATLANTIC WOOD INDUSTRIES INC	VIDALIA	13.59	.00	.00
GAD084914787	ATLANTIC WOOD INDUSTRIES-PORT WENTW	PORT WENTWORTH	200.87	.00	.00
GAD984315978	AVON PRODUCTS INC	SUWANEE	13.70	.00	.00
GAD000645895	AWH CORP - JASPER	JASPER	38.30	.00	.00
GAD048719108	AWH CORP - ROYSTON PLANT	ROYSTON	14.19	.00	.00
GAD981247489	BARD C R UROLOGICAL DIV	COVINGTON	14.38	.00	.00
GAR000000604	BASF CORP	AMERICUS	14.20	.00	.00
GAD046892824	BASSETT FURNITURE IND OF NC	MACON	14.14	.00	.00
GAD051008274	BEKAERT CORP	ROME	1,096.53	.00	.00
GAD984306845	BFI PHARMACEUTICAL SERVICES INC	CONYERS	50.49	68,741.00	.00
GAD980729974	BLUE BIRD BODY COMPANY	FORT VALLEY	74.79	.00	.00
GAD042710590	BLUE BIRD NORTH GEORGIA	LAFAYETTE	29.97	.00	.00
GAD981247984	BLUE BIRD WANDERLODGE	FORT VALLEY	18.81	.00	.00
GAD000615914	BOEING GEORGIA INC	MACON	79.41	.00	.00
GAD004060968	BROCKWAY STANDARD INC	HOMERVILLE	39.21	.00	.00
GAD082169855	BROWN & WILLIAMSON TOBACCO CORP	MACON	41.84	1.00	.00
GAD009703349	C & D POWERCOM INC	CONYERS	105.21	.00	.00
GAD075867564	CADILLAC PRODUCTS INC	ATLANTA	21.64	.00	.00
GAD981238199	CARADON INDALEX	GAINESVILLE	518.68	.00	.00
GAD981271539	CARIBBEAN LUMBER COMPANY INC	POOLER	14.95	.00	.00
GAD980556864	CENTRAL OF GEORGIA RAILROAD CO	SAVANNAH	30.55	.00	.00
GAD069223584	CERTAINTEED CORP - ATHENS	ATHENS	69.15	.00	.00
GAD004149951	CHAPARRAL BOATS INC	NASHVILLE	37.40	.00	.00
GAD065356057	CHEMCENTRAL/ATLANTA	DORAVILLE	88.99	.00	.00
GAD093380814	CHEMICAL CONSERVATION OF GA	VALDOSTA	10,034.27	.00	.00
GAD003275468	CHEMICAL PRODUCTS CORP	CARTERSVILLE	19,343.91	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
GAD980843155	CHEMICAL SPECIALTIES INC	VALDOSTA	18.67	.00	.00
GAD981267982	CHEMTRONICS INC	KENNESAW	22.94	.00	.00
GAD981268485	CHROMALLOY GEORGIA	NEWNAN	24.34	.00	.00
GAD981270226	CHROMALLOY GEORGIA	LAGRANGE	172.49	.00	.00
GAD003280872	CIRCUIT TECHNOLOGIES INC	ATLANTA	70.85	.00	.00
GAD003292877	CITGO ASPHALT REFINING COMPANY	SAVANNAH	193.27	.00	.00
GAD981021314	COIL COATERS OF AMERICA	MABLETON	209.08	.00	.00
GAD000622910	COLONIAL PIPELINE - ATHENS DELIVERY	ATHENS	42.95	.00	.00
GAD084910389	COLONIAL PIPELINE - ATLANTA JUNCTIO	POWDER SPRINGS	1,838.55	.00	.00
GAD000616557	CONOCO INC - ALBANY PRODUCTS TERMIN	ALBANY	23.35	.00	.00
GAD000616573	CONOCO INC - MACON PRODUCTS TERMINA	MACON	46.70	.00	.00
GAD088935200	COOPER TOOLS	STATESBORO	69.83	.00	.00
GAD066477142	COTTRELL INC	GAINESVILLE	52.91	.00	.00
GAD059554113	CRODA INKS CORPORATION	ATLANTA	20.02	.00	.00
GAD984297630	CROWE INDUSTRIAL COATINGS	LAWRENCEVILLE	39.05	.00	.00
GAD079362661	CROWN CENTRAL PETROLEUM - DORAVILLE	DORAVILLE	62.88	.00	.00
GAD991275900	CSX TRANSPORTATION - WAYCROSS	WAYCROSS	165.91	70.00	.00
GAD984307595	CSX TRANSPORTATION INC - SAVANNAH	SAVANNAH	35.28	.00	.00
GAD003335957	CT FILM (POLYPAC INC)	DALTON	15.99	.00	.00
GAD980602999	CUMMINS ENGINE COMPANY INC	FLOWERY BRANCH	120.35	.00	.00
GAT000002157	DEKALB PEST CONTROL	AVONDALE ESTATE	91.84	.00	.00
GAD075942706	DELPHI-E	FITZGERALD	583.56	.00	.00
GAD006924872	DELTA AIR LINES INC	ATLANTA	832.30	.00	.00
GAD003288370	DITTLER BROTHERS - ATLANTA	ATLANTA	68.57	.00	.00
GAD980709604	DITTLER BROTHERS - OAKWOOD	OAKWOOD	336.23	.00	.00
GAD000143677	DIXIE INDUTRIAL FINISHING	TUCKER	222.00	.00	.00
GA1570024306	DOBBINS ARB	DOBBINS ARB	22.63	.00	.00
GAD003294774	DOUGLAS & LOMASON COMPANY	NEWNAN	50.67	.00	.00
GAD045929643	DOW CHEMICAL COMPANY	DALTON	326.76	.00	.00
GAD000823112	DREXEL CHEMICAL CO	CORDELE	6.25	12,506.00	.00
GAD064489180	DSI TRANSPORTS INC	FAIRBURN	60.94	.00	.00
GAD051011609	DSM CHEMICALS NORTH AMERICA	AUGUSTA	3,776.20	.00	.00
GAD037875218	DURACELL USA	LAGRANGE	31.77	.00	.00
GAD981269210	DYNATRON/BONDO CORPORATION	ATLANTA	37.97	.00	.00
GAD981476831	E I DUPONT DE NEMOURS & CO INC	MARIETTA	20.59	.00	.00
GAD003302064	E-Z GO DIV OF TEXTRON INC	AUGUSTA	55.86	.00	.00
GAD000649145	EMORY UNIVERSITY	ATLANTA	63.34	.00	.00
GAD109263467	EMPAK INC	FITZGERALD	98.27	.00	.00
GAD000829028	ENGELHARD CORPORATION -GORDON PLANT	GORDON	82.73	.00	.00
GAD003279981	ENGINEERED FABRICS CORPORATION	ROCKMART	133.69	.00	.00
GAD000614347	ETHICON INC	CORNELIA	97.87	.00	.00
GAD981471535	FASHION CARE INC	SMYRNA	35.17	.00	.00
GAD066468521	FINA OIL AND CHEMICAL CO - ATLANTA	ATLANTA	392.88	.00	.00
GAD000653360	FITZGERALD RAILCAR SERVICES	FITZGERALD	108.59	.00	.00
GAD037878899	FLEX-PAK INC	ALPHARETTA	42.10	.00	.00
GAD981026388	FLINT INK	OAKWOOD	17.24	.00	.00
GAD054215652	FLINT INK CORPORATION	ATLANTA	214.97	.00	.00
GAD003305307	FORD MOTOR COMPANY ATLANTA ASSEMBLY	HAPEVILLE	1,391.80	.00	.00
GA3210020084	FORT BENNING US ARMY INFANTRY CENTE	FORT BENNING	126.91	21,854.00	.00
GA0210020368	FORT GORDON	FORT GORDON	35.27	.00	.00
GA9210020872	FORT STEWART	FT STEWART	173.19	324.00	.00
GAD099301632	FREUDENBERG-NOK - LAGRANGE	LAGRANGE	13.77	.00	.00
GAD082827452	FRIGIDAIRE COMPANY - MICROWAVE PROD	DALTON	42.35	.00	.00
GAD984275305	FRITO-LAY INC	KATHLEEN	22.19	.00	.00
GAR000002832	FULGHUM INDUSTRIES INC	WADLEY	15.62	.00	.00

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- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
GAT000002112	GA DOT - IM-STP-MS(22)01 - CHATHAM	GARDEN CITY	14.00	.00	.00
GAT000002207	GA DOT - IM-085-1(363)01	GAINESVILLE	18.50	.00	.00
GAT000002147	GA DOT - IM-16-1(120) - BRYAN	DENMARK	26.40	.00	.00
GAT000002206	GA DOT - IM-16-1(122) - BLECKLEY	DUBLIN	20.00	.00	.00
GAT000002209	GA DOT - IM-20-2(159)	MADISON	21.50	.00	.00
GAT000002194	GA DOT - IM-75-3(218)	CARTERSVILLE	19.00	.00	.00
GAT000002114	GA DOT - IM-75-3(218) - BARTOW	CARTERSVILLE	19.00	.00	.00
GAT000002215	GA DOT - IM-85-2(152)	CARNESVILLE	53.00	.00	.00
GAT000002140	GA DOT - STP-MS(11)01	LAGRANGE	15.00	.00	.00
GAT000002221	GA DOT - STP-MS(37) - CLARKE	ATHENS	22.00	.00	.00
GAT000002186	GA DOT - STP-MS(48) - DEKALB	TUCKER	19.50	.00	.00
GAT000002208	GA DOT - STP-MS(57)01	DALTON	13.50	.00	.00
GAD000612663	GA POWER CO - PLANT HAMMOND	COOSA	30.73	.00	.00
GAD984304055	GE CAPITAL TECHNOLOGY MANAGEMENT SE	NORCROSS	27.66	.00	.00
GAD981027147	GEIGER INTERNATIONAL	ATLANTA	76.73	.00	.00
GAD000226431	GENERAL AMERICAN TRANSPORTATION COR	WAYCROSS	2,969.65	.00	.00
GAD003308145	GENERAL ELECTRIC COMPANY	ROME	51.63	.00	.00
GAD003310810	GENERAL MOTORS CORP - DORAVILLE PLA	DORAVILLE	710.71	.00	.00
GAD057297400	GENERAL TIME CORPORATION	ATHENS	21.30	.00	.00
GAD003321619	GEORGIA INSTITUTE OF TECHNOLOGY	ATLANTA	24.42	.44	.00
GAD980515647	GEORGIA PACKAGING INC	COLUMBUS	48.34	.00	.00
GA0000107169	GEORGIA PLATING	COVINGTON	15.39	.00	.00
GAD000612945	GEORGIA POWER CO - PLANT MCDONOUGH	SMYRNA	46.49	.00	.00
GAD073425951	GEORGIA STATE UNIVERSITY	ATLANTA	17.75	1,415.00	.00
GAD072483431	GEORGIA WOOD PRESERVING COMPANY INC	CRAWFORDVILLE	207.71	.00	.00
GA0000971374	GEORGIA'S STONE MOUNTAIN PARK	STONE MOUNTAIN	14.64	.00	.00
GAD003271905	GEORGIAN ART LIGHTING DESIGNS INC	LAWRENCEVILLE	68.63	.00	.00
GAD984321489	GLOVES, INC	AUSTELL	37.70	.00	.00
GAD070330576	GNB TECHNOLOGIES INC	COLUMBUS	8,575.26	.00	.00
GAR000001321	GOLD KIST FARM SYSTEMS CENTER	COMMERCE	.63	1,257.68	.00
GAD000640953	GRAY DISTRIBUTION SERVICES	ASHBURN	313.40	.00	.00
GAD003326840	GREAT DANE TRAILERS INC	SAVANNAH	166.08	.00	.00
GAD092384874	GREAT SOUTHERN PAPER CO - CEDAR SPR	CEDAR SPRINGS	2.61	785.00	.00
GAD981216674	GREAT SOUTHERN WOOD PRES	CONYERS	18.15	.00	.00
GAD073440950	GREENFIELD INDUSTRIES INC	EVANS	32.89	.00	.00
GAD000813691	GRIFFIN CORP	VALDOSTA	16.10	.00	.00
GAD078106846	GRUMMAN AEROSPACE CORP	MILLEDGEVILLE	52.21	.00	.00
GAD061022216	GULFSTREAM AEROSPACE CORPORATION	SAVANNAH	220.79	.00	.00
GAD981014491	H B FULLER COMPANY	COVINGTON	84.60	.00	.00
GAD115319204	HARRIS CALORIFIC DIVISION	GAINESVILLE	71.80	.00	.00
GAD981226541	HAYES WHEELS INTERNATIONAL	GAINESVILLE	29.89	.00	.00
GAD046910915	HELENA CHEMICAL COMPANY	CORDELE	17.04	7,192.00	.00
GAD990741092	HENKEL CORPORATION	CEDARTOWN	44.52	.00	.00
GAD981229305	HERCULES AUTOMOTIVE PRODUCTS INC	PELHAM	120.40	.00	.00
GAD004065520	HERCULES INC - BRUNSWICK	BRUNSWICK	23.53	25.00	.00
GAD000821934	HICKSON CORPORATION	CONLEY	424.64	.00	.00
GAD000603605	HIGHWAY TRANSPORT INC	MORROW	47.18	.00	.00
GA4210022733	HUNTER ARMY AIRFIELD	SAVANNAH	130.64	125.00	.00
GA0000081281	HURON TECH CORP	AUGUSTA	97.96	.00	.00
GAD984293456	INFLATION SYSTEMS INC	LAGRANGE	32.37	10.00	.00
GAD981241565	INTERMARINE USA	SAVANNAH	72.86	.00	.00
GAD980842975	INTERMETRO INDUSTRIES CORP	DOUGLAS	7,777.24	.00	.00
GAD003285665	JEFFERSON SMURFIT CORP US	STONE MOUNTAIN	345.39	.00	.00
GAD097395693	KASON INDUSTRIES INC	SHENANDOAH	47.94	.00	.00
GAD981236441	KATO SPRING OF GEORGIA INC	DULUTH	35.39	.00	.00

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GEORGIA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
GAD981242613	KAWNEER COMPANY INC	JONESBORO	72.28	.00	.00
GAD981237878	KIMOTO TECH INC	CEDARTOWN	87.14	.00	.00
GAD981474059	KOBELCO AMERICA INC	CALHOUN	44.92	.00	.00
GAD981262462	KUBOTA MFG OF AMERICA	GAINESVILLE	176.80	.00	.00
GAD047591557	KYSOR WARREN	CONYERS	33.08	.00	.00
GAD981469224	KYSOR/WARREN COLUMBUS DIVISION	COLUMBUS	60.33	.00	.00
GAR000004614	LAGRANGE MOULDING COMPANY	LAGRANGE	167.86	.00	.00
GA0000263343	LAGRANGE PLASTICS COMPANY	LAGRANGE	235.15	.00	.00
GAD003300506	LANGDALE FOREST PRODUCTS CO	VALDOSTA	138.74	.00	.00
GAD033817354	LAURENCE-DAVID INC	CONYERS	38.61	.00	.00
GAD091534776	LEVOLOR HOME FASHIONS DEL MAR DIV	ATHENS	19.92	.00	.00
GAD981472673	LINEAR DYNAMICS INC	BALL GROUND	94.50	.00	.00
GAD981243843	LITHO-KROME COMPANY	COLUMBUS	17.71	.00	.00
GA8570024606	LOCKHEED MARTIN AERONAUTICAL SYSTEM	MARIETTA	696.30	.00	.00
GAD042216549	LPS LABORATORIES	TUCKER	48.27	.00	.00
GAD000735928	MARATHON OIL COMPANY - COLUMBUS	COLUMBUS	246.72	.00	.00
GAD000814400	MARATHON OIL COMPANY - DORAVILLE	DORAVILLE	67.24	.00	.00
GAD097799290	MARATHON OIL COMPANY - MACON	MACON	523.09	.00	.00
GA7170023694	MARINE CORPS LOGISTICS BASE	ALBANY	1,159.01	173.00	.00
GAD991303991	MARTA BROWNS MILL HEAVY MAINTENANCE	ATLANTA	30.86	.00	.00
GAD980803860	MATLACK INC	MORROW	16.82	.00	.00
GAD984311860	MATSUSHITA STORAGE BATTERY CO	COLUMBUS	244.89	.00	.00
GAD981255276	MATSUSHITA-ULTRA TECH BATTERY	COLUMBUS	1,095.87	.00	.00
GAD003277191	MAYO CHEMICAL COMPANY INC	SMYRNA	534.48	.00	.00
GAD073423881	MCGEAN-ROHCO INC	ATLANTA	31.46	.00	.00
GAD981260151	MCNEILUS TRUCK & MFG INC	VILLA RICA	31.45	.00	.00
GAD000613240	MCWHORTER TECHNOLOGIES	COLUMBUS	95.67	.00	.00
GAD084823301	MCWHORTER TECHNOLOGIES INC	FOREST PARK	4,589.67	.00	.00
GAD000609818	MEDICAL COLLEGE OF GEORGIA	AUGUST	15.22	36.70	.00
GAD003324985	MERCK & CO INC	ALBANY	6,033.37	.00	.00
GAD000827873	METAL COATERS OF GEORGIA INC	MARIETTA	306.30	.00	.00
GAD114381403	MICRO FLO COMPANY	SPARKS	26.10	52,200.00	.00
GAD981275993	MILLIKEN & CO - HILLSIDE COATING	LAGRANGE	18.14	.00	.00
GAD000821967	MILLIKEN & CO - LIVE OAK PLANT CARP	LAGRANGE	354.49	.00	.00
GAD003306750	MONROE AUTO EQUIPMENT CO	HARTWELL	267.30	.00	.00
GAD001700699	MONSANTO COMPANY	AUGUSTA	76.40	.00	.00
GA0570024109	MOODY AIR FORCE BASE	MOODY AIR FORCE	49.37	.00	.00
GAD981265366	MUNEKATA AMERICA INC	DALTON	27.33	.00	.00
GAD981264658	NAKANISHI MFG CORP	WINTERVILLE	18.00	.00	.00
GAD981234248	NAMPAC	TOCCOA	16.29	.00	.00
GA4170090001	NAVAL SUBMARINE BASE	KINGS BAY	145.73	.00	.00
GAD980845150	NAZDAR/KC ATLANTA	NORCROSS	35.12	.00	.00
GAR000004325	NCF MANUFACTURING INC	RICEBORO	69.83	.00	.00
GAD980726491	NORAMCO INC	ATHENS	906.87	.00	.00
GAD984319848	NORFOLK SOUTHERN RAILWAY CO	ATLANTA	16.45	.00	.00
GAD981264500	NORTHORP CORPORATION	PERRY	15.71	.00	.00
GAD097392971	NORTHWEST AIRLINES	ATLANTA	440.76	.00	.00
GAD040690737	OLIN CORPORATION	AUGUSTA	287.39	.00	.00
GAD106680002	OMC-CALHOUN	CALHOUN	172.50	.00	.00
GAD981278302	ONEDA CORPORATION	COLUMBUS	16.85	.00	.00
GAD981231970	OPTIMA CHEMICALS INC	DOUGLAS	46.95	.00	.00
GAD980556740	OWENS CORNING	FAIRBURN	59.01	.00	.00
GAR000001123	PACKAGING PRODUCTS CORP	ROME	50.80	.00	.00
GAD097800205	PAKTANK CORP - SAVANNAH TERMINAL	GARDEN CITY	26.31	.00	.00
GAD981236573	PARMARCO SOUTHERN INC	ATLANTA	101.86	.00	.00

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GEORGIA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
GAD000649137	PHILLIPS PIPE LINE COMPANY	DORAVILLE	140.95	.00	.00
GAD000609826	PHILLIPS PIPE LINE COMPANY - ALBANY	ALBANY	184.57	.00	.00
GAD095811162	PHOTOCIRCUITS CORPORATION	PEACHTREE CITY	4,237.56	.00	.00
GAD984318899	PHOTOCIRCUITS CORPORATION	PEACHTREE CITY	563.19	.00	.00
GAD131327546	PIEDMONT LABORATORIES INC	GAINESVILLE	677.88	.00	.00
GAD061401501	PIEDMONT MOULDING CO INC	CONYERS	20.60	.00	.00
GAD049702046	PIEDMONT PAINTS & PRIMERS INC	TOCCOA	184.42	.00	.00
GAD042825745	PLANTATION PIPE LINE CO - BREMEN	BREMEN	108.33	.00	.00
GAD065328056	PLICON - COLUMBUS PACKAGING	COLUMBUS	77.80	.00	.00
GAD981275449	POLYCHROME CORPORATION	COLUMBUS	137.85	.00	.00
GAD040673469	POLYFIBRON TECHNOLOGIES INC	ATLANTA	306.68	.00	.00
GAD075876623	PPG ARCHITECTURAL FINISHES INC	EAST POINT	1,795.53	.00	.00
GAD981267677	PPG INDUSTRIES INC	PERRY	966.03	.00	.00
GAD980839187	PPM INC OF GEORGIA	TUCKER	126.98	.00	.00
GAD980711816	PRATT & WHITNEY	COLUMBUS	219.42	.00	.00
GAD088940598	PRESTOLITE WIRE CORP	TIFTON	23.03	.00	.00
GAD003274545	PRINTPACK INC	ATLANTA	793.51	.00	.00
GAD981241300	PRINTPACK INC	VILLA RICA	101.19	.00	.00
GAD981256696	QUAD/GRAPHICS INC	THOMASTON	22.67	.00	.00
GAD984318568	QUALA SYSTEMS INC - ATLANTA	JONESBORO	14.63	.00	.00
GAD000603597	RAYLOC	ATLANTA	57.20	.00	.00
GAD048708044	RECKITT & COLMAN INC	ATLANTA	499.86	.00	.00
GAD096634910	RHONE-POULENC INC	WINDER	20.18	.00	.00
GAD003268885	RHONE-POULENC INC - MARIETTA	MARIETTA	187.27	.00	.00
GAD030035356	RHONE-POULENC INC WOODBINE PLANT	WOODBINE	334.70	429,512.00	.00
GAD073446965	RICO COATINGS INC	TOCCOA	107.46	.00	.00
GAD980601728	RINGIER AMERICA INC	EVANS	185.01	.00	.00
GAD067009670	ROBERT BOSCH CORP	LITHIA SPRINGS	146.42	.00	.00
GA1570024330	ROBINS AIR FORCE BASE	WARNER ROBINS	2,115.82	.00	.00
GAD063152573	SAFT AMERICA INC	VALDOSTA	232,265.01	.00	.00
GAD003305125	SAVANNAH PAINT MFG	SAVANNAH	392.74	.00	.00
GAD064494040	SCHOLLE CORPORATION	COLLEGE PARK	82.61	.00	.00
GAD984307801	SCIENTIFIC GAMES INC	ALPHARETTA	214.60	.00	.00
GAD003480530	SCOVILL FASTENERS INC	CLARKESVILLE	241.49	.00	.00
GAD039046800	SEARLE	AUGUSTA	11,169.96	.00	.00
GAD118273945	SHEBOYGAN PAINT CO	CEDARTOWN	23.43	.00	.00
GAD042869057	SHERWIN WILLIAMS - MORROW	MORROW	1,453.73	.00	.00
GAD981233463	SHERWIN-WILLIAMS	BUFORD	22.61	.00	.00
GAD095846614	SHOREWOOD PACKAGING CORP	LAGRANGE	31.69	.00	.00
GAD086961620	SIEMENS ENERGY & AUTOMATION	TUCKER	166.47	.00	.00
GAD003265527	SIMMONS PLATING WORKS INC	ATLANTA	22.46	.00	.00
GA0000575696	SLEEVECO INC	DAWSONVILLE	66.50	.00	.00
GAD981253289	SMITHKLINE BEECHAM CLINICAL LABORAT	TUCKER	13.82	.00	.00
GAD065365603	SNYDER BROTHERS CO INC	TOCCOA	170.21	.00	.00
GAD980515241	SONY MUSIC ENTERTAINMENT INC	CARROLLTON	104.68	.00	.00
GAD000609891	SOUTHEAST TERMINAL - ATHENS	ATHENS	18.76	.00	.00
GAD980798623	SOUTHERN GRAPHIC SYSTEMS INC	ATLANTA	33.00	.00	.00
GAD981024458	SOUTHERN STATES GALVANIZING	CLAXTON	587.24	.00	.00
GAD051034387	SOUTHERN WOOD PIEDMONT CO - AUGUSTA	AUGUSTA	18,698.60	.00	.00
GAD067560870	SOUTHERN WOOD PIEDMONT CO - EAST PO	EAST POINT	57.30	.00	.00
GAD003264421	SOUTHWIRE COMPANY	CARROLLTON	46.98	.00	.00
GAD981265267	SOUTHWIRE COMPANY GEORGIA WIRE PROD	MACON	349.09	.00	.00
GAD000814541	SOUTHWIRE COPPER DIVISION	CARROLLTON	637.65	.00	.00
GAR000001438	SOUTHWIRE/JERRY COOK PROPERTY	CARROLLTON	1,391.60	.00	.00
GAD984299529	SOUTHWIRE/OAK MOUNTAIN ACADEMY	CARROLLTON	18.30	.00	.00

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GEORGIA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
GAR000004549	SOUTHWIRE/PATTERSON PROPERTY	CARROLLTON	1,539.10	.00	.00
GAR000000901	SOUTHWIRE/STRIPLING CHAPEL RD	CARROLLTON	80.98	.00	.00
GAD033585985	ST SERVICES	AUGUSTA	41.23	.00	.00
GAD981274061	STEVENS AVIATION FFC	PEACHTREE CITY	368.57	.00	.00
GAD033885633	STOFFEL SEALS CORPORATION	TALLAPOOSA	29.70	.00	.00
GAD003298684	SUN CHEMICAL CORP	ATLANTA	14.20	.00	.00
GA0000486498	SUPERMARKET INFORMATION SYSTEMS INC	ATLANTA	23.21	.00	.00
GAD984285445	SURECO INC	FT VALLEY	.02	33.34	.00
GAD082828716	SWAINSBORO ELECTROPLATING	SWAINSBORO	47.80	.00	.00
GAD047941331	TEXACO/STAR ENTERPRISE TERM - BAINB	BAINBRIDGE	215.41	.00	.00
GAD069176261	TEXACO/STAR ENTERPRISE TERM - DORAV	DORAVILLE	225.05	.00	.00
GAD980803621	TEXTRON AEROSPACE PRODUCTS	COLUMBUS	1,186.56	.00	.00
GAD080107873	TEXTRON AUTOMOTIVE COMPANY	AMERICUS	424.08	.00	.00
GAD981273915	THE DUPONT MERCK PHARMACEUTICAL COM	DULUTH	10.38	6,118.00	.00
GAD981237118	THE NUTRASWEET COMPANY	AUGUSTA	23,666.45	.00	.00
GA0000054726	THE SHERWIN WILLIAMS CO - LAGRANGE	LAGRANGE	486.38	.00	.00
GAD065344301	THE TORRINGTON COMPANY	SYLVANIA	53.41	.00	.00
GA0000999805	THE UNIVERSITY OF GEORGIA/GA0000999	ATHENS	38.79	134.00	.00
GAD003273224	THE WILLIAM L BONNELL CO INC	NEWNAN	25,154.92	.00	.00
GAD003280807	THERMAL CERAMICS	AUGUSTA	10.32	45.00	.00
GAD004501862	THERMO KING CORP	LOUISVILLE	31.84	.00	.00
GAD981025265	THRALL CAR MANUFACTURING CO	CARTERSVILLE	249.98	.00	.00
GAD087519997	THRALL CAR MFG CO - WINDER	WINDER	296.04	.00	.00
GAD003484607	TIFTON ALUMINUM COMPANY	TIFTON	79.04	.00	.00
GAD981233356	TOPPAN INTERAMERICA INC	MCDONOUGH	176.71	.00	.00
GAD047958343	TRENT TUBE	CARROLLTON	273.30	.00	.00
GAD033842543	TRI-STATE STEEL DRUM INC	GRAYSVILLE	3,488.50	.00	.00
GAD981266380	TROJAN BATTERY CO	LITHONIA	171.32	.00	.00
GAD991291352	U S CAN COMPANY	TALLAPOOSA	171.45	.00	.00
GAD003275252	UNION CAMP - SAVANNAH	SAVANNAH	1,086.64	.00	.00
GAD003299526	UNION CAMP CORPORATION	VALDOSTA	823.45	.00	.00
GAD981221195	UNION CAMP CORPORATION - GRIFFIN	GRIFFIN	50.18	.00	.00
GAD981236490	UNION TANK CAR COMPANY	VALDOSTA	32.50	.00	.00
GAD981221419	UNITED PARCEL SERVICE	DORAVILLE	3.71	7,430.00	.00
GAD056238264	UNOCAL CORPORATION	SAVANNAH	134.91	.00	.00
GAD980845077	VAN WATERS & ROGERS INC	NORCROSS	26.47	.00	.00
GAD093383016	VANTAGE PRODUCTS CORPORATION	CONYERS	44.93	.00	.00
GAD981022031	VANTAGE PRODUCTS CORPORATION	COVINGTON	94.43	.00	.00
GAD033870585	VININGS INDUSTRIES	MARIETTA	44.12	.00	.00
GAD000143636	W R GRACE & CO - CONN	ATLANTA	97.40	.00	.00
GA0001038090	WAL-MART RETURN CENTER #9194	MACON	112.51	.00	.00
GAD003264256	WATTYL PAINT CORPORATION	ATLANTA	81.09	.00	.00
GAD984322503	WHITAKER OIL COMPANY	ATLANTA	49.58	.00	.00
GAD003323805	WILLIAM C MEREDITH CO INC	EAST POINT	3,144.87	.00	.00
GA0000973644	WOOD PROTECTION PRODUCTS	CAMILLA	1.13	2,270.00	.00
GAD981264880	YAMAHA MOTOR MFG CORP	NEWNAN	71.86	.00	.00
GAD099305989	YAMAHA MUSIC MANUFACTURING INC	THOMASTON	55.11	.00	.00
GAD981273659	YDK AMERICA INC	CANTON	102.75	.00	.00
GAD984304014	YKK AP AMERICA INC	DUBLIN	120.90	.00	.00
GAD069199628	YKK USA INC - OCMULGEE SIT	MACON	134.13	.00	.00
GAD003267192	ZEP MANUFACTURING COMPANY	ATLANTA	225.50	3,300.00	.00
GAD980500227	3M ATLANTA SALES CENTER	ATLANTA	27.90	.00	.00

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GEORGIA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
GAR000003517	A T & T CORP	COLUMBUS	4.28	.00	.00
GAD981236847	A T & T FITEL CO	CARROLLTON	9.66	.00	.00
GAD003480183	AKZO NOBEL COATINGS INC	NORCROSS	11.89	.00	.00
GAD981022064	ALLWASTE CONTAINER SERVICES	COLUMBUS	2.06	.00	.00
GAR000004978	AMERADA HESS CORP - AUGUSTA	AUGUSTA	1.88	.00	.00
GAD984269613	AMERICAN INDUSTRIAL CHEMICAL CORP	SMYRNA	4.31	.00	.00
GAD981238603	ATLANTA GAS LIGHT CO - GARAGE	ATLANTA	9.85	.00	.00
GA0000903898	BACOVA GUILD OF GEORGIA	DALTON	11.36	.00	.00
GAD073421695	BASSETT FURNITURE IND OF NC INC	DUBLIN	8.60	.00	.00
GAD057281156	BETZ LABORATORIES INC	MACON	1.25	.00	.00
GAD042125146	BLACKMAN UHLER CHEMICAL CO	AUGUSTA	2.31	.00	.00
GAR000004333	BPS EQUIPMENT RENTAL & SALES	ATLANTA	3.58	.00	.00
GAR000000869	CAMPBELL HIGH SCHOOL - COBB CTY BOE	SMYRNA	2.93	.00	.00
GAD981244429	CARRIER TRANSICOLD	ATHENS	5.34	.00	.00
GAD984310755	CELLO-FOIL PRODUCTS INC	ALBANY	8.77	.00	.00
GAD037881539	CIBA VISION CORP	ATLANTA	8.16	.00	.00
GAD984307637	CONEX OF GEORGIA INC	GREENSBORO	2.29	.00	.00
GAD000827410	CROWN BEVERAGE PACKAGING	ATLANTA	2.58	.00	.00
GAD049714579	CROWN CENTRAL PETROLEUM - COLUMBUS	COLUMBUS	7.51	.00	.00
GAD981235823	DENON DIGITAL INDUSTRIES	MADISON	10.92	.00	.00
GAD075869248	DOUGLAS & LOMASON CO	CARROLLTON	7.51	.00	.00
GAD981249949	ELITE COATINGS	GORDON	9.60	.00	.00
GA6202932244	FEDERAL LAW ENFORCEMENT TRAINING CE	GLYNCO	9.13	.00	.00
GAR000004747	FINEWRAP USA INC	DALTON	3.45	.00	.00
GAD981267735	FREUDENBERG NOK - CLEVELAND	CLEVELAND	11.05	.00	.00
GA0000080408	FUJI PHOTO FILM USA INC	DULUTH	5.99	.00	.00
GAT000002214	GA DOT - IM-MS(24)01 - DADE	TRENTON	4.80	.00	.00
GAT000002219	GA DOT - IM-20-2(157)	THOMSON	10.50	.00	.00
GAT000002210	GA DOT - NH-IM-95-1(09)01	RICHMOND HILL	2.50	.00	.00
GAT000002212	GA DOT - NH-IM-95-1(109)01	RICHMOND HILL	2.50	.00	.00
GAT000002189	GA DOT - NH-75-1(155)01	UNADILLA	3.00	.00	.00
GAT000002188	GA DOT - NH-75-1(155)01 - DOOLY	UNADILLA	3.00	.00	.00
GAT000002187	GA DOT - NH-75-1(155)01- DOOLY HOUS	UNADILLA	3.00	.00	.00
GAT000002113	GA DOT - STP-MS(11)01	LAGRANGE	1.25	.00	.00
GAT000002154	GA DOT - STP-MS(19)01	STONE MOUNTAIN	2.00	.00	.00
GAT000002153	GA DOT - STP-MS(19)01 FULTON	DULUTH	3.25	.00	.00
GAT000002205	GA DOT - STP-MS(47)01	NAHUNTA	2.00	.00	.00
GAT000002196	GA DOT - STP-MS(58)01 - DOUGHERTY	ALBANY	2.00	.00	.00
GAT000002195	GA DOT - STP-MS-(52)01 - BANKS	CORNELIA	13.00	.00	.00
GA0000479493	GATE CITY EQUIPMENT CO INC	ROSWELL	1.89	.00	.00
GAD984303032	GE ATLANTA APPARATUS SVC CENTER-CHA	CHAMBLEE	2.90	.00	.00
GAD003300878	GE ATLANTA APPARATUS SVC CTR	CHAMBLEE	5.45	5.00	.00
GAD042962001	GEORGIA POWER CO - PLANT YATES	NEWNAN	4.58	.00	.00
GAD060662301	GEORGIA POWER COMPANY - GENERAL SVC	FOREST PARK	12.54	.00	.00
GAD000742726	GOODY PRODUCTS INC	MANCHESTER	7.61	.00	.00
GAD980556906	HERCULES INC 009 LANDFILL	BRUNSWICK	2.01	.00	.00
GAD098583909	HERCULES INC- OXFORD PLT	COVINGTON	6.09	10.00	.00
GAD054204482	HUBB ENTERPRISES CO	ATLANTA	2.48	.00	.00
GAD003913159	JAMES RIVER CORPORATION	NEWNAN	4.28	.00	.00
GAD981225006	JERVIS B WEBB COMPANY OF GEORGIA	MARIETTA	3.30	.00	.00
GAD048696421	KENDALL COMPNAY - AUGUSTA PLANT	AUGUSTA	.40	6.01	.00
GAR000000885	LEE COUNTY HOUSING AUTHORITY	LEESBURG	5.00	.00	.00
GAD030058713	LUCENT TECHNOLOGIES	ATLANTA	10.84	.00	.00
GAD000735910	MARATHON OIL COMPANY - POWDER SPRIN	POWDER SPRINGS	4.34	.00	.00
GAD991302340	MARTA AVONDALE RAIL MAINTENANCE FAC	DECATUR	12.18	.00	.00

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GEORGIA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
GAD981022197	MARTA LAREDO BUS OPERATING SHOP	DECATUR	9.11	.00	.00
GAD033689282	MCCONNELL DRUM SERVICE	DORAVILLE	4.52	.00	.00
GAD984320986	METAL CONTAINER CORP	ROME	2.77	.00	.00
GAD072473622	METCAM INC	ALPHARETTA	7.88	.00	.00
GAT000002141	NORFOLK SOUTHERN RAILWAY CO -STOCKB	STOCKBRIDGE	5.63	.00	.00
GAD984295659	OKI TELECOM	SUWANEE	9.90	.00	.00
GAD003295243	OWENS-BROCKWAY GLASS CONTAINER INC	ATLANTA	12.57	.00	.00
GAD981237183	PARKER AMCHEM/HENKEL CORP	CALHOUN	5.11	.00	.00
GAD018916734	PRECISION CASTPARTS CORP	DOUGLAS	8.80	.00	.00
GA0001005511	PRECISION COMPONENTS INTL INC	COLUMBUS	6.30	.00	.00
GAD003308335	PRODUCTION ANODIZING CORP	ADEL	4.75	.00	.00
GAR000000588	PRUITT TRUCK SALES	MARIETTA	1.70	.00	.00
GAD984318360	QUALA SYSTEMS INC - AUGUSTA	AUGUSTA	2.91	.00	.00
GA0000263327	QUALA SYSTEMS INC - SAVANNAH	GARDEN CITY	3.28	.00	.00
GA0000988816	R MICHAEL WARREN	PORTERDALE	1.90	.00	.00
GAD984308312	REEDSPECTRUM	LAWRENCEVILLE	2.91	.00	.00
GAD063777197	REICHHOLD CHEMICALS INC	CHICKAMAUGA	2.57	.00	.00
GAD981282338	REVEST INC	ATLANTA	10.16	.00	.00
GAD003304862	RIVERWOOD INTERNATIONAL USA	MACON	6.43	.00	.00
GAD003264850	ROPER PUMP COMPANY	COMMERCE	10.54	.00	.00
GAD981269004	RUMMEL STAMPINGS	ROME	1.52	.00	.00
GAD000776781	SAFETY-KLEEN CORP - GARDEN CITY	GARDEN CITY	1.11	.00	.00
GAD980842777	SAFETY-KLEEN CORP - NORCROSS	NORCROSS	4.09	.00	.00
GAD047590476	SCHULLER INTERNATIONAL INC	WINDER	10.12	.00	.00
GAT000002148	SEARS UNIT #2135	ATLANTA	1.15	.00	.00
GAR000001925	SEARS UNIT #8016	COLUMBUS	2.01	.00	.00
GAD981241581	SHADE ALLIED INC	OAKWOOD	5.24	.00	.00
GAR000003384	SHAW INDUSTRIES INC #78	TOCCOA	2.45	.00	.00
GAD000609917	SOUTHEAST TERMINAL - BAINBRIDGE	BAINBRIDGE	1.15	.00	.00
GAD981469281	SOUTHEAST TERMINAL - LOOKOUT	LOOKOUT MOUNTAI	2.27	.00	.00
GAD980708762	TDK COMPONENTS USA INC	PEACHTREE CITY	10.71	.00	.00
GAD000613794	TENNECO PLASTICS COMPANY	COVINGTON	3.03	.00	.00
GAD046901427	THE GLIDDEN COMPANY	ATLANTA	2.45	.00	.00
GAD981268113	THE VALVOLINE CO	COLLEGE PARK	3.60	.00	.00
GAD003323482	THOMASTON MILLS INC - FINISHING DIV	THOMASTON	2.13	.00	.00
GAD042703215	THOMASTON MILLS INC - GRIFFIN DIV	GRIFFIN	1.20	.00	.00
GAD981226632	TOCCOA CASKET CO	TOCCOA	5.67	.00	.00
GAD033823386	TOLLESON LUMBER COMPANY INC	PERRY	4.25	.00	.00
GAD981221229	TRANSCONTINENTAL GAS PIPE LINE CORP	COMER	1.96	.00	.00
GAD064541568	UNION CARBIDE CORP	TUCKER	2.72	.00	.00
GAR000002774	UTILITY SERVICE - THOMASVILLE	THOMASVILLE	2.40	.00	.00

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GEORGIA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO CANNOT BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- LESS THAN 1.1 TONS RCRA HAZARDOUS WASTE, AND
- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
GAD000222083	ENSCO ENVIRONMENTAL SERVICES	DALTON	.00	.00	.00
GAT000002220	GA DOT - IM-75-2(191)01 - JACKSON	JACKSON	.50	.00	.00
GAT000002139	GA DOT - STP-IM-MS(18)01	MARIETTA	.00	.00	.00
GA0000004556	MCA SITE	ATLANTA	.00	.00	.00
GAD000823096	SAFETY-KLEEN CORP - COLUMBUS	COLUMBUS	.05	.00	.00
GAD981265424	SAFETY-KLEEN CORP - MORROW	MORROW	.00	.00	.00
GAD073460941	THE UNIVERSITY OF GEORGIA/GAD073460	ATHENS	.00	.00	.00

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GUAM

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
GUD982469462	GUAM MEMORIAL HOSPITAL AUTHORITY	TAMUNING	.49	258.00	.00
GU6571999519	USAF ANDERSEN AIR FORCE BASE	YIGO	40.57	.00	.00
GU5170022680	USNAVY PUBLIC WORKS CTN	PWC	112.76	.00	.00
GU4170027334	USNAVY SHIP REPAIR FACILITY GUAM	NAVAL ACTIVITIE	43.74	31.00	.00
GU4170090027	USNAVY US FLEET AND INDUSTRIAL SUPP	SUMAY DRIVE	39.03	.00	.00
GU7170027323	USNAVY US NAVAL ACTIVITIES GUAM	SANTA RITA	39.12	.00	.00

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GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
GU0170090021	USNAVY NCTAMS WESTPAC GUAM	DEDEDEO	10.10	.00	.00
GU4170090001	USNAVY PUBLIC WORKS CTN	PITI	3.16	.00	.00
GUT000010009	USNAVY SHELL AGAT TERMINAL	AGAT	2.51	.00	.00
GU3170090028	USNAVY US FLEET AND INDUSTRIAL SUPP	VILLAGE OF PITI	4.48	.00	.00
GU9170090022	USNAVY US NAVAL HOSPITAL GUAM	AGANA HEIGHTS	2.29	20.00	.00

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REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO CANNOT BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- LESS THAN 1.1 TONS RCRA HAZARDOUS WASTE, AND
- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
GU6170027316	DEFENSE REUTILIZATION MARKETING	NAVAL ACTIVITIE	.00	.00	.00
GU0170090013	USNAVY NAVAL ACTIVITIES GUAM	FPO AP	.39	.00	.00

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HAWAII

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
HID066272360	BHP GAS CO SNG PLANT	KAPOLEI	15.36	.00	.00
HID056786395	BHP PETROLEUM AMERICAS REFINING INC	KAPOLEI	591,157.91	442.00	.00
HIT160010005	CHEVRON PRODUCTS CO HAWAII REFINERY	KAPOLEI	42.36	3,628.00	.00
HIR000000224	COSTCO WHOLESALE NO 11	HONOLULU	53.09	.00	.00
HIR000000067	COSTCO WHOLESALE NO 119	KAHULUI	20.56	.00	.00
HI0000880542	COSTCO WHOLESALE NO 120	HONOLULU	27.99	.00	.00
HID984470112	GASCO INC PIER 38	HONOLULU	79.98	.00	.00
HID981581788	HAWAIIAN WESTERN STEEL LTD	EWA BEACH	20.87	.00	.00
HI0000705061	KEWALO INCINERATOR	HONOLULU	28.65	.00	.00
HID981164569	MIDPAC LUMBER CO LTD	HONOLULU	58.87	.00	.00
HID009158114	OAHU SUGAR CO LTD	WAIPAHU	2.93	200.00	.00
HID981574809	STATE OF HAWAII HWY DIV	HILO	46.48	.00	.00
HI8570028722	USAF HICKAM AIR FORCE BASE	HICKAM AFB	99.71	2,709.00	.00
HI0000243618	USAG HI EAST RANGE	SCHOFIELD BARRA	43.83	.00	.00
HI3210022239	USAG SCHOFIELD BARRACKS	SCHOFIELD BARRA	72.72	.00	.00
HI1170024342	USDOD FLEET AND INDUSTRIAL SUPPLY	PEARL HARBOR	15.18	.00	.00
HI6170022762	USMC BASE HAWAII	KANEOHE MCBH	93.61	.00	.00
HI1170024326	USNAVY NAS BARBERS POINT	BARBERS POINT	45.31	14.00	.00
HI9170090006	USNAVY NAVAL MAGAZINE LUALUALEI	EWA BEACH	76.60	.00	.00
HI3170024340	USNAVY NAVAL SUBMARINE BASE PEARL H	PEARL HARBOR	56.05	13.00	.00
HI6170024339	USNAVY PEARL HARBOR NAVAL SHIPYARD	PEARL HARBOR	420.76	66.00	.00
HI0000449199	USNAVY PUBLIC WORKS CNTR	PEARL HARBOR	15.39	.00	.00
HI1170024334	USNAVY PUBLIC WORKS CNTR	PEARL HARBOR	190.05	34.00	.00
HIT000610873	WAIAU GENERATING STA	PEARL CITY	28.41	.00	.00
HIR000000505	YOUNG LAUNDRY	HONOLULU	14.90	.00	.00
HID000633081	76 PRODUCTS CO DBA UNOCAL	HONOLULU	13.98	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
HIR000000166	BHP THE GAS CO DRIP LEG 1	KAPOLEI	7.41	.00	.00
HIR000000125	BHP THE GAS CO DRIP LEG 2	KAPOLEI	9.00	.00	.00
HID059472357	BREWER ENVIRONMENTAL INDUSTRIES INC	HONOLULU	4.64	.00	.00
HIT000615203	CHEVRON PRODUCTS CO	HONOLULU	4.59	.00	.00
HIT000615252	CHEVRON PRODUCTS CO	HILO	7.77	.00	.00
HIT000615385	CHEVRON PRODUCTS CO	ELEELE	4.28	.00	.00
HIR000000232	COSTCO WHOLESALE NO 140	KALUA	12.13	.00	.00
HID984468728	DONS MAKIKI UNOCAL NO 0344	HONOLULU	1.25	.00	.00
HID980883185	HAWAII WOOD PRESERVING CO	KAHULUI	8.15	.00	.00
HID981367683	HAWAIIAN COMMERICAL AND SUGAR	PUUNENE	4.42	11.00	.00
HID981651698	PACIFIC MACHINERY	WAIPAHU	12.76	.00	.00
HID000626333	TEXACO REFINING AND MARKETING INC	KAPOLEI	7.61	.00	.00
HID087190542	UNIV OF HAWAII	HONOLULU	1.30	.00	.00
HID984468876	UNOCAL PARADISE NO 3282	HONOLULU	1.25	.00	.00
HI9210022241	USARMY TRIPLER ARMY MED CNTR	TRIPLER ARMY ME	5.53	.00	.00
HI8690390036	USCG BASE HONOLULU	HONOLULU	10.74	.00	.00
HI3170090002	USDOD DRMO HAWAII	PEARL CITY	11.05	.00	.00
HI8170090015	USNAVY NAVAL MAGAZINE LUALUALEI	LUALUALEI	4.10	.00	.00
HI6170024388	USNAVY NCTAMS EASTPAC	WAHIAWA	9.11	.00	.00
HI6170024719	USNAVY PACIFIC MISSILE RANGE FACILI	KEHAHA	2.24	.00	.00
HI0170090005	USNAVY PUBLIC WORKS CNTR	PEARL HARBOR	11.60	.00	.00
HI1170090004	USNAVY PUBLIC WORKS CNTR BARBERS PO	BARBERS POINT	1.54	.00	.00
HI8170090007	USNAVY SHORE INTERMEDIATE MAINTENAN	PEARL HARBOR	9.87	.00	.00
HID044297042	76 PRODUCTS CO MAUI TERMINAL	KAHULUI	3.85	.00	.00
HID984468959	76 PRODUCTS CO WAIANAE	WAIANAE	2.00	.00	.00

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HAWAII

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- LESS THAN 1.1 TONS RCRA HAZARDOUS WASTE, AND
- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
HI0000043919	KULANI CORRECTIONAL FACILITY	HILO	.69	.00	.00
HIT000603514	UNITEK ENVIRONMENTAL SVCS INC	KAPOLEI	.00	.00	.00

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IDAHO

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- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
ID0000987719	ADA CO HWY DIST OWYHEE PLAZA	BOISE	85.22	.00	.00
IDD980835995	ADVANCED INPUT DEVICES-PRIEST RIVER	PRIEST RIVER	80.54	.00	.00
IDD053798104	AMERICAN MICROSYSTEMS INC	POCATELLO	142.97	.00	.00
IDD009066481	BLOUNT INC CCI OPER	LEWISTON	426,046.52	.00	.00
IDD984669424	BLOUNT INC SOUTHPORT OPER	LEWISTON	41.00	.00	.00
ID0000147850	BOISE AIR TERMINAL	BOISE	223.81	.00	.00
IDR000000489	COSTCO WHOLESALE 16	BOISE	13.48	.00	.00
IDD073114654	ENVIROSAFE SERVICES OF IDAHO	GRAND VIEW	3,804.15	.00	.00
IDD070929518	FMC CORP PHOSPHORUS CHEMICALS GROUP	POCATELLO	775,620.63	.00	.00
ID0000285106	HARPERS INC	POST FALLS	200.91	.00	.00
IDD113391775	IDAHO CIRCUIT TECHNOLOGY	GLENNS FERRY	28.90	.00	.00
IDR000000109	IDAHO ST OF DEPT OF AG CALDWELL	CALDWELL	10.70	11,386.50	.00
IDD984675124	IDAHO STATE DEPT OF AG JEROME	JEROME	1.13	80.00	.00
IDD009073511	J R SIMPLOT CO DON PLANT SOUTHSIDE	POCATELLO	23.17	.00	.00
IDD161812409	LAMB WESTON INC. TWIN FALLS	TWIN FALLS	16.96	.00	.00
IDR000000273	MATLACK BRITESOL INC POCATELLO	POCATELLO	27.60	.00	.00
IDD093120871	MICRON TECHNOLOGY INC	BOISE	337.89	.00	.00
IDD980976831	MORRISON KNUDSEN CORP BOISE LOCO OP	BOISE	14.23	.00	.00
IDR000000745	PACIFIC HIDE & FUR DEPOT	SANDPOINT	26.04	.00	.00
IDD009065848	SHOSHONE COUNTY	SMELTERVILLE	65.93	.00	.00
IDR000000026	SNAKE RIVER SD 52 SNAKE RIVER	BLACKFOOT	.16	48.00	.00
IDD055030852	UNION PACIFIC RAILROAD CO-POCATELLO	POCATELLO	21.45	.00	.00
IDD081827347	UNOCAL PUREGRO UNIT CP0B60	CALDWELL	25.00	.00	.00
ID3572124557	USAF MOUNTAIN HOME BASE	MOUNTAIN HOME	52.97	.00	.00
ID9143509330	USDOA POCATELLO SUPPLY DEPOT	POCATELLO	9.46	18,911.00	.00
ID4890008952	USDOE IDAHO NAT'L ENGINEERING LABOR	SCOVILLE	2,655.19	50.00	.00
ID0000998104	USDOI BLM CREAM CAN JCT	CARREY	.17	340.00	.00
IDR000000075	USDOI BLM DOBSON PASS	WALLACE	2.38	4,767.00	.00
IDR000000992	USDOI BLM INITIAL POINT DUMP	KUNA	.02	45.00	.00
IDD063334122	WOODGRAIN MOULDINGS INC	FRUITLAND	30.92	.00	.00
IDD097762231	ZILOG INC	NAMPA	88.90	.00	.00
ID0000309583	ZILOG MOD III	NAMPA	29.25	.00	.00

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IDAHO

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- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
IDD984666669	BLOUNT INC SPEER OPER	LEWISTON	13.20	.00	.00
IDD000641944	BOISE TERMINAL &STATION-CHEVRON PIP	BOISE	8.00	.00	.00
IDD000641977	CHEVRON PIPELINE CO-POCATELLO TERMI	POCATELLO	1.40	.00	.00
IDR000000497	COSTCO WHOLESALE 145	TWIN FALLS	9.56	.00	.00
ID0000990622	ENVIROSAFE SVCS OF NORTH AMERICA	GRAND VIEW	1.63	.00	.00
IDD990727471	HEWLETT-PACKARD COMPANY	BOISE	9.60	.00	.00
IDR000000679	IDAHO ST OF DEQ	NAMPA	4.69	.00	.00
IDD009062597	L D MCFARLAND CO	SANDPOINT	3.27	.00	.00
IDR000000612	MITCHELL PROPERTY	POCATELLO	3.96	.00	.00
IDD081830994	MONSANTO CO-SODA SPRINGS PLANT	SODA SPRINGS	3.05	.00	.00
IDD984668459	SPEARS MANUFACTURING COMPANY	JEROME	4.92	.00	.00
IDR000000216	TRIMAC TRANS INC BURNS BROS SITE	BOISE	2.92	.00	.00
IDD075746271	UNIVERSITY OF IDAHO MOSCOW	MOSCOW	7.26	8.70	.00
ID0570025874	USAF IDAHO AIR NATIONAL GUARD	BOISE	10.84	.00	.00
IDR000000380	USDA CFSA LAZY C H RANCH	MONTPELIER	11.70	.00	.00
IDR000000349	USDA FS MCCALL LOFT	MCCALL	5.40	.00	.00
IDD980988174	WESTERN STATES EQUIPMENT-POCATELLO	POCATELLO	11.58	.00	.00

Note: Please refer to the introduction for an explanation of this list.

IDAHO

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO CANNOT BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- LESS THAN 1.1 TONS RCRA HAZARDOUS WASTE, AND
- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
IDD984675322	HOBSON FABRICATING INC	BOISE	.48	.00	.00
IDD981770498	SAFETY-KLEEN CORP 1-183-08	BOISE	.00	.00	.00
IDR000000257	YMC MICRON CONSTR SITE	BOISE	.17	.00	.00

Note: Please refer to the introduction for an explanation of this list.

ILLINOIS

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
ILD005129697	A FINKLE & SONS CO	CHICAGO	761.23	.00	.00
ILR000010157	A&J PLATING CO	RIVER GROVE	20.35	.00	.00
ILD005093109	AB DICK CO	NILES	336.63	128.00	.00
ILD029025632	ABBOTT LABORATORIES	LAKE BLUFF	29.55	.00	.00
ILD055409940	ABBOTT LABORATORIES	NORTH CHICAGO	11,461.08	14,317.75	.00
ILD980795561	ABBOTT LABORATORIES	ABBOTT PARK	246.54	.00	.00
ILD984856435	ABBOTT LABORATORIES	NORTH CHICAGO	40.16	.00	.00
ILD984803577	ABLE CASTING	CHICAGO	21.76	.00	.00
ILD005098611	ABLE ELECTRO POLISHING COMPANY	CHICAGO	584.17	.00	.00
IL0000875583	ABLE ELECTRO POLISHING COMPANY	CHICAGO	163.85	.00	.00
ILD054344510	ACCO USA INC	WHEELING	24.46	.00	.00
ILD010601110	ACCURATE COATINGS & DISPERSION	SOUTH HOLLAND	409.56	.00	.00
ILD005258405	ACE ANODIZING & IMPREGNATING	HILLSIDE	61.98	.00	.00
ILD005087812	ACME FINISHING CO INC	ELK GROVE VILLA	53.81	.00	.00
ILD984858076	ACME PACKAGING CORPORATION	RIVERDALE	29.85	.00	.00
ILD020952362	ACME STEEL CO	RIVERDALE	21.53	.00	.00
ILD984791798	ACME WILEY CORP	ELK GROVE VILLA	25.01	.00	.00
ILD981527260	ADELPHI LANDFILL	WAUKEGAN	1,870.06	.00	.00
ILD005198866	ADHERON COATINGS CORP	OAK FOREST	24.56	.00	.00
ILR000000869	ADVANCED ELECTRONICS INC	WEST CHICAGO	191.21	.00	.00
ILD005104781	AE STALEY MFG CO	DECATUR	13.95	.00	.00
ILD005070545	AG COMMUNICATIONS SYSTEMS	NORTHLAKE	369.35	.00	.00
ILD047580006	AGI PLANT INC	MELROSE PARK	115.39	.00	.00
ILD001662816	AIRTEX PRODUCTS	FAIRFIELD	25,541.58	.00	.00
ILD059449991	AJ DAW PRINTING INK CO	COUNTRYSIDE	14.20	.00	.00
ILD057833642	AKZO CHEMICALS INC	MCCOOK	24.56	.00	.00
ILD065237851	AKZO CHEMICALS INC	MORRIS	79.35	.00	.00
ILD006390553	AKZO COATINGS INC	ZION	2,952.75	.00	.00
ILD040125080	AKZO NOBEL RESINS	EAST ST LOUIS	337.63	.00	.00
ILD005071378	ALBERTO CULVER COMPANY	MELROSE PARK	27.46	500.42	.00
ILD000716860	ALCAN-TOYO AMERICA INC	LOCKPORT	1,097.22	.00	.00
ILD981955990	ALDEN & OTT PRINTING INKS CO	ARLINGTON HEIGH	15.02	.00	.00
IL0210090049	ALLIANT TECHSYSTEMS INC	WILMINGTON	68.37	1,047.24	.00
ILD057863847	ALLIED TUBE & CONDUIT CORP	HARVEY	2,243.46	.00	.00
ILD005463344	ALLIED-SIGNAL INC	DANVILLE	41.91	.00	.00
ILD006278170	ALLIED-SIGNAL INC	METROPOLIS	129,948.23	.00	.00
ILR000011825	ALLSTATE ROC	SKOKIE	14.00	.00	.00
ILD000716886	ALLSTEEL INC	AURORA	14.98	.00	.00
ILD151755980	ALLWASTE CONTAINER SERVICE	JOLIET	36.93	.00	.00
ILD984808022	ALLWASTE CONTAINER SERVICE	CHICAGO	97.20	.00	.00
ILD122597495	ALLWASTE TANK CLEANING INC	GRANITE CITY	23.87	.00	.00
ILD984775080	ALPHA CIRCUIT CORP	ELMHURST	158.48	.00	.00
ILD096800925	ALPHA METALS INC	BENSENVILLE	28.14	.00	.00
ILD074573163	ALUMAX EXTRUSIONS	WEST CHICAGO	4,517.27	.00	.00
ILD059949818	ALUMAX MILL PRODUCTS INC	MORRIS	18.82	.00	.00
ILD054319892	ALUMINUM COIL ANODIZING CORP	STREAMWOOD	755.72	.00	.00
ILD984775627	ALUMINUM COIL ANODIZING CORP	STREAMWOOD	755.72	.00	.00
ILD055266324	AMAX COAL CO SUNSPOT MINE	VERMONT	326.79	.00	.00
ILD980896658	AMAX PLATING INC	ELGIN	540.02	.00	.00
ILD005233192	AMBER PLATING WORKS INC	CHICAGO	358.72	.00	.00
ILD984774315	AMCO CORP	CHICAGO	15.13	.00	.00
ILT180013427	AMERICAN AIRLINES	CHICAGO	17.13	.00	.00
ILD177667128	AMERICAN CIRCUIT SYSTEMS INC	ADDISON	71.67	.00	.00
ILD005434733	AMERICAN DECAL & MFG CO	CHICAGO	62.19	.00	.00
ILD005156146	AMERICAN FLANGE & MFG CO	CAROL STREAM	2,128.12	.00	.00

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ILLINOIS

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

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- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
ILD980795157	AMERICAN GENERATOR	SKOKIE	36.21	.00	.00
ILD009668492	AMERICAN NATIONAL CAN CO	BATAVIA	199.40	.00	.00
ILD074372517	AMERICAN NATIONAL CAN CO	CHICAGO	1,896.46	.00	.00
ILD005072517	AMERICAN NICKELOID CO	PERU	3,523.36	.00	.00
ILD005154943	AMERICAN PASSENGER RAIL CAR	CHICAGO	50.64	.00	.00
ILD984908665	AMERICAN PROGRESSIVE CIRCUITS	ADDISON	118.97	.00	.00
IL0000015719	AMERICAN REFINING GROUP INC	HARTFORD	129.34	.00	.00
ILD005130612	AMERICAN RIVET COMPANY INC	FRANKLIN PARK	22.19	.00	.00
ILT180012643	AMERICAN SPRING WIRE CORP	KANKAKEE	362.39	.00	.00
ILD005189196	AMERICAN STAIR CORP	WILLOW SPRINGS	24.20	.00	.00
ILD025477837	AMERICAN STANDARD CIRCUITS	FRANKLIN PARK	251.44	.00	.00
ILD046374062	AMERICAN STEEL FOUNDRIES	GRANITE CITY	637.30	.00	.00
ILD005163332	AMEROCK CORP	ROCKFORD	820.20	.00	.00
ILD984848226	AMITRON CORP	ELK GROVE VILLA	5,502.47	.00	.00
ILD002994259	AMOCO CHEMICAL CO	JOLIET	377.49	.00	.00
ILT180012049	AMOCO OIL CO	DES PLAINES	1,663.33	.00	.00
ILD984913244	AMOCO PETROLEUM ADDITIVES CO	WOOD RIVER	21,621.00	.00	.00
ILD076877877	AMOCO, RESEARCH CENTER	NAPERVILLE	371.08	410.01	.00
ILD102182714	AMPEL INC	ELK GROVE VILLA	283.92	.00	.00
ILD982623571	ANCHOR METAL FINISHING INC	SCHILLER PARK	13.63	.00	.00
ILD087534459	ANDERSON COPPER & BRASS CO	ALSIP	34.94	.00	.00
ILD005177084	ANDREW CORP	ORLAND PARK	94.17	.00	.00
ILD069942662	ANTEC MFG	ROCK FALLS	54.75	.00	.00
ILD074582420	AO SMITH HARVESTORE PRODUCTS	DEKALB	220.01	.00	.00
ILD980994867	API INDUSTRIES	ELK GROVE VILLA	823.31	.00	.00
ILD064014210	APPLIED COMPOSITES	ST CHARLES	46.09	.00	.00
ILD058588302	ARAMARK UNIFORM SERVICE INC	ROCKFORD	16.20	.00	.00
ILD000670893	ARCO PETROLEUM PRODUCTS CO	ARLINGTON HEIGH	56.30	.00	.00
ILD984922229	ARCOCHEM DANA TRANSPORT INC	SUMMIT	34.98	.00	.00
IL3890008946	ARGONNE NATIONAL LABORATORY	ARGONNE	172.38	25.50	.00
ILD000670828	ARLINGTON PLATING COMPANY	PALATINE	161.70	.00	.00
ILD000670836	ARMSTRONG WORLD INDUSTRIES INC	KANKAKEE	30.61	.00	.00
ILD005163803	ARNOLD ENGINEERING COMPANY	MARENGO	48.07	285.01	.00
ILD043369446	ASHLAND CHEMICAL, ASHLAND OIL	CALUMET CITY	550.30	.00	.00
ILD980700538	ASHLAND CHEMICAL, ASHLAND OIL	WILLOW SPRINGS	220.72	.00	.00
ILD005172663	ASSOCIATES ENGRAVING CO INC	SPRINGFIELD	579.76	.00	.00
ILD005238159	AUBREY MANUFACTURING INC	UNION	14.18	.00	.00
ILD065873630	AUSTEEL LEMONT CO INC	LEMONT	3,443.02	.00	.00
ILD067989905	AVERY COMMERCIAL PRODUCTS	WAUKEGAN	2,666.82	.00	.00
ILD053969408	B-LINE SYSTEMS INC	HIGHLAND	13.87	.00	.00
ILD005071253	BAGCRAFT CORP OF AMERICA	CHICAGO	45.47	.00	.00
ILD025757188	BALL-FOSTER GLASS CONTAINER CO	PLAINFIELD	32.90	.00	.00
ILD005145958	BARBER-COLMAN CO	ROCKFORD	328.36	.00	.00
ILD074587585	BARBER-COLMAN CO	LOVES PARK	176.23	.00	.00
ILD051937068	BARON BLAKESLEE	CICERO	432.42	.00	.00
ILD081039422	BARR NILES DIV OF CCL CUSTOM	NILES	337.20	.00	.00
ILD094291648	BARRETT VARNISH COMPANY	CICERO	161.26	.00	.00
ILD064404981	BARTLETT MANUFACTURING CO INC	ELK GROVE VILLA	24.98	.00	.00
ILT180019713	BARTLETT MFG CO INC	CARY	600.39	.00	.00
ILD005237805	BATTERY BUILDERS INC	NAPERVILLE	78.44	.00	.00
ILD067989723	BAXTER HEALTHCARE CORP	ROUND LAKE	18.66	6.70	.00
ILD000819946	BEAZER EAST INC	CARBONDALE	88.67	.00	.00
ILD981952203	BEE CHEMICAL CO	CHICAGO HEIGHTS	258.90	.00	.00
ILD984806448	BEECHER DEVELOPMENT	BEECHER	788.65	.00	.00
ILD068608314	BELL LABORATORIES-DIV OF LUCNT	NAPERVILLE	13.44	.00	.00

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ILLINOIS

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- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
ILD005114665	BELMONT PLATING WORKS INC	FRANKLIN PARK	252.82	.00	.00
ILD005457155	BENJAMIN MOORE & CO	MELROSE PARK	36.99	.00	.00
ILD048948178	BERKSHIRE FURNITURE CO INC	CHICAGO	1,161.04	.00	.00
ILR000000711	BERT JOHNSON	MOUND CITY	113.00	.00	.00
ILD005129192	BERTEAU LOWELL PLATING WORKS	CHICAGO	163.79	.00	.00
ILD005128814	BESLY PRODUCTS CORPORATION	SOUTH BELOIT	17.45	.00	.00
ILD009722281	BETZDEARBORN INC	ADDISON	59.43	.00	.00
ILD062407853	BETZDEARBORN INC	LAKE ZURICH	29.88	2,457.48	.00
ILD980700728	BFI 1	ZION	202.73	.00	.00
ILD980700751	BFI, DAVIS JUNCTION	DAVIS JUNCTION	526.55	.00	.00
ILD062444435	BIG RIVER ZINC CORP	SAUGET	31.73	63,453.24	.00
ILD982611717	BINKS MFG CO	FRANKLIN PARK	50.31	.00	.00
ILD980996862	BIRMINGHAM BOLT CO	BOURBONNAIS	11,075.28	.00	.00
ILR000011536	BLOOMINGTON CITY OF, POLICE	BLOOMINGTON	879.28	.00	.00
ILD005522982	BOBCO ENTERPRISES INC	CHICAGO	138.82	.00	.00
ILR000000067	BOEING PRECISION GEAR INC	CHICAGO	75.55	.00	.00
ILD045051117	BONCOSKY TRANSPORTATION INC	LAKE IN THE HIL	32.00	.00	.00
ILD005158548	BORDEN CHEMICALS & PLASTICS	ILLIOPOLIS	195.15	.00	.00
ILD082070608	BORDEN FOUNDRY & IND RESINS	FOREST PARK	299.75	765.03	.00
ILD067994798	BORDEN INC, N AMERICAN RESIN	OREGON	126.23	.00	.00
ILD005457221	BORG-WARNER AUTOMOTIVE	BELLWOOD	286.68	.00	.00
ILD005124342	BRADLEY PRINTING CO	DES PLAINES	15.98	.00	.00
ILD005976865	BRENT AMERICA INC	LAKE BLUFF	163.32	.00	.00
ILD005199013	BRIDGESTONE FIRESTONE INC	DECATUR	39.36	.00	.00
ILD005126297	BRIGHTLY GALVANIZED PRODUCTS	CICERO	217.34	.00	.00
ILD067448159	BRISKIN MANUFACTURING CO	CHICAGO	38.30	.00	.00
ILD982640906	BRISKIN MFG CO	CHICAGO	84.05	.00	.00
ILD042075978	BROCKWAY STANDARD INC	FRANKLIN PARK	165.66	.00	.00
ILD193600657	BURLINGTON NORTHERN RAILROAD	GALESBURG	44.47	.00	.00
ILD005153077	BURNHAM STEEL & WIRE CO INC	BURNHAM	36.20	.00	.00
ILP200000836	BUTLER	WASHINGTON PARK	1,746.31	.00	.00
ILD005135892	BUTLER MFG CO	GALESBURG	28.18	.00	.00
ILD119567402	BWD CORP	OTTAWA	20.02	.00	.00
ILD009848045	BYERLY AVIATION	PEKIN	51.35	.00	.00
IL0001010479	C&R AG SUPPLY	FAIRMOUNT	58.77	.00	.00
ILD042075333	CABOT CORP	TUSCOLA	422,284.44	.00	.00
ILD079748109	CALUMET STEEL CO	CHICAGO HEIGHTS	1,268.09	.00	.00
ILD064626344	CAMBRIDGE IND INC	CENTRALIA	114.88	.00	.00
ILD984808394	CAPITOL MACHINERY CO	EAST PEORIA	14.51	.00	.00
IL0000263095	CAPRON MFG CO	CAPRON	261.53	.00	.00
ILT180010134	CARADCO A DIV OF STOLLE CORP	RANTOUL	1,523.37	2,884,401.42	.00
ILD005268073	CASE CORP	EAST MOLINE	20.71	.00	.00
ILD060861978	CASSWOOD TREATED PROD INC	BEARDSTOWN	15.75	.00	.00
ILD005197397	CASTLE METAL FINISHING CORP	SCHILLER PARK	80.41	.00	.00
ILD051065647	CATALYTIC PROD INTL INC	LAKE ZURICH	39.65	.00	.00
ILD005070537	CATERPILLAR INC	JOLIET	62,196.09	.00	.00
ILD005070651	CATERPILLAR INC	AURORA	144.90	.00	.00
ILD005070719	CATERPILLAR INC	DECATUR	158.45	.00	.00
ILD005244777	CATERPILLAR INC	MOSSVILLE	24.89	.00	.00
ILD052664604	CATERPILLAR INC	EAST PEORIA	21.27	.00	.00
ILD052664364	CATERPILLAR INC MAPLETON PLANT	MAPLETON	18.81	.00	.00
ILD067407627	CATERPILLAR TECHNICAL CTR	MOSSVILLE	8.71	75.00	.00
ILD005141726	CCL CUSTOM MFG INC	DANVILLE	60.65	.00	.00
ILD051083541	CELCO IND	SCHILLER PARK	22.81	.00	.00
ILD000161422	CENTEON LLC	BRADLEY	47.31	1,500.00	.00

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ILLINOIS

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
ILD000666271	CENTER TERMINAL CO	HARTFORD	268.62	.00	.00
ILD005069711	CENTRAL CAN CO	CHICAGO	115.80	.00	.00
ILD005131891	CENTURY PLATING CO INC	CHICAGO	131.51	.00	.00
ILD080018914	CERRO COPPER PROD CO	SAUGET	155.64	.00	.00
ILD089828016	CFC INTERNATL INC	CHICAGO HEIGHTS	568.45	.00	.00
ILD006147342	CHAMPION LABORATORIES INC	WEST SALEM	274.19	.00	.00
ILD099666935	CHAMPION LABORATORIES INC	ALBION	16.79	.00	.00
ILD990785552	CHAMPION LABORATORIES INC	ALBION	198.01	.00	.00
IL1570024157	CHANUTE AFB	RANTOUL	11.29	4,320.15	.00
ILD068502475	CHARTER ELECT MELTING INC	CHICAGO	270.16	.00	.00
ILD005079975	CHASE PROD CO	BROADVIEW	110.70	.00	.00
ILD980680177	CHEM PLATE IND INC	ELK GROVE VILLA	398.04	.00	.00
ILD006929095	CHEMCENTRAL-CHICAGO	BEDFORD PARK	45.44	.00	.00
ILR000001339	CHEMICAL CONNECTION	CHICAGO	59.48	.00	.00
ILD000806604	CHEMICAL WASTE MGMT	ALSIP	1.05	41.70	.00
ILD980613426	CHEMICAL WASTE MGMT	RIVERDALE	48.19	.00	.00
ILD984787457	CHEMIMPEX INTERNATL	WOOD DALE	26.34	.00	.00
ILD005107149	CHERRY ELECTRICAL PROD	WAUKEGAN	143.87	.00	.00
IL0001021492	CHEVRON USA PROD CO	MORTON	14.33	.00	.00
IL0000127282	CHICAGO DEPT OF TRANS	CHICAGO	25.18	.00	.00
ILR000009472	CHICAGO DEPT OF TRANS BRIDGES	CHICAGO	25.18	.00	.00
IL0000882779	CHICAGO DEPT OF TRANS BRIDGES	CHICAGO	130.94	.00	.00
ILR000004523	CHICAGO DEPT OF TRANS VIADUCTS	CHICAGO	100.72	.00	.00
ILD010605574	CHICAGO EXTRUDED METALS CO	CICERO	1,425.44	.00	.00
ILD005105572	CHICAGO FAUCET CO	DES PLAINES	1,278.97	.00	.00
ILD984775304	CHICAGO FAUCET CO	DES PLAINES	34.47	.00	.00
ILD010282598	CHICAGO FINISHED METALS INC	BRIDGEVIEW	109.99	.00	.00
ILD051928398	CHICAGO METALLIC PROD	LAKE ZURICH	13.29	.00	.00
ILD005144316	CHICAGO STEEL & WIRE CO	CHICAGO	202.47	.00	.00
ILD005532205	CHICAGO TRANSIT AUTHORITY	CHICAGO	7,641.71	.00	.00
ILD020032199	CHICAGO TRANSIT AUTHORITY	SKOKIE	40.38	.00	.00
ILD152303376	CHICAGO TRANSIT AUTHORITY	CHICAGO	31.63	.00	.00
ILD984774133	CHICAGO TRANSIT AUTHORITY	CHICAGO	49.70	.00	.00
ILD984774141	CHICAGO TRANSIT AUTHORITY	CHICAGO	15.54	.00	.00
ILD045304367	CHICAGO TRIBUNE CO	CHICAGO	47.22	.00	.00
ILD053213922	CHILO MFG & PLATING	CHICAGO	32.09	.00	.00
ILD001874320	CHRYSLER CORP	BELVIDERE	506.49	.00	.00
ILD984907931	CIBA GEIGY PHARMACEUTICAL CO	BUFFALO GROVE	8.25	16,509.80	.00
ILD010284248	CID RECYCLING & DISP FAC	CALUMET CITY	73,752.29	.00	.00
IL0000204198	CIPS	TAYLORVILLE	85.53	.00	.00
ILD984812701	CIRCUIT ETCHING TECHNICS INC	ELK GROVE VILLA	93.98	.00	.00
ILD089061568	CIRCUIT INTERNATL INC	CAROL STREAM	926.14	.00	.00
ILD049291172	CIRCUIT SYSTEMS INC	ANTIOCH	271.26	.00	.00
ILD981781339	CIRCUIT SYSTEMS INC	ELK GROVE VILLA	676.33	.00	.00
ILD984774513	CIRCUIT SYSTEMS INC	ELK GROVE VILLA	1,562.64	.00	.00
ILD102185675	CIRCUIT WORLD INC	SCHAUMBURG	147.45	.00	.00
ILR000007559	CIRCUIT WORLD INC	ITASCA	390.98	.00	.00
ILD057857146	CIRCUITRONICS CORP	WHEATON	177.30	.00	.00
ILD005098694	CJ SAPORITO PLATING CO	CICERO	408.42	.00	.00
ILD005155973	CLAIRE MFG CO INC	ADDISON	22.24	.00	.00
ILT180012692	CLARK OIL	BARTONVILLE	89.99	.00	.00
ILD005109822	CLARK OIL & REFINING	BLUE ISLAND	337.59	.00	.00
ILD041889023	CLARK OIL & REFINING	HARTFORD	5,214.82	.00	.00
ILD066918327	CLAYTON CHEMICAL CO	SAUGET	4,102.09	.00	.00
ILD000608471	CLEAN HARBORS SERVICES INC	CHICAGO	693.07	4,840.16	.00

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ILLINOIS

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
IL0000245381	CLEVELAND STEEL CONTAINER CORP	PEOTONE	38.31	.00	.00
ILD005124672	COATINGS & CHEMICALS CORP	CHICAGO	67.09	.00	.00
ILD984785113	COILPLUS	PLAINFIELD	15.40	.00	.00
ILD060868916	COLEMAN TAYLOR INC	PEORIA	96.49	.00	.00
ILD984912279	COLOR CO THE	ELK GROVE VILLA	17.40	.00	.00
ILD000171546	COLOR COMMUNICATIONS INC	CHICAGO	262.05	.00	.00
ILD000805838	COLTEC IND	QUINCY	17.60	.00	.00
ILT180015216	COM ED CHICAGO NORTH DIV HQ	CHICAGO	33.31	.00	.00
ILD112422944	COM ED CHICAGO SOUTH DIV HQ	CHICAGO	36.53	.00	.00
ILD000665497	COM ED COLLINS STA	MORRIS	19.28	.00	.00
ILD043352509	COM ED TECHNICAL CTR	MAYWOOD	14.70	.00	.00
ILD067419242	COMBE LABORATORIES INC	RANTOUL	14.36	.00	.00
ILD069998334	CONSOLIDATED FREIGHT WAY	BRIDGEVIEW	5.99	4,390.15	.00
ILD001799428	CONTINENTAL WHITE CAP INC	CHICAGO	351.66	.00	.00
ILD984903708	CONVENIENT FOOD MART	SAVOY	16.00	.00	.00
ILD006303333	COOPER POWER SYSTEMS	MACOMB	27.34	.00	.00
ILT180010340	CP HALL CO	BEDFORD PARK	754.97	.00	.00
ILD981196843	CP SYSTEMS INC	CHICAGO	4,070.40	.00	.00
ILD005105598	CR IND	ELGIN	32.02	.00	.00
ILT180010183	CRAFTSMAN PLATING & TINNING	CHICAGO	104.17	.00	.00
ILT180013849	CRANE KEMLITE DIV OF DYROTECH	JOLIET	59.07	.00	.00
ILD005473350	CRAWFORD LABORATORIES INC	CHICAGO	225.07	.00	.00
ILD984775874	CREATIVE PROD INC	ROSSVILLE	20.69	.00	.00
ILD005097621	CRESCENT PLATING WORKS INC	CHICAGO	198.25	.00	.00
IL0000148437	CROWN CORK & SEAL CO INC	ALSIP	1,103.86	.00	.00
ILD005470125	CTS KNIGHTS INC	SANDWICH	19.11	.00	.00
ILD006289011	CURWOOD INC	MURPHYSBORO	154.36	.00	.00
ILD000672121	CWM CHEMICAL SVCS INC	CHICAGO	907.15	41.00	.00
ILD053189254	D'ANGELO ENTERPRISES INC	FRANKLIN PARK	141.37	.00	.00
ILT180012114	DA STUART CO	CHICAGO	1,215.65	.00	.00
ILD068469386	DANA VICTOR PRODUCTS	CICERO	2,069.25	.00	.00
ILD005150750	DAUBERT CHEMICAL COMPANY	CHICAGO	346.04	.00	.00
ILD002985737	DAUBERT COATED PRODUCTS	DIXON	70.94	.00	.00
ILD984809905	DEH PRINTED CIRCUITS INC	ELGIN	991.16	.00	.00
ILD055782346	DELTA PRECISION CIRCUITS INC	CHICAGO	73.01	.00	.00
ILD047036009	DEMERT & DOUGHERTY INC	COAL CITY	290.73	.00	.00
ILD005067756	DEMUTH STEEL PRODUCTS CO	SCHILLER PARK	70.86	.00	.00
ILD005174404	DEVRO-TEEPAK INC	DANVILLE	108.62	.00	.00
ILD006297931	DIAGRAPH CORP	HERRIN	23.40	.00	.00
ILD006264402	DIAMOND PLATING	MADISON	157.05	.00	.00
ILD005093273	DIEBEL MANUFACTURING CO	MORTON GROVE	35.71	.00	.00
ILD054318837	DIETZGEN CORP	DES PLAINES	41.22	.00	.00
ILD061047502	DIVERSIFIED COMPOSITES CORP	ROCK FALLS	50.85	.00	.00
ILD005267810	DIXLINE CORP	GALVA	17.56	.00	.00
ILD005244991	DOLTON EXTRUSION COMPANY INC	DOLTON	156.88	.00	.00
ILD980999395	DOMINO AMJET INC	GURNEE	41.80	.00	.00
ILD984844811	DOMINO AMJET INC	GURNEE	34.46	.00	.00
ILD005125588	DOVER INDUSTRIAL CHROME INC	CHICAGO	33.24	.00	.00
ILD093154599	DOW CHEMICAL COMPANY	CHANNAHON	96.58	.00	.00
ILR000004762	DOWNERS GROVE SPORTSMANS CLUB	WOODRIDGE	1,774.49	.00	.00
ILD984809871	DOWNERS GROVE, VILLAGE OF	DOWNERS GROVE	105.92	.00	.00
ILT180010241	DREEBLAN PAINT SUPPLY CO INC	CHICAGO	50.72	.00	.00
ILD058587759	DSM DESOTECH INC	ELGIN	70.29	.00	.00
ILD076890284	DUNLEE	BELLWOOD	36.71	.00	.00
ILD005119441	DUO FAST CORP	FRANKLIN PARK	50.25	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
ILD005067632	DUPLI-COLOR PRODUCTS CO INC	ELK GROVE VILLA	350.92	.00	.00
ILD046579421	DUPONT REFINISH SERVICE CTR	MORTON GROVE	26.93	.00	.00
ILD005174461	DYNACHEM INC	GEORGETOWN	225.83	.00	.00
ILD002992683	DYNACIRCUITS MFG INC	FRANKLIN PARK	1,005.31	.00	.00
ILD981088800	EAGLE ELECTRONICS INC	SCHAUMBURG	252.73	.00	.00
ILD005556956	EATON CORP	LINCOLN	26.13	.00	.00
ILD064385701	ECOLAB INC	JOLIET	138,977.28	.00	.00
ILT180011561	ED ETNYRE & CO	OREGON	24.89	.00	.00
ILD005129945	ELCO INDUSTRIES	ROCKFORD	26.41	.00	.00
ILD001979350	ELECTRIC ENERGY INC	JOPPA	23.78	.00	.00
ILD984901645	ELECTRO CIRCUITS	SCHAUMBURG	1,059.77	.00	.00
ILD980821557	ELECTRONIC INTERCONNECT CORP	ELK GROVE VILLA	199.01	.00	.00
ILD005166145	ELECTRONIC PLATING CO	CICERO	197.95	.00	.00
ILD981533193	ELECTRONIC SUPPORT SYSTEMS	WEST CHICAGO	2,218.30	.00	.00
ILD006929905	ELGIN JOLIET & EASTERN RAILWAY	JOLIET	17.10	.00	.00
ILD025444837	ELGIN SALVAGE & SUPPLY CO INC	ELGIN	1,452.70	.00	.00
ILD005212303	ELGIN SWEEPER COMPANY	ELGIN	40.44	.00	.00
ILD062472360	ELK GROVE PLATING	ELK GROVE VILLA	3,295.13	.00	.00
ILD074399155	EM LUBRICANTS INC	LOMBARD	21.99	.00	.00
ILD005070495	EMCO CHEMICAL DISTRIBUTORS	NORTH CHICAGO	435.24	.00	.00
ILD070012265	EMPIRE GALVANIZING	FRANKLIN PARK	2,306.55	.00	.00
ILD062503115	ENAMELERS & JAPANNERS	CHICAGO	16.29	.00	.00
ILD984809152	ENGIS CORPORATION	WHEELING	54.47	.00	.00
ILD982624777	ENSIGN-BICKFORD CO	WOLF LAKE	17.00	.00	.00
ILD069973790	ENTHONE-OMI INC	BRIDGEVIEW	77.64	.00	.00
ILD000666206	ENVIRITE CORP	HARVEY	144.14	.00	.00
ILD087157251	ENVIRONMENTAL WASTE RESOURCES	COAL CITY	8,827.37	.00	.00
ILD984924175	ENVIROPURE SOLUTIONS	BROADVIEW	24.20	.00	.00
ILD062411285	ESSEX GROUP INC	ROCKFORD	31.19	.00	.00
ILD005129952	ESSEX SPECIALTY PRODUCTS	KANKAKEE	31.13	.00	.00
ILD055871370	ETHYL PETROLEUM ADDITIVES INC	SAUGET	1,065.52	.00	.00
ILD001163823	EUREKA CO	BLOOMINGTON	23,306.63	.00	.00
ILD005075577	EXCEL FOUNDRY & MACHINE INC	PEKIN	113.66	.00	.00
ILD155126030	EXCELL ELECTRONICS CORP	ELK GROVE VILLA	655.90	.00	.00
ILD040116303	EXPLORER PIPELINE CO	HARTFORD	101.53	.00	.00
ILD984767590	EXPORT PACKAGING CO	MILAN	42.88	.00	.00
ILD980793400	EXXON COMPANY USA	CHANNAHON	702.84	.00	.00
ILD000672139	FANSTEEL/ESCAST INC	ADDISON	18.89	.00	.00
ILD009653767	FARR CO	CRYSTAL LAKE	55.98	.00	.00
ILD052606621	FEDDERS CORP	EFFINGHAM	26.71	.00	.00
ILD984788208	FEDERAL EXPRESS CORP	NORTHBROOK	28.63	.00	.00
ILD021293717	FEDERATED PAINT MFG	CHICAGO	265.70	.00	.00
ILD005119334	FEL-PRO INC	SKOKIE	64.52	.00	.00
IL6890030046	FERMILAB	BATAVIA	11.10	90.00	.00
ILD084741123	FERRO CORP, ROSEMAR OPERATIONS	SCHAUMBURG	16.58	.00	.00
ILD051928463	FINISHES UNLIMITED INC	SUGAR GROVE	15.70	.00	.00
ILT180010274	FLEMING-POTTER CO INC	PEORIA	23.27	.00	.00
ILD984815142	FLEXICON	CARY	72.86	.00	.00
ILD050577097	FLEXONICS	BARTLETT	42.61	.00	.00
ILD006537245	FLINT INK CORP	BROADVIEW	62.22	.00	.00
ILD077006443	FLINT INK CORP	CHICAGO	117.70	.00	.00
ILT180011660	FLINT INK CORP	SALEM	13.94	.00	.00
ILD074406299	FLUID MANAGEMENT LIMITED PARTNERSHI	WHEELING	27.31	.00	.00
ILD005472881	FMC CORP	WYOMING	8.27	16,539.00	.00
ILD060364882	FORD MOTOR CO, ASSEMBLY PLANT	CHICAGO	3,671.97	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
ILD042074559	FOTO FABRICATION CORP	CHICAGO	277.36	.00	.00
ILD048312201	FP WEBKOTE INC	PEORIA	41.97	.00	.00
ILD094740412	FPM HEAT TREATING INC	ELK GROVE VILLA	126.82	.00	.00
ILD000672675	FPM IPSEN HEAT TREATING	CHERRY VALLEY	13.69	.00	.00
ILD043916733	FSC CORPORATION	ALSIP	30.22	.00	.00
ILD981952187	FUCHS LUBRICANTS CO	HARVEY	468.15	2.00	.00
ILD053218251	FUJI HUNT PHOTOGRAPHIC CHEMICA	ROLLING MEADOWS	19.74	81.00	.00
ILD982621989	FUJI PHOTO FILM USA INC	ITASCA	45.35	.00	.00
ILD005129069	FURNAS ELECTRIC COMPANY	BATAVIA	43.00	.00	.00
ILD068458835	G D SEARLE & CO	SKOKIE	478.50	277.00	.00
ILD000802777	G J NIKOLAS & CO INC	BELLWOOD	15.35	.00	.00
ILD005230370	GATES RUBBER CO	GALESBURG	28.01	.00	.00
ILD007432529	GATES RUBBER CO	ROCKFORD	52.99	.00	.00
ILD984832311	GATTO INDUSTRIAL PLATERS INC	CHICAGO	165,667.37	201,716,058.35	.00
ILD005161476	GATX TERMINALS CORP	ARGO	634.36	.00	.00
ILD980503023	GENERAL ELECTRIC	CICERO	1,346.69	.00	.00
ILD005272992	GENERAL ELECTRIC CO	MORRISON	98.69	.00	.00
ILD005443866	GENERAL ELECTRIC CO	MATTOON	23.73	.00	.00
ILD005453691	GENERAL ELECTRIC CO	BLOOMINGTON	107.38	.00	.00
ILD079135133	GENERAL ELECTRIC CO	OTTAWA	232.16	.00	.00
ILD069952414	GENERAL TUBE CORP	DIXMOOR	2,348.79	.00	.00
ILD984915090	GEON COMPANY	HENRY	13.49	.00	.00
ILD094736857	GERLIN INC	CAROL STREAM	98.71	.00	.00
ILD000666149	GFC BRIDGEVIEW INC	BRIDGEVIEW	23.10	.00	.00
ILD982604043	GIBRALTAR CHEMICAL WORKS INC	SOUTH HOLLAND	38.94	.00	.00
ILD005109525	GILBERT & BENNETT MFG CO	BLUE ISLAND	504.44	.00	.00
ILD047031273	GILLETTE CO	NORTH CHICAGO	22.54	.00	.00
IL3170022930	GLENVIEW NAVAL AIR STATION	GLENVIEW	72.77	.00	.00
ILD006009690	GMC ELECTRO-MOTIVE DIV	MCCOOK	257.11	.00	.00
ILD005141551	GMC POWERTRAIN DIV	DANVILLE	36.52	.00	.00
ILD005215256	GNB BATTERIES INC	KANKAKEE	50.31	.00	.00
ILD005123211	GOLD EAGLE CO	CHICAGO	241.81	.00	.00
ILD005171004	GORDON BARTELS CO	ROCKFORD	133.29	.00	.00
ILD008873937	GRANITE CITY STEEL	GRANITE CITY	2,737.61	41.70	.00
ILD005076781	GRAPH-ON INC	FRANKLIN PARK	24.55	.00	.00
ILD984767855	GRAPHICS & INDUSTRIAL CIRCUIT	KIRKLAND	236.07	.00	.00
ILD024921074	GREAT LAKES TERM & TRANSPORT	BEDFORD PARK	144.71	.00	.00
ILD054325758	GREIF BROTHERS CORP	CHICAGO	15.95	.00	.00
ILD980616072	GTE COMMUNICATION SYSTEM CORP	GENOA	1,925.33	.00	.00
ILT180012585	H D CATTY CORP	HUNTLEY	59.79	.00	.00
ILD005096664	H H HOWARD COMPANY	CHICAGO	2,414.80	.00	.00
ILD084317452	HACO INC	ATLANTA	.60	1,199.50	.00
ILD056085863	HAEGER POTTERIES INC	MACOMB	15.94	.00	.00
ILD018116749	HANDSCHY INDUSTRIES INC	BELLWOOD	14.56	.00	.00
ILD000675249	HANDY & HARMAN REFINING GROUP	VILLA PARK	188.07	.00	.00
ILD069496248	HANNAH MARINE CORP	LEMONT	1,006.96	.00	.00
ILD005148085	HARPER-WYMAN COMPANY	PRINCETON	95.31	.00	.00
ILD004203568	HARRIS BROADCAST	QUINCY	51.08	.00	.00
ILD041056565	HARRIS HUB COMPANY	HARVEY	225.60	.00	.00
ILR000003376	HARRISON SHEET STEEL SITE	CHICAGO	8,059.46	.00	.00
ILD005082953	HAYDOCK CASTER COMPANY	NILES	20.50	.00	.00
ILD005440656	HCC INC	MENDOTA	14.44	.00	.00
ILD065247355	HEATCRAFT REFRIGERATION PROD	DANVILLE	90.96	.00	.00
ILD005145701	HELENE CURTIS INC	CHICAGO	106.92	.00	.00
ILD064395577	HENKEL ADHESIVES CORP	ELGIN	153.82	.00	.00

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ILD005215769	HENKEL CORP	KANKAKEE	720.57	.00	.00
ILD085349264	HERITAGE ENVIRONMENTAL SERVICE	LEMONT	509.90	.00	.00
ILD005111273	HI GRADE ALLOY CORP	EAST HAZEL CRES	47.61	.00	.00
ILD984774703	HOOD FLEXIBLE PACKAGING	MARENGO	38.82	.00	.00
ILP200001658	HOUSEHOLD INTERNATIONAL	PROSPECT HEIGHT	36.28	.00	.00
ILD005085972	HU FRIEDY	CHICAGO	253.25	.00	.00
ILD984834838	HUDSON SCREW MACHINE PRODUCTS	CHICAGO	24.77	.00	.00
ILD087154555	HUNTSMAN CHEMICAL CORP	PERU	94.19	.00	.00
ILD984845628	HYDRO-GEAR	SULLIVAN	37.52	.00	.00
ILD005115043	HYDRO-LINE INC	ROCKFORD	48.76	.00	.00
ILD984766279	HYDROMET ENVIRONMENTAL INC	NEWMAN	437.94	.00	.00
ILD077001741	HYDROSOL INC	BRIDGEVIEW	656.09	.00	.00
ILD055398028	HYSAN CORP	BLUE ISLAND	48.23	.00	.00
IL0000910836	IDOT DISTRICT ONE	CHICAGO	57.67	.00	.00
ILD057862393	IL CENTRAL RR WOODCREST SHOP	HOMEWOOD	15.24	.00	.00
ILR000001719	IL DEPT OF TRANSPORTATION	VARIOUS	1,714.59	.00	.00
ILR000009787	IL DEPT OF TRANSPORTATION	VARIOUS	31.27	.00	.00
ILP200001530	ILLINOIS CENTRAL RR	THOMPSONVILLE	174.21	.00	.00
ILR000009415	ILLINOIS EPA	CHICAGO	15.11	.00	.00
ILD000806075	ILLINOIS POWER CO	CLINTON	2,255.18	.00	.00
ILD982208431	ILLINOIS POWER CO	IRVING	26.49	.00	.00
ILD083076018	IMPERIAL EASTMAN	NILES	281.57	.00	.00
ILD070015938	IMPERIAL PLATING CO	CHICAGO	13.97	.00	.00
ILD049014921	IMPERIAL PLATING INC	CHICAGO	28.45	.00	.00
ILD984817924	INDIAN REFINING LTD PTNRSHP	LAWRENCEVILLE	65.21	.00	.00
ILD984892711	INDUSTRIAL HARD CHROME LTD	GENEVA	148.76	.00	.00
ILD005130307	INGERSOLL MILLING MACHINE CO	ROCKFORD	20.69	.00	.00
ILD981097652	INGERSOLL MILLING MACHINE CO	ROCKFORD	24.24	.00	.00
ILD025760638	INTERLAKE INC	PONTIAC	63.57	.00	.00
ILD005214077	INTERMATIC INC	SPRING GROVE	24.20	.00	.00
ILD005236468	INTERNATIONAL PAPER CO	PEORIA	85.47	.00	.00
ILD079155446	INTERNATIONAL PAPER CO	MARSEILLES	156.42	.00	.00
ILD006933600	INTERSTATE STEEL CO	DES PLAINES	43.04	.00	.00
ILD005103528	INX INTERNATIONAL INK CO	CHICAGO	280.57	.00	.00
ILD081030678	ITT BELL & GOSSETT	MORTON GROVE	20.03	.00	.00
ILD005162417	J L CLARK MANUFACTURING CO	ROCKFORD	74.50	.00	.00
ILD005121850	JAMES B DAY CO	CARPENTERSVILLE	61.89	.00	.00
ILD000666073	JEFFERSON SMURFIT CORP	MORRIS	15.61	.00	.00
ILD005230420	JEFFERSON SMURFIT CORP	CAROL STREAM	50.51	.00	.00
ILD981093180	JLM CHEMICALS INC	ALSIP	4,119.18	.00	.00
ILD005094347	JOHN CRANE CORP	MORTON GROVE	46.72	.00	.00
ILD005481627	JOHN DEERE HARVESTER WORKS	MOLINE	476.45	.00	.00
ILD025423054	JOHN DEERE HARVESTER WORKS	EAST MOLINE	199.19	.00	.00
ILD980502470	JOHNSON CONTROLS BATTERY GROUP	GENEVA	49.72	.00	.00
ILD098977796	JOSLYN MANUFACTURING CO	CHICAGO	74.40	.00	.00
ILD005066923	KALMUS & ASSOCIATES INC	BROADVIEW	1,126.37	.00	.00
ILD984774257	KALMUS & ASSOCIATES INC	BROADVIEW	698.73	.00	.00
ILD003096286	KELLY-SPRINGFIELD DIV	FREEPORT	31.20	.00	.00
ILD006273262	KEMPEN PAINT CO	EAST CARONDELET	22.70	.00	.00
ILD020367561	KERR-MCGEE CHEMICAL CORP	MADISON	108.40	.00	.00
ILD058002429	KESTER SOLDER CO	DES PLAINES	122.54	.00	.00
ILD000714881	KEYSTONE STEEL & WIRE CO	BARTONVILLE	10,322.18	.00	.00
ILD005149141	KLEIN TOOLS INC	SKOKIE	53.83	.00	.00
ILD000671081	KOMATSU DRESSER CO	PEORIA	26.95	.00	.00
ILD005164611	KOPPERS INDUSTRIES INC	CICERO	2,338.47	.00	.00

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ILD990817991	KOPPERS INDUSTRIES, INC.	GALESBURG	23.05	.00	.00
ILD005433644	KYSOR/WESTRAN	BYRON	19.54	.00	.00
ILD000814590	LABINAL COMPONENTS & SYSTEMS	ELK GROVE VILLA	67.02	.00	.00
ILD006280606	LACLEDE STEEL CO	ALTON	11,067.09	.00	.00
ILD000605469	LAKE LANDFILL	NORTHBROOK	51.56	.00	.00
ILD010597276	LAKE RIVER TERMINALS	FOREST VIEW	130.34	.00	.00
ILD076875285	LAKE SALVAGE CO	CHICAGO	151.53	.00	.00
ILD005145040	LAKEWOOD ENGINEERING	CHICAGO	24.68	.00	.00
ILD074411745	LARAWAY RECYCLING & DISP FAC	ELWOOD	4,842.17	.00	.00
ILD022254080	LASALLE ROLLING MILLS INC	LASALLE	537.44	.00	.00
ILD005263173	LAWRENCE BROTHERS INC PLANT 1	STERLING	762.97	.00	.00
ILD980589824	LAWRENCE BROTHERS INC-PLANT 2	ROCK FALLS	662.54	.00	.00
ILD040466823	LAWSON MARDON FLEXIBLE INC	BELLWOOD	49.10	.00	.00
ILD055431126	LAWTER CHEMICALS INC	CHICAGO	46.91	.00	.00
ILD041938408	LEFEBVRE INTERGRAPHICS INC	DES PLAINES	54.90	.00	.00
ILD981002884	LIBRA INDUSTRIES INC	CHICAGO	236.94	.00	.00
ILD005265749	LILLY INDS INC MOLINE PLANT	MOLINE	542.12	.00	.00
ILD984915462	LINOTYPE-HELL CO	SCHAUMBURG	16.94	.00	.00
ILD082545732	LIQUID CARBONIC INDUSTRIES	CHICAGO	4.73	29.50	.00
ILD005212246	LITTELFUSE INC	DES PLAINES	130.89	.00	.00
ILD069994218	LITTON PRECISION GEAR	CHICAGO	65.56	1,595.05	.00
ILR000010975	LOCKPORT, CITY OF	LOCKPORT	101.00	.00	.00
ILD000781591	LTV STEEL CO	HENNEPIN	35,195.77	.00	.00
ILD056623598	LTV STEEL-CHICAGO WKS	CHICAGO	4,951.20	.00	.00
ILD056625858	LUCENT TECHNOLOGIES	MONTGOMERY	475.37	.00	.00
ILD984783563	LUCENT TECHNOLOGIES INC	WEST CHICAGO	31.99	.00	.00
ILD079154779	LUNDIA	JACKSONVILLE	19.00	.00	.00
ILD005119474	LYON METAL PRODUCTS INC	MONTGOMERY	394.28	.00	.00
ILD984775973	M-C POWER CORP	BURR RIDGE	15.39	.00	.00
ILD049998297	MAGNETIC INSPECTION LABORATORY	ELK GROVE VILLA	114.66	.00	.00
ILD002293124	MANDERS PREMIER INC	NILES	41.31	.00	.00
ILD000814715	MANNHEIM TERMINAL & WHSE	WILLOW SPRINGS	468.55	.00	.00
ILD000666263	MARATHON OIL CO	ROCKFORD	534.02	.00	.00
ILD005476882	MARATHON OIL CO	ROBINSON	12,971.22	70.00	.00
ILD059430298	MARATHON OIL CO	ARLINGTON HEIGH	661.95	.00	.00
ILD084311059	MARATHON OIL CO	CHAMPAIGN	487.52	.00	.00
ILD980264766	MARATHON PIPE LINE CO	VERNON	81.66	.00	.00
ILD984792424	MARATHON PIPE LINE COMPANY	NOBLE	31.43	.00	.00
ILD000815183	MARATHON TERMINAL	ROBINSON	635.10	.00	.00
ILD980702252	MARSH STENCIL MACHINE CO	BELLEVILLE	19.09	.00	.00
ILD025821513	MASONITE CORP-RESEARCH CTR	WEST CHICAGO	25.72	.00	.00
ILR000010090	MATERIAL SERVICE CORPORATION	CHICAGO	48.52	.00	.00
ILD094753407	MATSUSHITA INDUSTRIAL CO	FRANKLIN PARK	29.07	.00	.00
ILD005068184	MATTISON TECHNOLOGIES INC	ROCKFORD	53.55	.00	.00
ILD093746014	MAYTAG HERRIN LAUNDRY PRODUCTS	HERRIN	14.10	.00	.00
ILD067417337	MAYTAG, GALESBURG REFRIG PROD	GALESBURG	129.88	.00	.00
ILD055413371	MAZER CHEMICALS/DIV OF PPG IND	GURNEE	28.22	.00	.00
ILD981000995	MCINTYRE GROUP LIMITED	UNIVERSITY PARK	291.68	.00	.00
ILD005269295	MCKAY, WILBUR	HAMPTON	1,401.73	.00	.00
ILD005083316	MCWHORTER INC	CARPENTERSVILLE	20,296.07	.00	.00
ILD095299020	MCWHORTER INC	CARPENTERSVILLE	556.64	.00	.00
ILD980578876	MCWHORTER TECHNOLOGIES INC	CHICAGO HEIGHTS	656.73	.00	.00
ILD000666370	MEAD PACKAGING	GODFREY	69.39	.00	.00
ILD980681720	MECH-TRONICS CORP	MELROSE PARK	51.45	.00	.00
ILD984782169	MEGA CIRCUITS	ADDISON	1,229.98	.00	.00

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ILLINOIS

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
ILD038503900	MEYER STEEL DRUM INC	CHICAGO	28.76	.00	.00
ILD081037772	MEYER STEEL DRUM INC	CHICAGO	39.87	.00	.00
ILD005103593	MEYERCORD COMPANY	CAROL STREAM	33.82	.00	.00
ILD068474147	MEYERCORD INTERNATIONAL INC	NORTHBROOK	29.98	.00	.00
IL0000340489	MGF INDUSTRIES	ROCKFORD	21,995.76	.00	.00
ILD980997118	MICRO SWITCH PLANT 1	FREEPORT	97.45	.00	.00
ILD980997803	MICRO SWITCH PLANT 2	FREEPORT	17.43	.00	.00
ILD001899772	MICRO SWITCH PLANT 4	FREEPORT	10,970.66	.00	.00
ILD000666388	MID-AMERICA PROTECTIVE COATING	FRANKLIN PARK	16.38	.00	.00
ILD069499234	MID-AMERICA PROTECTIVE COATING	ELK GROVE VILLA	32.25	.00	.00
ILD051937852	MID-WEST COMPANY	CHICAGO HEIGHTS	1,846.68	.00	.00
ILD025494246	MID-WEST PLATING CO	HERBERT	2,606.51	.00	.00
ILD049672736	MIDCOAST AVIATION INC	CAHOKIA	292.84	.00	.00
ILD005162003	MIDWAY WIRE INC	CHICAGO	710.97	.00	.00
ILD005115886	MIDWEST LACQUER MFG CO	SCHILLER PARK	46.91	.00	.00
ILD005149505	MIDWEST PRINTED CIRCUIT SVS	ROUND LAKE BEAC	183.54	.00	.00
IL0000366849	MILPLEX CIRCUITS INC	ITASCA	307.99	.00	.00
ILD982072357	MITSUBISHI MOTOR MFG OF AMERIC	NORMAL	1,138.27	.00	.00
ILD059435537	MOBIL OIL CORP	ARLINGTON HEIGH	80.68	.00	.00
ILD064403199	MOBIL OIL CORP	JOLIET	960,344.24	.00	.00
ILD005172325	MODERN PLATING CORP-PLANT 2	FREEPORT	193,835.55	.00	.00
ILD000802702	MONSANTO INDUSTRIAL CHEMICALS	SAUGET	1,146.10	35,057.00	.00
ILD982603730	MONTGOMERY TANK LINES INC	WILMINGTON	33.75	.00	.00
ILD005473467	MORGAN MARSHALL INDUSTRIES	CHICAGO HEIGHTS	172.90	.00	.00
ILD984774877	MORTON GROVE PHARMACEUTICALS	MORTON GROVE	71.68	.00	.00
ILD055425854	MORTON INTERNATIONAL	WOODSTOCK	61.46	.00	.00
ILD095309647	MORTON INTERNATIONAL	BATAVIA	529.54	.00	.00
ILD096787049	MORTON INTERNATIONAL	CHICAGO	301.67	.00	.00
ILD005229448	MORTON INTERNATIONAL INC	LANSING	2,088.01	.00	.00
ILD025110834	MORTON INTERNATIONAL INC	ELK GROVE VILLA	205.69	.00	.00
ILD062410550	MORTON INTERNATIONAL INC	RINGWOOD	939.34	.00	.00
ILD001762541	MORTON METALCRAFT CO	MORTON	158.73	.00	.00
ILD982603490	MORTON METALCRAFT COMPANY	MORTON	17.90	.00	.00
ILD006536239	MOTOR WHEEL CORP	MENDOTA	20.57	.00	.00
ILD079763140	MOTOROLA INC	SCHAUMBURG	178,056.52	.00	.00
ILD980904593	MOTOROLA INC	ARLINGTON HEIGH	33.25	.00	.00
ILD984887349	MOTOROLA INC	LIBERTYVILLE	58.11	.00	.00
ILD056639883	MSC LAMINATES & COMPOSITES	ELK GROVE VILLA	693.67	.00	.00
ILD005162102	MUELLER CO	DECATUR	129.77	.00	.00
ILD981192552	MUELLER CO	DECATUR	2,119.83	.00	.00
ILD984872077	MULTICOLOR SPECIALTIES MANUFAC	CICERO	71.50	.00	.00
ILD144906658	MULTITEK CIRCUITRONICS INC	MELROSE PARK	198.20	.00	.00
ILD061044566	MURPHY BROS INC	EAST MOLINE	35.01	.00	.00
ILD980901953	N AMERICAN LIGHTING INC	FLORA	65.35	.00	.00
ILD005092572	NALCO CHEMICAL CO	BEDFORD PARK	721,791.35	22,700.00	.00
ILD981961121	NASCOTE INDUSTRIES	NASHVILLE	1,343.16	.00	.00
ILD984804856	NAT PRECISION CIRCUITS & ELECT	ELMHURST	317.82	.00	.00
ILD049015134	NATIONAL CASTINGS INC	CICERO	277.92	.00	.00
ILD072317761	NATIONAL CASTINGS INC	MELROSE PARK	252.72	.00	.00
ILD021164983	NATIONAL COATINGS INC	GALESBURG	172.00	.00	.00
ILD005126222	NATIONAL DRUM CLEANERS INC	CHICAGO	172.44	.00	.00
ILD005263124	NATIONAL MANUFACTURING CO	STERLING	330.24	.00	.00
ILD980826515	NATIONAL MANUFACTURING CO	ROCK FALLS	678.19	.00	.00
ILD059424598	NATIONAL METALWARES INC	AURORA	194.38	.00	.00
ILD003934569	NATIONAL STARCH & CHEMICAL	MEREDOSIA	3,049.36	95.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
ILD081021388	NATIONAL TECHNOLOGY INC	ROLLING MEADOWS	2,236.14	.00	.00
ILD984767129	NATIONAL TECHNOLOGY INC	ELK GROVE VILLA	225.90	.00	.00
ILD981531247	NATURAL GAS PIPELINE CO	HOFFMAN	22.86	.00	.00
ILT180015091	NATURAL GAS PIPELINE CO	HAMMOND	20.96	.00	.00
ILD005245238	NAVISTAR INTERNATIONAL CORP	MELROSE PARK	20.68	.00	.00
IL7170024577	NAVY PUBLIC WORKS CENTER	GREAT LAKES	128.60	.00	.00
ILD005233960	NAZ-DAR CO	CHICAGO	76.45	.00	.00
ILD006265698	NESCO STEEL BARREL COMPANY	GRANITE CITY	27.60	.00	.00
ILD984851451	NEW TECH ELECTRONICS INC	BENSENVILLE	705.91	.00	.00
ILR000007617	NIGHT GAMES	LEMONT	17.00	.00	.00
ILD002977619	NOBERT PLATING CO	CHICAGO	85.55	.00	.00
ILD005088737	NOBERT PLATING CO	CHICAGO	54.46	.00	.00
ILD005266168	NORCROSS SAFETY PRODS LLC	ROCK ISLAND	28.21	.00	.00
ILR000000257	NORFOLK & WESTERN RAILROAD	SORENTO	25.19	.00	.00
ILD981955891	NORTH AMERICAN LIGHTING INC	SALEM	48.25	.00	.00
ILD097271563	NORTH CHICAGO REFINERS	NORTH CHICAGO	1,038.73	.00	.00
ILT180013468	NORTHERN METAL FINISHING	ROCKFORD	90,875.69	.00	.00
ILD005215199	NORTHERN STAR PLATING	LOVES PARK	96.69	.00	.00
ILD005128988	NORTHROP CORP	ROLLING MEADOWS	98.10	.00	.00
ILD005076146	NORTHWESTERN FLAVORS INC	WEST CHICAGO	66.09	.00	.00
ILD059457150	NORTHWESTERN MEMORIAL HOSPITAL	CHICAGO	31.19	902.62	.00
ILD059426049	NORTHWESTERN PLATING WORKS INC	CHICAGO	24.88	.00	.00
ILD005263157	NORTHWESTERN STEEL & WIRE #2	STERLING	73,778.72	.00	.00
ILT180011546	NORTHWESTERN UNIVERSITY	CHICAGO	8.21	269.01	.00
ILT180011553	NORTHWESTERN UNIVERSITY	EVANSTON	15.54	1,109.04	.00
ILD005132410	NOVA-CHROME INC	FRANKLIN PARK	48.62	.00	.00
ILD981953599	NUTRA-SWEET	MT PROSPECT	66.16	86.00	.00
ILD005215504	NYLINT CORP	ROCKFORD	46.49	.00	.00
IL1570024272	O'HARE AIR RESERVE FORCES	CHICAGO	43.72	.00	.00
ILD000802801	OLIN CORP	MARION	23.09	.00	.00
ILD000802819	OLIN CORP	EAST ALTON	167.33	.00	.00
ILD006271696	OLIN CORP	EAST ALTON	1,454.02	.00	.00
IL5140090221	OLIN CORP	MARION	3,194.00	.00	.00
IL6140090220	OLIN CORP - I AREA	MARION	15.06	.00	.00
ILD018260075	OMEGA PLATING INC	CRESTWOOD	22.65	.00	.00
ILD119596153	OMNI CIRCUITS	GLENVIEW	666.19	12,443.62	.00
ILD005123690	ORGANICS INC	CHICAGO	15.94	.00	.00
ILD000802827	OUTBOARD MARINE CORP	WAUKEGAN	583.32	255.01	.00
ILD068602895	OVERDALE CORP	ALSIP	80.48	.00	.00
ILD005127865	P & H PLATING COMPANY INC	CHICAGO	271.62	.00	.00
ILD005215116	PAMARCO INC	BATAVIA	44.87	.00	.00
ILD984849166	PANDUIT CORP	LOCKPORT	24.49	.00	.00
ILT180013583	PANDUIT CORP	NEW LENOX	162.06	.00	.00
ILT180013591	PANDUIT CORP	BURR RIDGE	212.28	.00	.00
ILP200001661	PARENT PETROLEUM	VILLA PARK	22.80	.00	.00
ILT180011694	PARKVIEW METAL PRODUCTS INC	CHICAGO	18.99	.00	.00
ILD025261959	PEER BEARING	WHEELING	45.08	.00	.00
ILD980679468	PENN ALUMINUM INTERNATIONAL	MURPHYSBORO	41.83	.00	.00
ILD984774554	PENTAPLEX INC	ELGIN	27.80	.00	.00
ILD069503027	PEOPLES GAS LIGHT & COKE CO	ELWOOD	1,218.57	.00	.00
ILD000805812	PEORIA DISPOSAL CO INC	PEORIA	124,760.24	.00	.00
ILD981961113	PERFECT PLASTIC PRINTING CORP	ST CHARLES	22.68	.00	.00
ILD046569620	PERFECTION PLATING INC	ELK GROVE VILLA	113.10	.00	.00
ILD005203476	PFANSTIEHL LABS INC	WAUKEGAN	1,188.02	.00	.00
ILD070168968	PFAUTER-MAAG CUTTING TOOLS	LOVES PARK	67.15	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
ILD062480850	PHIBRO-TECH INC	JOLIET	2,891.43	100.00	.00
ILD984921767	PHILIPS LIGHTING COMPANY	ROSELLE	23.49	.00	.00
ILD053981601	PHILLIPS PIPE LINE CO	CAHOKIA	7,156.23	.00	.00
ILD093871291	PHILLIPS PIPE LINE CO	KANKAKEE	1,149.20	.00	.00
ILD055434443	PIERCE & STEVENS CHEMICAL CORP	CAROL STREAM	24.75	.00	.00
ILD005258074	PIONEER PAINT PRODUCTS INC	MELROSE PARK	95.58	.00	.00
ILD005201769	PIONEER PLATING COMPANY INC	CHICAGO	26.00	.00	.00
ILD984804112	PITTSBURGH TUBE CO-FAIRBURY DV	FAIRBURY	27.75	.00	.00
ILD052673027	PLYMOUTH TUBE CO	STREATOR	80.06	.00	.00
ILD067464875	POLYCIRCUITS INC	BENSENVILLE	3,056.85	.00	.00
ILD980823835	POWELL DUFFRYN TERMINALS INC	LEMONT	183.39	.00	.00
ILD005174297	PPG INDUSTRIES INC	MT ZION	381.34	.00	.00
ILD981957822	PPG INDUSTRIES INC	BELVIDERE	65.35	.00	.00
ILD981961568	PPG INDUSTRIES INC	NORMAL	59.36	.00	.00
ILD980266464	PRE FINISH METALS INC	ELK GROVE VILLA	528.03	.00	.00
ILD089062871	PRECISION CHROME INC	FOX LAKE	59.31	.00	.00
ILD102193273	PRECISION COATINGS INC	SPRING VALLEY	36.34	.00	.00
ILD005067376	PRECISION PLATING CO INC	CHICAGO	64.72	.00	.00
ILD005076567	PRECISION TWIST DRILL CO	CRYSTAL LAKE	1,183.21	.00	.00
ILD049813256	PRECOAT METALS	CHICAGO	43,300.97	.00	.00
ILT180014698	PRECOAT METALS	GRANITE CITY	48,175.22	.00	.00
ILD089825780	PRINTPACK INC	ELGIN	186.12	.00	.00
ILD001833714	PVS CHEMICALS INC (ILLINOIS)	CHICAGO	47.86	.00	.00
ILD064409683	PYLE NATIONAL CO	CHICAGO	1,505.91	.00	.00
ILD041948001	PYRAMID NORTHERN MOLDING	CHICAGO	30.62	.00	.00
ILD096466701	QUALA SYSTEMS INC	LANSING	25.86	.00	.00
ILD005215421	QUALITY METAL FINISHING CO	BYRON	23,452.05	.00	.00
ILD005078126	QUANTUM CHEMICAL COMPANY	TUSCOLA	5,455.99	1,351.00	.00
ILD048296180	QUANTUM CHEMICAL CORP	MORRIS	1,161.07	.00	.00
ILD005162565	QUEBECOR PRINTING MT MORRIS	MT MORRIS	105.54	.00	.00
ILD005198395	R F MAU COMPANY	LINCOLNWOOD	41.79	.00	.00
ILD042078840	R R DONNELLEY & SONS CO	MATTOON	95.85	.00	.00
ILD005085998	R S OWENS & CO	CHICAGO	58.13	.00	.00
ILD980682447	READETTE & DUNN PLATERS	ROCKFORD	6,860.43	.00	.00
ILD044218055	RECKITT & COLMAN INC	LINCOLN	35.51	.00	.00
ILD095267316	RECON OPTICAL INC	BARRINGTON	1.94	60.00	.00
ILD005434279	REDEEN ENGRAVING CO	ELK GROVE VILLA	14.66	.00	.00
ILD005129457	REFLECTOR HARDWARE CORP	MELROSE PARK	118.71	.00	.00
ILD984784272	REGENCY METAL FINISHING	ELK GROVE VILLA	81.07	.00	.00
ILD005065594	REGIS TECHNOLOGIES INC	MORTON GROVE	61.38	.00	.00
ILD050932144	REICHHOLD CHEMICALS INC	MORRIS	55.00	.00	.00
ILD006278360	REILLY INDUSTRIES INC GC	GRANITE CITY	23.28	.00	.00
ILD044225050	RELIABLE GALVANIZING CO	CHICAGO	31.76	.00	.00
ILD005137914	RELIABLE PLATING CORP	CHICAGO	27.49	.00	.00
ILD981957434	RELIABLE POWER PRODUCTS INC	FRANKLIN PARK	29.48	.00	.00
ILD005154851	RELIANT BOLT	BEDFORD PARK	567.83	.00	.00
ILD005263538	RELIANT FASTENER	ROCK FALLS	562.00	.00	.00
ILD984780163	REPUBLIC ENGINEERED STEELS,INC	CHICAGO	3,997.30	.00	.00
ILD005078274	REVERE WARE INC	CLINTON	1,332.14	84.00	.00
ILD005205604	REXAM MEDICAL PACKAGING	MUNDELEIN	28.95	.00	.00
ILD005120423	REXAM RELEASE	BEDFORD PARK	79.48	.00	.00
ILD984780379	REXAM RELEASE	WEST CHICAGO	43.39	.00	.00
ILD005455571	REXNORD CORPORATION	DOWNERS GROVE	342.45	.00	.00
ILD005180070	REYNOLDS METALS	MCCOOK	36.80	.00	.00
ILD062405204	RICHARDSON ELECTRONICS LTD	LAFOX	89.75	.00	.00

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ILD984870451	RIPPEL ARCHITECTURAL METALS	CHICAGO	20.54	.00	.00
ILD005237250	RIVER VALLEY COATINGS INC	AURORA	83.54	.00	.00
ILD005104443	RIVERDALE INDUSTRIES INC	RIVERDALE	49.04	.00	.00
ILD005531132	RIVERDALE PLATNG-HEAT TREATING	RIVERDALE	193.62	.00	.00
ILD006304109	ROADMASTER CORP	OLNEY	298.79	.00	.00
IL5210021833	ROCK ISLAND ARSENAL	ROCK ISLAND	527.86	23.00	.00
ILD054356266	ROCK VALLEY OIL & CHEMICAL CO	LOVES PARK	13.40	.00	.00
ILD005113063	ROGERS BROTHERS INC	ROCKFORD	54.84	.00	.00
ILD049993165	ROHM & HAAS ILLINOIS INC	CHICAGO HEIGHTS	155.25	.00	.00
ILD984766642	ROLLPRINT PACKAGING PRODUCTS	ADDISON	131.61	.00	.00
ILR000013250	ROSELAND PUMPING STATION	CHICAGO	58.53	.00	.00
IL0000301382	RR DONNELLEY COLOR CENTER	PONTIAC	15.25	.00	.00
ILD068610245	RUSH PRESBYTERIAN ST LUKES	CHICAGO	6.66	64.58	.00
ILD005111893	RYCOLINE PRODUCTS INC	CHICAGO	42.53	.00	.00
ILD005068895	S & C ELECTRIC CO	CHICAGO	1,160.05	.00	.00
ILD980613913	SAFETY KLEEN ENVIROSYSTEMS CO	DOLTON	25,897.27	.00	.00
ILD005450697	SAFETY-KLEEN CORP	CHICAGO	5,387.75	.00	.00
ILD984766600	SAFETY-KLEEN CORP-TECH CTR	ELK GROVE VILLA	119.91	85.00	.00
ILD085013449	SALEM GRAVURE	SALEM	2,000.00	.00	.00
ILD980267090	SALL CORPORATION	ROCKFORD	334.91	.00	.00
ILD005269188	SANDSTROM PRODUCTS CO	PORT BYRON	24.40	.00	.00
ILD005067574	SANFORD CORP	BELLWOOD	77.21	.00	.00
ILD038408894	SCHROCK CABINET CO	ARTHUR	37.20	.00	.00
ILD067408054	SCHUMACHER ELECTRIC CORP	HOOPESTON	33.28	.00	.00
ILD981795297	SCIENTIFIC PLATING CO INC	CHICAGO	267.98	.00	.00
IL7570024177	SCOTT AIR FORCE BASE-DRMO	SCOTT AFB	160.48	.00	.00
ILD053215315	SEALMASTER BEARINGS	AURORA	31.98	.00	.00
ILD052308210	SEGERDAHL CORP	WHEELING	23.44	.00	.00
ILR000002782	SELFIX INC	CHICAGO	38.46	.00	.00
ILD066197195	SELIG SEALING PRODUCTS INC	FORREST	16.85	.00	.00
ILD005100789	SEYMOUR OF SYCAMORE INC	SYCAMORE	1,002.64	.00	.00
ILD990817249	SHAKEPROOF	ELGIN	20.47	.00	.00
ILD000608992	SHELL OIL CO	BEDFORD PARK	479.87	.00	.00
ILD080012305	SHELL WOOD RIVER REFINING CO	ROXANA	8,627,306.03	.00	.00
ILD000672451	SHERWIN WILLIAMS CO	CHICAGO	122.81	.00	.00
ILD005456439	SHERWIN WILLIAMS CO	CHICAGO	3,519.53	.00	.00
ILD079761649	SHERWIN WILLIAMS CO	COUNTRYSIDE	71.75	.00	.00
ILD980901995	SHERWIN WILLIAMS CO	EFFINGHAM	169.69	.00	.00
ILD005444781	SIGNODE CONSUMABLE PRODUCTS	BRIDGEVIEW	49.68	.00	.00
ILT180013880	SILGAN CONTAINERS CORP #115	ROCHELLE	71.44	.00	.00
ILD037037686	SIMKINS INDUSTRIES INC	CICERO	49.31	.00	.00
ILD041057902	SKILD PLATING CORP	CHICAGO	21.47	.00	.00
ILD005121033	SLOAN VALVE CO	FRANKLIN PARK	528.38	.00	.00
ILD082940081	SMURFIT LAMINATING & COATING	SCHAUMBURG	109.87	.00	.00
ILR000007088	SOL TICK & CO	DECATUR	174.05	.00	.00
ILD984775858	SOLAR COMMUNICATIONS INC	NAPERVILLE	17.20	.00	.00
ILD981959224	SOUTH HOLLAND METAL FINISHING	SOUTH HOLLAND	228.98	.00	.00
ILD064000011	SPAULDING FIBRE CO INC	DEKALB	194.65	.00	.00
ILD005140108	SPECIALTY COATINGS CO	ELK GROVE VILLA	159.78	.00	.00
ILT180011611	SPECIFIED PLATING COMPANY	CHICAGO	98.56	.00	.00
IL0001006618	SPECTRUM CIRCUITS INC	ADDISON	60.18	.00	.00
ILD005071071	SPRAYING SYSTEMS CO	GLENDALE HEIGHT	17.18	.00	.00
ILD000814665	SPRAYLAT CORP	CHICAGO	110.74	.00	.00
ILT180010472	ST CLAIR MFG CORP	BELLWOOD	32.21	.00	.00
ILD058591090	STACK-ON PRODUCTS	WAUCONDA	14.50	.00	.00

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ILLINOIS

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
ILD042067058	STANDARD REGISTER	SPRING GROVE	20.21	.00	.00
ILD984779587	STAR ELECTRONICS	ELK GROVE VILLA	584.47	.00	.00
ILD005197652	STAR FINISHING PRODUCTS INC	BURR RIDGE	20.21	.00	.00
ILD054351770	STEPAN COMPANY	ELWOOD	1,399.74	.00	.00
ILD005134564	STERLING LABORATORIES	HARWOOD HEIGHTS	52.40	.00	.00
ILD081035867	STIFFEL CO	CHICAGO	28.19	.00	.00
ILD051093367	SUN CHEMICAL CORP	NORTHLAKE	1,350.74	.00	.00
ILD075603886	SUN CHEMICAL CORP	KANKAKEE	53.97	.00	.00
ILD082933508	SUN CHEMICAL CORP	CHICAGO	36.38	.00	.00
ILD053191029	SUN CHEMICAL CORP-PLANT I&II	CHICAGO	44.10	.00	.00
ILD980700777	SUN CHEMICAL CORP-PLANT II	CHICAGO	18.29	.00	.00
ILD102177607	SUN PROCESS CONVERTING INC	MT PROSPECT	15.36	.00	.00
ILD046583993	SUNDSTRAND AEROSPACE	ROCKFORD	1,150.29	.00	.00
ILD010219665	SUNDSTRAND AVIATION	ROCKFORD	463.49	.00	.00
ILD102183522	SUNTRONICS	ELK GROVE VILLA	81.10	.00	.00
ILD984918193	SUPERIOR CARRIERS INC	MARKHAM	21.35	.00	.00
ILD984766725	SUPERIOR PRINTED CIRCUITS INC	WHEELING	203.23	.00	.00
ILD984838250	SURFACE MFG CO	CAPRON	23.78	.00	.00
ILD052622917	SWAN CORP	CENTRALIA	219.18	.00	.00
ILD005098389	SWITCHCRAFT INC	CHICAGO	16.22	.00	.00
ILD980793020	TAKASAGO INTERNATIONAL CORP	UNIVERSITY PARK	245.43	.00	.00
ILD981191190	TANK TRAILER CLEANING INC	EAST ST LOUIS	33.55	.00	.00
ILD024953291	TAPTITE PRODUCTS	BELVIDERE	81.08	.00	.00
ILD096731468	TARACORP INDUSTRIES INC	GRANITE CITY	123.73	.00	.00
ILD005075346	TAUBENSEE STEEL & WIRE CO	WHEELING	92.65	.00	.00
ILD018188540	TECH FINISHERS INC	ADDISON	20.84	.00	.00
ILD051933075	TECH FINISHERS INC	ADDISON	533.40	.00	.00
ILD005178975	TECHALLOY, INC.	UNION	1,906.01	.00	.00
ILD059430561	TECHNICAL COATING CO	MELROSE PARK	81.10	.00	.00
ILD005441696	TECHNICAL PRODUCTS INC	CHICAGO	82.99	.00	.00
ILD984844134	TEK-TRONICS MANUFACTURING	CRYSTAL LAKE	368.01	.00	.00
ILD981775059	TELLABS OPERATIONS INC	LISLE	1.98	80.00	.00
ILD980998751	TEMPEL STEEL CO	CHICAGO	31.57	.00	.00
ILD984787663	TEMPEL STEEL COMPANY	LIBERTYVILLE	19.81	.00	.00
ILD984827246	TENNECO PACKAGING INC	WHEELING	59.08	.00	.00
ILD098749294	TENNECO PLASTICS CO	JACKSONVILLE	111.72	.00	.00
IL0000081380	TEROSON INCORPORATED	AURORA	28.56	.00	.00
IL0001002047	TESA TAPE INC	CARBONDALE	67.94	.00	.00
ILD981955008	TESTOR CORP	ROCKFORD	24.57	.00	.00
ILT180010506	TESTOR CORP	ROCKFORD	55.67	.00	.00
ILD041518861	TEXACO REFINING & MARKETING	LOCKPORT	14,364.68	.00	.00
ILD010596260	TEXTILE CARE DIV OF ECOLAB	FRANKLIN PARK	23.18	.00	.00
ILT180010324	THE BF GOODRICH CO	HENRY	23.36	.00	.00
ILD004531927	THE DEXTER CORPORATION	WAUKEGAN	1,025.30	.00	.00
ILD045690724	THE FINISHING COMPANY INC	FRANKLIN PARK	74.48	.00	.00
ILD006278212	THE KNAPHEIDE MFG CO	QUINCY	82.42	.00	.00
ILD006537542	THE THERMOS CO	FREEPORT	22.49	.00	.00
ILD981778939	THE UNO-VEN COMPANY	ORLAND PARK	39.32	.00	.00
ILD984822791	THE UNO-VEN COMPANY	HOFFMAN ESTATES	36.07	.00	.00
ILD984823096	THE UNO-VEN COMPANY	WHEATON	26.27	.00	.00
ILD060571189	THOMPSON MINWAX CO, THE	FLORA	118.31	.00	.00
ILD005094651	THRALL CAR MANUFACTURING CO	CHICAGO HEIGHTS	164.09	.00	.00
ILD984806745	THREE J'S INDUSTRIES, INC.	ELK GROVE VILLA	76.70	.00	.00
ILD005182282	TINGSTOL COMPANY	CHICAGO	931.50	.00	.00
ILD046100939	TIOGA COATINGS	ROCKFORD	34.15	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
ILD980824734	TITAN WHEEL INTERNATIONAL INC	QUINCY	176.53	.00	.00
ILD005474846	TOTE CART CO	ROCKFORD	35.58	.00	.00
ILD098642424	TRADE WASTE INCINERATION INC	SAUGET	11,652.15	.00	.00
ILD052670734	TRAILMOBILE	CHARLESTON	14.55	.00	.00
ILD980681795	TRANS-TECHNOLOGY ELECTRONICS	WYOMING	103.42	800.03	.00
ILD982067928	TREASURE CHEST ADVERTISING	ELK GROVE VILLA	199.02	.00	.00
ILD169724440	TREDEGAR MOLDED PRODUCTS	ALSIP	16.60	.00	.00
ILD065241267	TREKKER CHEMICAL	MENDOTA	.38	752.00	.00
ILD980794739	TRIAD CIRCUITS INC	ROUND LAKE	109.44	.00	.00
ILD005241914	TRILLA STEEL DRUM CORP	CHICAGO	25.93	.00	.00
ILD005245923	TRU-COAT PLATING & FINISHING	BELLWOOD	14.35	.00	.00
ILD010238491	TRU-TEST MFG CO	CARY	66.70	.00	.00
ILD074401530	TRU-TEST MFG-DIV OF COTTER CO	CHICAGO	24.02	.00	.00
ILD984828525	TRUNKLINE GAS COMPANY	GRAND CHAIN	91.33	.00	.00
ILD005476700	TRW TRANSPORTATION ELECTRONICS	MARSHALL	23.96	.00	.00
ILD005138771	TURTLE WAX INC	CHICAGO	17.65	.00	.00
ILT180010498	TWR SERVICE CORP	ROSEMONT	77.37	.00	.00
ILD982069627	UNC INC-GARRETT PAINT HANGAR	SPRINGFIELD	225.33	.00	.00
ILD980792584	UNITED AIRLINES	CHICAGO	237.25	.00	.00
ILD984848416	UNITED ELECTRONICS	ROSEMONT	95.24	.00	.00
ILD984847590	UNITED ELECTRONICS CORP	ROSEMONT	211.03	.00	.00
ILR000006338	UNITED ELECTRONICS CORP	ROSEMONT	109.56	.00	.00
ILD020034989	UNITED METAL FINISHERS	CHICAGO	207.88	.00	.00
ILD096787585	UNITED REMANUFACTURING CO INC	SCHILLER PARK	43.51	.00	.00
ILD005455159	UNITED STATES CAN CO	ALSIP	161.67	.00	.00
ILD005105713	UNITY MANUFACTURING CO	CHICAGO	36.01	.00	.00
ILD984906198	UNIV OF IL CHICAGO WEST CAMPUS	CHICAGO	28.34	.00	.00
ILD042326207	UNIVERSAL CHEMICALS & COATINGS	ELK GROVE VILLA	246.43	.00	.00
ILD981189376	UNIVERSAL CHEMICALS & COATINGS	ELGIN	224.04	.00	.00
ILD980898159	UNIVERSAL PACKAGING CORP	CENTRALIA	26.13	.00	.00
ILD006377543	UNIVERSAL SCIENTIFIC	ELK GROVE VILLA	75.85	.00	.00
ILD005421136	UNIVERSITY OF CHICAGO HOSPITAL	CHICAGO	38.11	.00	.00
ILD041544081	UNIVERSITY OF ILLINOIS	URBANA	72.34	.00	.00
ILD984792770	UNO-VEN	DES PLAINES	24.91	.00	.00
ILD041550567	UNO-VEN CHICAGO REFINERY	LEMONT	102.66	.00	.00
ILD000814640	UOP INC	MCCOOK	182.00	1,431.00	.00
ILD084741222	UOP RESEARCH CENTER	DES PLAINES	108.74	589.00	.00
IL2210020838	US ARMY	FT SHERIDAN	24.12	.00	.00
ILD980904601	US CAN CO	ELGIN	166.75	.00	.00
ILD005119821	US CAN COMPANY	CHICAGO	194.83	.00	.00
ILD045063450	US ECOLOGY INC	SHEFFIELD	37.68	.00	.00
ILD005119839	US FILTER/IWT	ROCKFORD	63,889.39	.00	.00
ILD094292307	US PACKAGING CORP	WHEELING	96.67	.00	.00
ILD005210216	US PLATING CORP	CHICAGO	16.78	.00	.00
ILD005130190	US ROBOTICS	MT PROSPECT	42.25	.00	.00
ILD010279222	US STEEL CORP	CHICAGO	2,878.61	.00	.00
ILD005098629	V J DOLAN & COMPANY INC	CHICAGO	27.49	.00	.00
ILD005087168	V S GRINDING CO INC	WHEELING	17.34	.00	.00
ILD000187013	VACTOR MANUFACTURING INC	STREATOR	63.70	.00	.00
ILD001980135	VALSPAR CORP	ROCKFORD	287.42	.00	.00
ILD002525723	VALSPAR CORP	KANKAKEE	910.76	.00	.00
ILD047907555	VALSPAR CORP	CHICAGO	602.27	.00	.00
ILD085346468	VAN LEER CONTAINERS INC	ALSIP	297.16	.00	.00
ILD981093628	VAN TRAN ELECTRIC/IEPA	VANDALIA	39.61	.00	.00
ILD006317614	VANEX COLOR INC	MT VERNON	31.09	.00	.00

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ILD059458604	VAPOR CORP	NILES	94.27	.00	.00
ILD981201437	VARIAN-EUREKA X-RAY TUBE PROD	ARLINGTON HEIGH	19.56	.00	.00
ILD984790337	VARN PRODUCTS COMPANY INC	ADDISON	19.40	.00	.00
ILD984843235	VIDEOJET SYSTEMS INTERNATIONAL	WOOD DALE	41.15	.00	.00
ILD984775619	VIDIOJET SYSTEMS INTERNATIONAL	ELK GROVE VILLA	169.30	.00	.00
ILD039617337	VWR SCIENTIFIC	BATAVIA	11.12	410.31	.00
ILD001754167	W C RICHARDS COMPANY	BLUE ISLAND	376.70	.00	.00
ILD074406075	W R GRACE & COMPANY	CHICAGO	19.14	.00	.00
ILD097281521	W R MEADOWS INC	HAMPSHIRE	34.34	.00	.00
ILD006195853	WALDORF CORP	CHICAGO	173.11	710.00	.00
ILD119572212	WARNER-LAMBERT COMPANY	ELK GROVE VILLA	3.00	3,000.00	.00
ILD046578241	WAYNE CIRCUITS INC	YORKVILLE	2,578.47	.00	.00
ILD005467725	WEBER MARKING SYSTEMS INC	ARLINGTON HEIGH	182.71	.00	.00
ILD004510491	WERNER CO	FRANKLIN PARK	195.37	.00	.00
ILD984818518	WESLEY JESSEN CORPORATION	DES PLAINES	19.11	.00	.00
ILD005473970	WEST TOWN PLATING INC	CICERO	15.76	.00	.00
ILD005212253	WESTERN RUST PROOF CO	CHICAGO	243.53	.00	.00
ILD010593861	WESTON ENVIRONMENTAL METRICS	UNIVERSITY PARK	62.37	.00	.00
ILD984917633	WILLIAMSON H B CO	FAIRFIELD	315.26	.00	.00
ILD095792859	WITCO CORP	MAPLETON	19.11	.00	.00
ILD982616344	WMX TECHNOLOGY CENTER INC	GENEVA	99.23	200.01	.00
ILD005069380	WOODWARD GOVERNOR CO	LOVES PARK	111.30	.00	.00
ILD982609331	WOODWARD GOVERNOR CO	ROCKTON	23.17	.00	.00
ILD000806109	WRICO PACKAGING	CHICAGO	83.08	.00	.00
ILD005120498	WRIGLEY CO	CHICAGO	707.14	.00	.00
ILD047137385	YORK INTERNATIONAL CORP	WHEELING	14.72	.00	.00
ILD005120589	ZENITH ELECTRONICS CORP	CHICAGO	883.01	.00	.00
ILD005120704	ZENITH ELECTRONICS CORP	GLENVIEW	4.38	34.02	.00
ILD049297765	ZENITH ELECTRONICS CORP	MELROSE PARK	3,512.11	.00	.00
ILD087533113	ZENITH RADIO CORP	CHICAGO	217.84	.00	.00
ILD182768085	ZEXEL USA CORP	DECATUR	1,747.12	.00	.00
ILD981091291	115TH ST CORP	CHICAGO	463.90	.00	.00
ILD006220123	3M COMPANY	BEDFORD PARK	479.78	.00	.00
ILD054236443	3M COMPANY	CORDOVA	8,075.65	.00	.00
ILD981094279	3M MIDWEST DISTRIBUTION CENTER	DEKALB	67.53	.00	.00

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ILD984843938	ACCO USA INC	BURR RIDGE	2.12	.00	.00
ILD113090336	ACE HARDWARE CORP	MATTESON	6.80	.00	.00
ILD984784280	AEL DEFENSE CORP REGNL AIRPORT	EAST ALTON	11.06	.00	.00
ILD021310222	AGFA DIVISION BAYER CORP	DES PLAINES	6.12	.00	.00
ILD079143426	AGRI-FAB INC	SULLIVAN	8.92	.00	.00
ILD000467522	AIRCRAFT GEAR CORPORATION	CHICAGO	10.04	.00	.00
ILD982206716	ALCHEMITRON INC	ELGIN	2.06	.00	.00
ILD005091889	ALDEN PRESS INC	ELK GROVE VILLA	9.69	.00	.00
ILD984817270	ALLWASTE CONTAINER SERVICE INC	CAIRO	2.29	.00	.00
ILD005093778	AMERICAN MAIL WELL ENVELOPE	CHICAGO	12.16	.00	.00
ILD026330969	AMERICAN MAIL WELL ENVELOPE	CHICAGO	1.66	.00	.00
ILT180012718	AMERICAN NATIONAL CAN CO	CHICAGO	7.75	.00	.00
ILD984817858	AMERICAN PFAUTER L P	LOVES PARK	5.42	.00	.00
ILD000806190	AMEROCK CORP	ROCKFORD	6.58	.00	.00
ILD005076443	AMOCO CHEMICAL CO	WILLOW SPRINGS	7.53	.00	.00
ILD000805697	AMOCO OIL CO	FOREST VIEW	3.97	.00	.00
ILD984792630	AMOCO PIPELINE E FT MADISON	NIOTA	9.29	.00	.00
ILD039634043	ANALYSTS MAINTENANCE LAB INC	HOFFMAN ESTATES	9.45	.00	.00
ILR000000927	ANDREW CORP	TINLEY PARK	10.84	.00	.00
ILD068458827	ANETS INC	NORTHBROOK	1.87	.00	.00
ILD085224376	ARMOLOY OF ILLINOIS	DEKALB	1.50	.00	.00
ILD003853314	AZZARELLI CONSTRUCTION	KANKAKEE	1.23	.00	.00
ILD000717934	BALL-FOSTER GLASS CONTAINER CO	DOLTON	9.58	.00	.00
ILD089813588	BASF CORP	JOLIET	5.12	.00	.00
ILD982427163	BASF CORP, INMONT	LOMBARD	12.09	.00	.00
ILD006288872	BASLER ELECTRIC CO	HIGHLAND	2.64	.00	.00
ILR000013284	BASSWOOD HEALTHCARE CENTER	PRINCETON	6.00	.00	.00
ILR000001446	BATES INC	CHICAGO	3.96	.00	.00
ILD075611525	BELL SPORTS INC	RANTOUL	8.58	.00	.00
ILD055435895	BELVEDERE CO	BELVIDERE	6.96	.00	.00
ILD024502239	BERRY BEARING CO	CICERO	1.75	.00	.00
ILD055417794	BORG-WARNER	FRANKFORT	8.34	.00	.00
ILD000781526	BP OIL PIPELINE CO	ODIN	3.44	.00	.00
ILD981091861	BRITESOL	CRESTWOOD	10.25	.00	.00
ILD984798074	BROMENN REGIONAL MEDICAL CTR	NORMAL	5.06	.00	.00
ILD005146964	BUHRKE INDUSTRIES INC	ARLINGTON HEIGH	2.58	.00	.00
ILD089640676	BUMPER WORKS	DANVILLE	5.70	.00	.00
ILD984774406	CAHOKIA MARINE SVC	SAUGET	9.24	.00	.00
ILD056635568	CAMCAR LDR PRODUCTS	ROCKFORD	10.08	.00	.00
ILD000821801	CARDWELL WESTINGHOUSE	CHICAGO	10.77	.00	.00
ILR000008987	CARL HANSON PAINTING INC	JOLIET	1.76	.00	.00
ILD980902647	CARTER WALLACE INC	MOMENCE	4.74	.00	.00
ILD984926139	CASTROL IND NORTH AMERICA INC	DOWNERS GROVE	1.94	.00	.00
ILD089640619	CATERPILLAR INC	PONTIAC	5.67	.00	.00
ILD062330162	CBI SVC INC	BOURBONNAIS	12.54	.00	.00
ILD000665372	CHEM PLATE IND INC	MAYWOOD	1.10	.00	.00
ILR000009860	CHEMICAL LEAMAN TANK LINES	CENTRALIA	2.26	.00	.00
ILD005108659	CHICAGO DUBUQUE FOUNDRY	EAST DUBUQUE	11.84	.00	.00
ILD089821037	CHICAGO STEEL CONTAINER CORP	CHICAGO	2.49	.00	.00
ILD152303079	CHICAGO TRANSIT AUTHORITY	CHICAGO	6.22	.00	.00
ILD984783431	CHROMCRAFT DIV GILBERT PRINTIN	CHICAGO	8.62	.00	.00
ILD045683471	CHROMIUM IND INC	CHICAGO	4.11	.00	.00
ILD000806570	CILCO	EAST PEORIA	1.68	.00	.00
ILR000004929	CILCO	CREVE COEUR	4.20	.00	.00
IL0000993428	CILCO	BARTONVILLE	3.50	.00	.00

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ILD984780270	CIRQON TECHNOLOGIES CORP	GURNEE	11.48	.00	.00
ILD064389828	CITGO PETROLEUM CORP	ARLINGTON HEIGH	8.72	.00	.00
IL0000917278	COLOR COMMUNICATIONS INC	CHICAGO	2.12	.00	.00
ILD047584198	COLOVOS CO	CHICAGO	12.19	.00	.00
ILD096464458	COM ED CRESTWOOD AREA HQ	CRESTWOOD	5.79	.00	.00
ILD000665489	COM ED DRESDEN STA	MORRIS	4.25	.00	.00
ILD000803643	COM ED LASALLE CTY STA	MARSEILLES	9.08	.00	.00
ILD981091366	COM ED ROCK RIVER DIV HQ	ROCKFORD	1.66	.00	.00
ILD025087412	COMMUNITY MOTORS INC	OAK FOREST	5.39	.00	.00
ILD981093727	CONTAINER TECHNOLOGIES INC	BARRINGTON	10.99	.00	.00
ILD064396633	CONTINENTAL WEB PRESS	ITASCA	4.70	.00	.00
ILD057739427	CROWN CORK & SEAL CO	BRADLEY	2.43	.00	.00
ILD984876433	CURTIN MATHESON SCIENTIFIC INC	WOOD DALE	3.50	.00	10.00
ILD005215678	CUSTOM ALUMINUM PROD INC	SOUTH ELGIN	5.22	.00	.00
ILD005119656	DANLY MACHINE LP	CICERO	3.71	.00	.00
ILD005120456	DAP INC	ROSEMONT	3.45	.00	.00
ILD984774091	DELTA CIRCUITS INC	ELK GROVE VILLA	9.41	.00	.00
ILD041542580	DICKEY-JOHN CORP	AUBURN	9.47	.00	.00
ILR000006015	DOMINICKS FINER FOODS	CHICAGO	1.50	.00	.00
ILR000010470	DORIC PRODUCTS INC	MARSHALL	12.54	.00	.00
ILD005100961	DRIV LOK INC	SYCAMORE	7.51	.00	.00
ILD005145560	DUKANE CORP	ST CHARLES	4.29	.00	.00
ILD984916205	DUNLEE	AURORA	6.44	.00	.00
ILD984775353	EAGLE PICHER AUTOMOTIVE GROUP	PARIS	12.96	.00	.00
ILR000013268	EASTSIDE HEALTH DISTRICT	EAST ST LOUIS	3.08	.00	.00
ILD049010564	ELECPAC	CARY	8.09	.00	.00
ILD006302764	EM WIEGMANN & CO INC	FREEBURG	5.47	.00	.00
ILD984902619	ETCH A DIE DIV OF BEST CUT DIE	SKOKIE	7.92	.00	.00
ILD010300531	ETHICON INC	BEDFORD PARK	10.05	.00	.00
IL0001018811	FEL-PRO CHEMICAL PRODUCTS LP	SKOKIE	6.39	.00	.00
ILD005112842	FIELD CONTAINER CORP	ELK GROVE VILLA	7.97	.00	.00
ILD005180641	FORD MOTOR CO, STAMPING PLANT	CHICAGO HEIGHTS	6.80	.00	.00
ILD005104930	FORT DEARBORN LITHOGRAPH CO	CHICAGO	4.55	.00	.00
ILD056646508	FURNAS ELECTRIC COMPANY	WEST CHICAGO	5.05	.00	.00
ILD005076625	G & W ELECTRIC SPECIALTY CO	BLUE ISLAND	12.65	.00	.00
ILD982616104	G D SEARLE & CO	MT PROSPECT	9.93	.00	.00
ILD984791962	GARDEN MARKET SHOPPING CENTER	WESTERN SPRINGS	5.01	.00	.00
ILD005453758	GENERAL ELECTRIC CO	DEKALB	4.05	.00	.00
ILD070015714	GENERAL ELECTRIC CO	CHICAGO	5.38	.00	.00
ILD005150206	GENERAL PACKAGING PRODUCTS INC	CHICAGO	5.20	.00	.00
ILD005128673	GRAHAM PLATING WORKS INC	CHICAGO	2.72	.00	.00
ILD984774752	GREENLEE/TEXTRON	ROCKFORD	2.54	.00	.00
ILD984807651	H S CROCKER CO INC	HUNTLEY	6.35	.00	.00
ILD005071667	HANDY BUTTON MACHINE CO	MELROSE PARK	10.10	.00	.00
ILD049296304	HELENE CURTIS, INC	CHICAGO	4.09	.00	.00
ILD092545953	HENRY PRATT CO	AURORA	5.03	.00	.00
ILD000180869	HENRY PRATT COMPANY	DIXON	8.80	.00	.00
ILD984811349	HERITAGE ENVIRONMENTAL SERV	ROMEOVILLE	7.30	.00	.00
ILD000805952	HI-TEMP INC	NORTHLAKE	10.64	.00	.00
ILD980613160	HOMESHIELD EAST FACILITY	CHATSWORTH	2.76	.00	.00
ILD051078756	HONEYWELL INC	ARLINGTON HEIGH	10.90	.00	.00
ILD984918466	HYDRITE CHEMICAL CO	UNIVERSITY PARK	3.05	.00	.00
ILD005094685	IDEAL INDUSTRIES INC	SYCAMORE	2.54	.00	.00
ILD006277966	IDEAL STENCIL MACHINE CO	BELLEVILLE	6.57	.00	.00
ILD000806034	ILLINOIS CENTRAL RAILROAD	CENTRALIA	9.40	.00	.00

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ILLINOIS

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
ILD980701833	IMI-TECH CORP	ELK GROVE VILLA	4.79	.00	.00
ILD980615066	IMPERIAL BONDWARE	SHELBYVILLE	4.08	.00	.00
ILR000002097	INGERSOLL MILLING MACHINE CO	ROCKFORD	5.25	.00	.00
ILD980995294	INTERCONNECT SYSTEMS INC	SKOKIE	9.84	.00	.00
ILD984920678	INTERMATIC INC	CHICAGO	6.33	.00	.00
ILD054332598	INX INTERNATIONAL INK CO	CHICAGO	11.28	.00	.00
ILD980502280	ITW SIGNODE CORP	GLENVIEW	5.30	.00	.00
ILD025820812	JEFFERSON SMURFIT CORP	ST CHARLES	11.94	.00	.00
ILD055433668	JOHN CRANE INC	CRYSTAL LAKE	10.08	.00	.00
ILD022096168	JOHNSON PAINTING	EAST MOLINE	6.20	.00	.00
ILD039011242	JOSYLN MFG CO	CHICAGO	11.44	.00	.00
ILD065235053	JUSTRITE MANUFACTURING CO	MATTOON	2.48	.00	.00
ILD005162177	KOMATSU DRESSER CO	LIBERTYVILLE	4.05	.00	.00
ILD006294623	LAFARGE CORP	GRAND CHAIN	3.99	.00	.00
ILD980264329	LAKEWOOD ENGINEERING & MFG CO	CHICAGO	2.49	.00	.00
ILD085858710	LEARONAL INC	ADDISON	8.30	.00	.00
ILD005468616	LIBBEY-OWENS-FORD CO	OTTAWA	2.08	.00	.00
ILD005071808	LINDBERG HEAT TREATING CO	MELROSE PARK	3.32	.00	.00
ILD043333863	LOCTITE CORP	AURORA	1.37	.00	.00
ILD980616346	LOUIS MELIND CO	ONARGA	11.67	.00	.00
ILD068584978	LOYOLA UNIVERSITY	CHICAGO	3.31	.00	.00
ILD005067707	M & W GEAR COMPANY	GIBSON CITY	12.39	.00	.00
ILD982219388	MACK-CHICAGO CORP	CHICAGO	6.88	.00	.00
ILD984877035	MACON RESOURCES INC	DECATUR	1.75	.00	.00
ILD066210394	MAGNAFLUX CORP	HARWOOD HEIGHTS	6.09	.00	.00
ILT180012593	MAPEI CORP	WEST CHICAGO	9.98	.00	.00
ILD072362536	MASURY-COLUMBIA CORP	CHICAGO	12.44	.00	.00
ILD984774646	MCLAUGHLIN BODY-GOV'T PROD DIV	ROCK ISLAND	5.41	.00	.00
ILD005104872	MECO INC	PARIS	4.31	.00	.00
ILD045700945	METAL FINISHING RESEARCH CORP	CHICAGO	3.57	.00	.00
ILD062333968	METAMORA WOODWORKING CO	METAMORA	8.64	.00	.00
ILD984885012	METRA-CNW PASSENGER TERMINAL	CHICAGO	4.18	.00	.00
ILD982625006	MICHAEL REESE HOSPITAL & M/C	CHICAGO	7.53	.00	.00
ILD082077595	MIDWEST/GENDEX DENTAL DIVS	DES PLAINES	1.89	.00	.00
ILD984823112	MOBIL OIL CORP, #A4L	DEKALB	1.33	.00	.00
IL0000302695	MOBIL PIPELINE GIBSON CITY ST	GIBSON CITY	1.15	.00	.00
ILD098641012	MONTEREY COAL CO	CARLINVILLE	6.21	.00	.00
ILD056637879	MOTOROLA INC	LIBERTYVILLE	5.58	.00	.00
ILT180013617	MOTOROLA INC	GRAYSLAKE	2.02	.00	.00
ILD984775049	MR FRANK INC	MATTESON	2.64	.00	.00
ILD000870832	MWRDGC	CHICAGO	3.12	.00	.00
ILT180014490	MWRDGC METRO WATER RECL-CHGO	CICERO	11.55	.00	.00
ILD005082805	NACCO MATERIALS HANDLING	DANVILLE	11.31	.00	.00
ILD042075044	NALCO CHEMICAL CO	CHICAGO	6.82	1.00	.00
ILD000682120	NALCO CHEMICAL CO.	NAPERVILLE	2.52	22.50	.00
ILD082256678	NATIONAL AUTO SUPPLY CO	EAST ST LOUIS	1.43	.00	.00
ILR000008953	NICOAT	BENSENVILLE	6.82	.00	.00
ILD984766295	NIEDERMAIER INC	CHICAGO	10.19	.00	.00
ILD000802785	NORFOLK & WESTERN RAILWAY CO	DECATUR	5.54	.00	.00
IL0000959163	NORFOLK & WESTERN RR	CHICAGO	5.32	.00	.00
ILD981002074	NORTH BRANCH WASTE OIL SERVICE	SCHAUMBURG	6.48	.00	.00
ILD062341805	NORTHERN ILLINOIS GAS	KANKAKEE	3.10	.00	.00
ILD030566228	NORTHERN ILLINOIS GAS CO	MORRIS	4.08	.00	.00
IL0000917252	NORTHERN ILLINOIS GAS-STA 143	VOLO	3.81	.00	.00
ILD001745512	NORTHERN ILLINOIS UNIVERSITY	DEKALB	8.19	.00	.00

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ILLINOIS

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
ILD982646721	NORTHWESTERN UNIVERSITY	EVANSTON	1.74	.00	.00
ILD043910256	NTN BEARING CORP	DES PLAINES	8.11	.00	.00
ILR000006916	OLD DELTA TIPPLE	CARRIER MILLS	3.93	.00	.00
IL4140090222	OLIN CORP - P AREA	MARION	2.35	.00	.00
ILD005112164	OWENS-BROCKWAY GLASS CONTAINER	STREATOR	3.18	.00	.00
ILD006272058	OWENS-BROCKWAY GLASS CONTAINER	GODFREY	2.93	.00	.00
ILD081024440	OWENS-BROCKWAY GLASS CONTAINER	CHICAGO HEIGHTS	1.27	.00	.00
ILD131583817	OWENS-BROCKWAY PLASTIC PROD	VANDALIA	6.81	.00	.00
ILD984831693	PARK CORP	BARRINGTON	4.96	.00	.00
ILD005067913	PAYMASTER CORP	CHICAGO	6.26	.00	.00
IL0000190074	PDC LABORATORIES INC	PEORIA	2.00	.00	.00
ILD005130794	PEERLESS OF AMERICA INC	CHICAGO	10.50	.00	.00
ILD982074783	PEOPLES GAS:ROOSEVELT ROAD STA	CHICAGO	3.20	.00	.00
ILD051001055	PINES TRAILER CORP	KEWANEE	2.48	.00	.00
ILD043362441	PPC LAMINATIONS	ELK GROVE VILLA	5.32	.00	.00
ILD005215876	PRECISION INSTRUMENTS INC	DES PLAINES	7.66	.00	.00
ILD981777378	PRINT-O-TAPE INC	MUNDELEIN	11.79	.00	.00
ILT180010100	R A BRIGGS & COMPANY	LAKE ZURICH	1.54	.00	.00
ILD000814723	R R DONNELLEY & SONS CO	CHICAGO	5.01	.00	.00
ILD000780528	RANTOUL PRODUCTS COMPANY	RANTOUL	12.14	.00	.00
ILD005181128	RAWAL ENGRAVERS INC	VILLA PARK	8.70	.00	.00
ILD005110143	RHONE-POULENC BASIC CHEMICALS	CHICAGO HEIGHTS	9.15	.00	.00
ILD980677843	ROADWAY EXPRESS	CHICAGO HEIGHTS	4.59	.00	.00
ILD005455431	ROCKFORD POWERTRAIN INC	ROCKFORD	2.47	.00	.00
ILD000805895	ROCKFORD PRODUCTS CORP PLT 2	ROCKFORD	4.57	.00	.00
ILD005212097	ROCKFORD PRODUCTS CORP PLT 3	ROCKFORD	9.75	.00	.00
ILD980898167	SANDOZ CROP PROTECTION CORP	DES PLAINES	7.80	.00	.00
IL3210020803	SAVANNA ARMY DEPOT ACTIVITY	SAVANNA	8.77	.00	.00
ILD001746684	SCHOLLE CORP	NORTHLAKE	3.20	.00	.00
ILR000007708	SEARS #1090	CHICAGO	4.51	.00	.00
ILR000002899	SEARS #8360	SCHAUMBURG	3.59	.00	.00
ILR000006064	SEARS AUTOMOTIVE CENTER	OAK BROOK	2.58	.00	.00
ILD984783381	SEARS ROEBUCK & CO	FAIRVIEW HEIGHT	2.77	.00	.00
ILD984846568	SEARS ROEBUCK & CO	PARK FOREST	5.41	.00	.00
ILD984903849	SEARS ROEBUCK & CO	CHICAGO	1.87	.00	.00
IL0000450247	SEARS ROEBUCK & CO	CHICAGO	2.19	.00	.00
ILD981957236	SET ENVIRONMENTAL INC	WHEELING	10.14	.00	.00
ILD068588664	SHELL OIL CO	ARLINGTON HEIGH	8.36	.00	.00
ILD003938818	SILGAN CONTAINERS CORP	WAUKEGAN	10.93	.00	.00
ILD005462361	SILGAN CONTAINERS CORP	HOOPESTON	10.58	.00	.00
ILD177872439	SILGAN CONTAINERS CORP	WOODSTOCK	2.45	.00	.00
ILD006282941	SNAP-ON TOOLS CORP	MT CARMEL	1.50	.00	.00
ILD984783985	SOUND ENHANCEMENTS INC	CARY	12.12	.00	.00
ILD071965214	SOUTHERN ILLINOIS UNIVERSITY	CARBONDALE	8.86	.00	.00
ILD005162052	ST CHARLES MANUFACTURING CO	ST CHARLES	11.55	.00	.00
ILD068464684	STIMSONITE CORP	NILES	11.43	.00	.00
ILD984836148	STIMSONITE CORPORATION	MT PROSPECT	10.52	.00	.00
ILD980898514	SUNDSTRAND AVIATION	ROCKFORD	2.79	.00	.00
ILD984826834	SUPER AMERICA #4141	MACOMB	2.13	.00	.00
ILD005093133	SWEETHEART CUP	CHICAGO	11.44	.00	.00
ILD119496800	SWISS PRECISION MACHINING INC	NILES	10.97	.00	.00
ILD005524434	TAB CHEMICALS INC	CHICAGO	9.94	.00	.00
ILD984900407	TECHNIPAQ INC	CRYSTAL LAKE	11.57	.00	.00
ILR000011171	TERRA INTERNATIONAL INC	DEWEY	12.51	.00	.00
ILD087532859	TEXAS EASTERN PROD PIPELINE	MONEE	5.46	.00	.00

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ILLINOIS

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
ILR000007054	THE MAYFAIR HOTEL	CHICAGO	2.92	.00	.00
ILD000815324	THRALL CAR MANUFACTURING CO	CLINTON	11.35	.00	.00
ILR000011759	TIBBS, JOHN	PEKIN	2.97	.00	.00
ILD984806885	TRM COPY CENTERS CORPORATION	DES PLAINES	10.16	.00	.00
ILD984828533	TRUNKLINE GAS COMPANY	JOHNSONVILLE	13.16	.00	.00
ILD089637847	UNC INC-GARRETT MAIN HANGAR	SPRINGFIELD	13.02	.00	.00
ILD984874156	UNIMIN SPECIALTY MINERALS INC	ELCO	2.38	.00	.00
ILD981536048	UNION CARBIDE AT GATX TERMINLS	BEDFORD PARK	12.33	.00	.00
ILD981953763	UNITED GLOBE NIPPON INC	CHICAGO HEIGHTS	5.73	.00	.00
ILD113544134	UNITED PARCEL SERVICE	BEDFORD PARK	1.46	.00	5.00
ILD095266698	UNIVERSAL METAL FINISHING CO	CHICAGO	2.58	.00	.00
ILD155166952	US SILICA CO	OTTAWA	3.95	.00	.00
ILD006300602	VAUGHAN & BUSHNELL MFG CO	BUSHNELL	8.89	.00	.00
ILR000002030	VERMILION RUBBER TECH INC	DANVILLE	8.06	.00	.00
ILD065240319	VIOBIN CORP	MONTICELLO	3.75	.00	.00
ILD065871477	VOLVO & GMC TRUCKS OF CHICAGO	ALSIP	7.79	.00	.00
ILD000814699	WAGNER CASTINGS CO	DECATUR	4.65	.00	.00
ILD045462082	WAGNER ZIP CHANGE INC	MELROSE PARK	4.10	.00	.00
ILD025807488	WARNER-LAMBERT COMPANY	ROCKFORD	6.98	.00	.00
ILD000682138	WISMARQ CORP	FRANKLIN PARK	2.12	.00	.00
ILD074405150	WITCO CORP	CHICAGO	7.43	.00	.00
ILD074411646	XEROX CORP	OAK BROOK	5.13	.00	.00
ILD096786009	XEROX CORP	OAK BROOK	2.96	.00	.00
ILD984810739	182ND AIRLIFT WING IL AIR NATL	PEORIA	5.42	.00	.00

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ILLINOIS

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO CANNOT BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- LESS THAN 1.1 TONS RCRA HAZARDOUS WASTE, AND
- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
IL0001006014	A&R TRANSPORT INC	JOLIET	.00	.00	.00
ILD984921981	ACCORAT TRANSMISSION	MUNDELEIN	.00	.00	.00
ILD000716894	AMERICAN WASTE PROCESSING LTD	MAYWOOD	.00	.00	.00
ILD980503106	AMOCO - RIVERFRONT PROPERTY	WOOD RIVER	.00	.00	.00
ILD981785231	AVON PRODUCTS INC	GLENVIEW	.00	.00	.00
ILD082939588	CBI RESEARCH CORP	PLAINFIELD	.36	.00	.00
ILD005205620	CHESEBROUGH PONDS PROD DIV	BEDFORD PARK	.41	.00	.00
ILD057843120	CHICAGO KENWORTH INC	MARKHAM	.00	.00	.00
ILD984805317	CLEAR LAM PACKAGING INC	ELK GROVE VILLA	.00	.00	.00
ILD020942728	CROSFIELD CATALYSTS	CHICAGO	.70	.00	.00
ILD074424938	DETREX CORP,SOLVENT & ENVR SVC	MELROSE PARK	.00	.00	.00
ILD984866756	DOMESTIC UNIFORM RENTAL CO	CHICAGO	.00	.00	.00
ILR000007070	DOWNTOWN OIL CO	CHICAGO	.00	.00	.00
ILD984768317	EAGLE WING IND	RANTOUL	.00	.00	.00
ILD005123948	EMPIRE HARD CHROME INC	CHICAGO	.84	.00	.00
ILD113823058	FREEMAN UNITED COAL MINING CO	VIRDEN	.96	.00	.00
ILD984816264	FREEMAN UNITED COAL MINING CO	WEST FRANKFORT	.23	.00	.00
ILR000010371	GELL CHEMICALS INC	NORTH CHICAGO	.00	.00	.00
ILD005234034	GRAHAM PAINT & VARNISH CO INC	CHICAGO	.00	.00	.00
ILD005070412	IBP ACQUISITIONS CO INC DBA	LAKE ZURICH	.50	.00	.00
ILD984925065	IDOT	CHICAGO	.00	.00	.00
ILD984915819	IL DEPT OF TRANSPORTATION	VARIOUS	.16	.00	.00
ILR000010686	IL DEPT OF TRANSPORTATION	VARIOUS	.00	.00	.00
ILD984774927	ILLINOIS EPA ORGANIC LAB	SPRINGFIELD	.00	.00	.00
ILD980502744	LAIDLAW ENVIRTL SER OF ILLINOI	PECATONICA	.00	.00	.00
IL0000903302	MEMORIAL MEDICAL CENTER	WOODSTOCK	.75	.00	.00
ILR000007666	METRA RR ELECTRIC BRIDGE 28-2	MATTESON	.08	.00	.00
ILD005089867	MIDLAND CHICAGO CORP	ALSIP	.00	.00	.00
ILD099669749	MONTEREY COAL CO-MINE #2	ALBERS	.83	.00	.00
ILD984786772	NATIONAL G.F. CORP.	HARTFORD	.00	.00	.00
IL0000201822	NEUMANN CO CONTRACTORS INC	ROMEOVILLE	.76	.00	.00
IL0001003789	NEW DIMENSION PRECISIONS INC	FRANKLIN PARK	.00	.00	.00
ILD984774885	OHMAN BOILER DESCALING	NORTH CHICAGO	.00	.00	.00
IL8143609487	OLIN CORP - AREA 13	MARION	.00	.00	.00
ILR000000026	PITT-DES MOINES INC	MELROSE PARK	.00	.00	.00
IL0000242552	REACO BATTERY SERV	JOHNSTON CITY	.00	.00	.00
ILD122328677	RELIABLE METAL FINISHING	ZION	.00	.00	.00
ILD984767293	RR DONNELLEY & SONS PONTIAC	PONTIAC	.55	.00	.00
ILD000805911	SAFETY-KLEEN CORP	ELGIN	.00	.00	.00
ILD093862811	SAFETY-KLEEN CORP	PEKIN	.00	.00	.00
ILD981088388	SAFETY-KLEEN CORP	URBANA	.00	.00	.00
ILD981097819	SAFETY-KLEEN CORP	CASEYVILLE	.00	.00	.00
ILD001870179	SANOFI WINTHROP INC	DES PLAINES	.00	.00	.00
ILD000669234	SHERWIN-WILLIAMS CO	DECATUR	.05	.00	.00
ILD177652831	STUART-IRONSIDES INC	WILLOWBROOK	.90	.00	.00
ILD044246817	TABOR GRAIN CO	HAVANA	.00	.00	.00
ILD042855510	TAYLOR COMPANY	ROCKTON	.00	.00	.00
ILD005087630	UNITED REFINING & SMELTING CO	FRANKLIN PARK	.00	.00	.00
ILD984768531	UNIVERSAL TECH INSTITUTE	GLENDALE HEIGHT	.00	.00	.00
ILD057236952	USG CORP	LIBERTYVILLE	.45	.00	.00
ILD984771089	VANGUARD ENTERPRISES INC	CICERO	.39	.00	.00
ILD981192487	WESLEY-JESSEN	CHICAGO	.54	.00	.00

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INDIANA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
IND985046713	AACOA	ELKHART	14.34	.00	.00
IND984869719	AAD DISPOSAL	GARY	170.01	.00	.00
IND082293903	AB SPECIALTY PACKAGING, INC.	FOWLER	37.70	.00	.00
IND006062582	ABB POWER T&D COMPANY	MUNCIE	15.28	.00	.00
IND006062467	ABB POWER T&D COMPANY, INC	BLOOMINGTON	88.14	.00	.00
IND064712516	ABT CO INC.	MIDDLEBURY	111.85	.00	.00
IND042080614	ACCRA PAC INC.	ELKHART	718.71	.00	.00
IN0000142356	ACCURIDE	SOUTH BEND	116.78	.00	.00
IND048994131	AERO METALS INC	LAPORTE	67.64	.00	.00
IND984866194	AERO-FAB/TPC COATINGS	INDIANAPOLIS	35.82	.00	.00
IND984894865	AEROQUIP CORPORATION	NEW HAVEN,	88.59	.00	.00
IND982617318	AISIN U.S.A. MFG., INC.	SEYMOUR	46,574.83	.00	.00
IND005478094	ALCOA - LAFAYETTE OPERATIONS	LAFAYETTE	73.41	.00	.00
IND006366819	ALCOA - WARRICK OPERATIONS	NEWBURGH	12,283.10	.00	.00
IND006062848	ALCOA CLOSURE SYSTEMS INTN'L.	RICHMOND	188.05	.00	.00
IND049940307	ALCOA GENERATING CORP.	YANKEETOWN	191.00	.00	.00
IND088736103	ALLIEDSIGNAL AIRCRAFT LANDING SYSTE	SOUTH BEND	143.61	.00	.00
IND005461165	ALLIEDSIGNAL CONTROLS & ACCESSORIES	SOUTH BEND	59.51	.00	.00
IND051193456	ALLIEDSIGNAL LAMINATE SYSTEMS	FRANKLIN	96.65	.00	.00
IND021641758	ALLIEDSIGNAL TRUCK BRAKE SYS.	HUNTINGTON,	22.73	.00	.00
IND000806810	ALLISON ENGINE CO.,INC.PLT.10	INDIANAPOLIS	43.12	.00	.00
IND000806836	ALLISON ENGINE COMPANY, INC	INDIANAPOLIS	6,546.98	.00	.00
IND081005795	ALLISON ENGINE COMPANY, INC.	EVANSVILLE,	22.52	.00	.00
IND006413348	ALLISON TRANS. DIV. GM PLT.# 3	INDIANAPOLIS,	129.73	.00	.00
IND980897524	AM GENERAL CORP.	MISHAWAKA	346.25	.00	.00
IN0000085464	AM GENERAL CORP.	SOUTH BEND	484.26	.00	.00
IND102349743	AMCAST, WHEELTEK PLANT #1	FREMONT	42.01	.00	.00
IND006065593	AMERICAN ART CLAY CO., INC.	INDIANAPOLIS,	20.91	.00	.00
IND098646052	AMERICAN ROLLER COMPANY	WALKERTON	17.27	.00	.00
IND074375585	AMOCO OIL CO.-WHITING REFINERY	WHITING,	636.26	.00	.00
IND000810861	AMOCO OIL COMPANY WHITING LAKEFRONT	WHITING	399,930.36	.00	.00
IND005251327	AMPCOR II, INC.	LAPORTE	71.65	.00	.00
IND006039689	ANCHOR GLASS CONTAINER CORP.	WINCHESTER	46.64	.00	.00
IND074403296	ANDERSON DEVELOPMENT CO.	GARY	21.42	.00	.00
INT190010728	ARTEC MANUFACTURING	JASPER	69.05	.00	.00
IND006414361	ARVIN NAA DIV. 17TH ST. PLANT	COLUMBUS,	72.46	.00	.00
IND016621476	ASHLAND CHEMICAL CO	SOUTH BEND	28.73	.00	.00
IND092043595	ATLAS CHEM-MILLING	ELKHART	73.68	.00	.00
IND004236295	AURORA CASKET COMPANY	AURORA	25.36	.00	.00
IND980702492	AURORA CASKET COMPANY	AURORA	389.14	.00	.00
IND064400054	AVERY DENNISON DFD	SCHERERVILLE	542.68	.00	.00
IND039339759	AVERY DENNISON MFD	LOWELL	166.46	.00	.00
IND093220861	AVESTA SHEFFIELD PLATE INC.	NEW CASTLE	2,314.23	.00	.00
IND006065585	BABCOCK & WILCOX/ERI OPERATIONS	INDIANAPOLIS	29.37	.00	.00
IND006066559	BAILEY CORPORATION	PORTLAND,	254.98	.00	.00
IND085045441	BAILEY MANUFACTURING CORP.	MADISON	27.52	.00	.00
IND005225149	BALL BRASS & ALUMINUM FOUNDRY	AUBURN	105.05	.00	.00
IND006412274	BALL-FOSTER GLASS CONTAINER CO.	MARION	33.87	.00	.00
IND026735506	BASF CORP.	WARSAW	113.48	.00	.00
IND004254876	BATESVILLE CASKET COMPANY	BATESVILLE	63.55	.00	.00
IND980680094	BAYCOTE METAL FINISHING	MISHAWAKA	335.70	.00	.00
IND000807016	BAYER CORPORATION	ELKHART	30.39	.00	.00
IND005068705	BAYER CORPORATION	ELKHART	47.08	1,446.00	.00
IND984879692	BAYER CORPORATION	ELKHART	7.05	115.00	.00
IND006421374	BELDEN WIRE & CABLE COMPANY	RICHMOND	17.81	.00	.00

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INDIANA

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- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
IND006034300	BEMIS COMPANY, INC.	TERRE HAUTE	938.16	.00	.00
IND001927961	BEST LOCK CORPORATION	INDIANAPOLIS,	84.30	.00	.00
IND003913423	BETHLEHEM STEEL CORPORATION	BURNS HARBOR	392,442.44	.00	.00
IND062803697	BICC CABLES COMPANY	MARION	26.60	.00	.00
IND052499142	BLUE GRASS CHEM	NEW ALBANY	24.21	.00	.00
IND980681449	BOEHRINGER MANNHEIM CORP.	INDIANAPOLIS	31.09	9,836.00	.00
IND005464706	BOMARKO, INC	PLYMOUTH	25.57	.00	.00
IND005116082	BRIGGS INDUSTRIES, INC.	FLORA	101.34	56.50	.00
IND984866533	BRUNSWICK MARINE	TOPEKA	15.40	.00	.00
IND005106984	BTR ANTIVIBRATION SYSTEMS INC	LOGANSPORT	32.64	.00	.00
IND045340890	BTR-AVS, INC.	PERU	21.80	.00	.00
IND980792691	BUCKEYE PIPE LINE CO.,L.P.	GRIFFITH	18.00	.00	.00
IND984867358	BUDD CO. PLASTICS DIV.	KENDALLVILLE	26.55	.00	.00
IND000810754	C & D POWERCOM	ATTICA	40.17	.00	.00
IND006042857	C.P. INC.	CONNERSVILLE	13.42	.00	.00
IN0000261917	C&R PLATING CORP.	COLUMBIA CITY	86.21	.00	.00
IND057396608	CAPTIOL PRODUCTS CORPORATION	KENTLAND	321.69	.00	.00
IND044073922	CARLISLE -MOTION CONTROL IND.	BLOOMINGTON	14.00	.00	.00
IND006418008	CARPENTER MANUFACTURING INC.	MITCHELL	65.37	.00	.00
IND046170569	CARPENTER MANUFACTURING INC.	RICHMOND	153.04	.00	.00
IND005226253	CHARLESTON METAL PRODUCTS, INC.	WATERLOO	34.61	.00	.00
IND981950066	CHEMCENTRAL CORPORATION	INDIANAPLOLIS	30.08	.00	.00
IND078911146	CHEMICAL WASTE MANAGEMENT	FORT WAYNE	10,359.06	.00	.00
IND006365464	CHILD CRAFT IND., INC.	SALEM,	38.26	.00	.00
IND087032611	CHRYSLER CORPORATION	INDIANAPOLIS	2,690.70	.00	.00
IND095267381	CITGO PETROLEUM CORP. E. CHICAGO	EAST CHICAGO	441.40	.00	.00
INT190014506	CITGO PETROLEUM CORPORATION	HUNTINGTON	42.03	.00	.00
IND042361139	CLARK REFINING & MARKETING INC	CLERMONT	34.34	.00	.00
IND053221537	CLARK REFINING & MARKETING, INC.	HAMMOND	32.37	.00	.00
IND057534620	CLEVITE ELASTOMERS	ANGOLA	23.03	.00	.00
IND102357415	CMI WABASH CAST, INC.	WABASH	20.81	.00	.00
IN0000196436	COLLIS, INC.	EVANSVILLE	74.31	.00	.00
IND078909025	COLWELL GENERAL, INC	FORT WAYNE	62.68	.00	.00
IND984868836	COLWELL GENERAL, INC.	KENDALLVILLE	272.19	.00	.00
IND059621672	COMO PRODUCTS CORPORATION	COLUMBUS	30.63	.00	.00
IND098958283	CONSOLIDATED RECYCLING CO.,INC.	TROY	17.89	.00	.00
IND016520017	COOPER AUTOMOTIVE INC ANCO PRODUCTS	MICHIGAN CITY	13.62	.00	.00
IND990681496	COOPER TIRE & RUBBER COMPANY	AUBURN	210.26	.00	.00
IND000715573	COPELAND CORPORATION	RUSHVILLE	1,481.73	.00	.00
IND044908663	COUNTRYMARK COOPERATIVE, INC.	MT. VERNON	309.78	.00	.00
IND006419865	CREATIVE EXPRESSIONS GROUP, INC	INDIANAPOLIS	32.74	.00	.00
IND006037857	CROWN CORK & SEAL COMPANY	CRAWFORDSVILLE	67.22	.00	.00
IND005079884	CROWN INTERNATIONAL, INC.	ELKHART	37.34	.00	.00
IND082864729	CTS CORP. AUTOMOTIVE PRODUCTS	ELKHART	65.60	.00	.00
IND990849770	CUMMINS ENGINE CO.,INC.PLT.# 1	COLUMBUS	49.54	.00	.00
IND000806778	CUMMINS FUEL PUMP PLANT	COLUMBUS	16.67	.00	.00
IND980898522	CUSTOM CIRCUITCRAFT, INC.	VINCENNES	76.03	.00	.00
IND006036792	D & L PAINT CO., INC.	LIBERTY	102.24	.00	.00
IND005145784	DA-LITE SCREEN CO., INC.	WARSAW	23.09	.00	.00
IND005480942	DANA CORP	ANGOLA	376.12	.00	.00
IND040289357	DANA CORP PERFECT CIRCLE DIV.	HAGERSTOWN	602.70	.00	.00
IND980503841	DANA CORP. RICHMOND MACHINE	RICHMOND	320.04	.00	.00
IND000804781	DANA CORPORATION	COLUMBIA CITY	89.04	.00	.00
IND005470885	DANA CORPORATION SPICER AXLE DIV	FT. WAYNE	39.42	.00	.00
IND984902205	DAR COATINGS	MUNCIE	14.56	.00	.00

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IND047023197	DAVIES IMPERIAL COATINGS, INC.	HAMMOND	71.36	.00	.00
IND000806851	DELCO ELECTRONICS CORP BYPASS	KOKOMO	1,560.45	.00	.00
IND006068050	DELCO ELECTRONICS CORP. PLT.1	KOKOMO	1,737.44	.00	.00
IN0000186601	DELCO REMY AMERICA, INC.	ANDERSON,	34.22	.00	.00
IND000806877	DELPHI AUTOMOTIVE SYSTEMS	MUNCIE	325.54	.00	.00
IND980503825	DELPHI ENERGY & ENGINE MGMT.SYSTEM	ANDERSON	206.01	.00	.00
IND980700801	DELPHI INTERIOR & LIGHTING SYS.	ANDERSON	4,734.76	640.00	.00
IND098138936	DELTA FAUCET COMPANY	GREENSBURG	621.84	.00	.00
IND074092115	DESIGN INSTITUTE AMERICA, INC	JASPER	82.57	.00	.00
IND085616837	DETREX CORP. SOLVENTS & ENV. SERV.	INDIANAPOLIS	364.90	.00	.00
IND072361868	DIETRICH INDUSTRIES, INC	HAMMOND	22.21	.00	.00
IND103631131	DIGITAL AUDIO DISC CORP.	TERRE HAUTE	131.01	.00	.00
IND984940551	DIGITAL AUDIO DISC CORP.	TERRE HAUTE	16.74	.00	.00
IND075954222	DIVERSIFIED SYSTEMS, INC.	INDIANAPOLIS	186.66	460.00	.00
IND000715615	DONALDSON COMPANY, INC.	FRANKFORT,	27.87	.00	.00
IND054649090	DOORCRAFT OF INDIANA	PLYMOUTH	30.65	.00	.00
IND984894741	DOW ELANCO	INDIANAPOLIS	70.12	.00	.00
IND007365414	DRESSER IND. INC. ROOTS DIV.	CONNERSVILLE	15.15	.00	.00
IND980792154	E-A-R SPECIALTY COMPOSITES	INDIANAPOLIS	76.75	.00	.00
IND150127934	EAGLE-PICHER	HUNTINGTON	81.51	.00	.00
IND016351272	EAGLE-PICHER PLASTICS DIVISION	GRABILL	145.22	.00	.00
IND098647266	EAGLE-PICHER PLASTICS DIVISION	ASHLEY	63.94	.00	.00
IND020939856	EAGLEBROOK, INC	SCHERERVILLE	80.48	.00	.00
IND062818620	EASCO ALUMINUM	KOKOMO	199.12	.00	.00
IND984971259	EATON CORPORATION	HAMILTON	32.83	.00	.00
IND984895714	ECM PHOTO-TOOLING, INC	ELKHART	2,378.78	.00	.00
IND002178291	EGYPTIAN LACQUER MFG.INC.	LAFAYETTE	163.03	.00	.00
IND057520868	ELECTROCHEMICAL COATINGS, INC.	LEBANON	17.28	.00	.00
IND072040348	ELI LILLY & CO. CLINTON LAB	CLINTON,	81,906.98	.00	.00
IND006048417	ELI LILLY & CO. KENTUCKY AVE (1200)	INDIANAPOLIS	15,866.72	.00	.00
IND006421325	ELI LILLY & CO. MATERIAL CTR.	INDIANAPOLIS,	48.56	.00	.00
IND000806927	ELI LILLY & CO. MC BIOCHEM MFG	INDIANAPOLIS	692.08	.00	.00
INT190010371	ELI LILLY & CO. MC RESEARCH	INDIANAPOLIS	322.68	1,676.38	.00
IND016354755	ELI LILLY & CO.-DOW ELANCO & CO.	GREENFIELD	51.37	.00	.00
IND000806935	ELI LILLY & CO.-KENTUCKY AVE (1555)	INDIANAPOLIS	231,915.72	.00	.00
IND006050967	ELI LILLY & CO.-TIPPECANOE LABORATO	SHADELAND,	57,807.33	450.00	.00
IND005467618	ELKHART PLATING CORP.	ELKHART	85,613.01	.00	.00
IND053658654	ELKHART PRODUCTS CORP.	ELKHART	17.57	.00	.00
IND005240015	ELPACO COATINGS CORP.	ELKHART	53.71	.00	.00
IND981952989	ENKEI AMERICA, INC.	COLUMBUS	116.68	.00	.00
IND980590947	ENVIRONMENTAL SERVICES OF AMERICA	SOUTH BEND	14,152.47	.00	.00
IND000803908	ESSEX GROUP INC CHEM PROCESSING	FORT WAYNE	116.98	.00	.00
IND005068952	ESSEX GROUP INC. FT. WAYNE PLT.	FORT WAYNE	62.15	.00	.00
IND044192953	ESSEX GROUP, INC	VINCENNES	76.77	.00	.00
IND985102565	ESSEX GROUP, INC.	FRANKLIN	32.25	.00	.00
IND005081542	ESSROC MATERIALS INC.	LAGANSPORT	331.00	.00	.00
IND001647460	EXIDE CORPORATION	FRANKFORT,	491.64	.00	.00
IND005237011	EXIDE CORPORATION	LOGANSPORT,	58.51	.00	.00
IND056656127	EXPLORER PIPELINE CO. HAMMOND STATI	HAMMOND	55.16	.00	.00
IND016505786	EXPLORER VAN COMPANY	WARSAW	57.92	.00	.00
IND005146741	FAIRFIELD MFG. CO.	LAFAYETTE	60.41	.00	.00
IND001747203	FAULTLESS CASTER DIV/FKI IND. INC.	EVANSVILLE,	86.44	.00	.00
IND984879957	FEDERAL MOGUL	LOGANSPORT	14.85	.00	.00
IND006419964	FEDERAL-MOGAL CORP.	MOORESVILLE	51.37	.00	.00
IND005382346	FEDERAL-MOGUL CORPORATION	FRANKFORT	245.79	.00	.00

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IND082071234	FERRO CORP. KEIL CHEMICAL DIV.	HAMMOND	4,887.16	.00	.00
IND052867595	FERRO CORPORATION	PLYMOUTH	83.15	.00	.00
IND005224837	FINISH CORP.	AUBURN,	435.10	.00	.00
IND006418263	FIRESTONE INDUSTRIAL PROD. CO.	NOBLESVILLE	18.00	.00	.00
IND984879866	FLEETWOOD MOTORHOMES #44	DECATUR	40.26	.00	.00
IND005446729	FLEXEL INDIANA, INC.	COVINGTON	48.60	.00	.00
IND058960329	FOAMEX LP	FT. WAYNE	53.41	.00	.00
IND006420699	FORD ELECTRONICS & REFRIG. CORP.	CONNERSVILLE	1,617.86	.00	.00
IND005146683	FORD METER BOX CO., INC. THE	WABASH	1,943.69	.00	.00
IND001926013	FORD MOTOR COMPANY	INDIANAPOLIS	23.34	.00	.00
IND985057025	FORTH INDUSTRIES INC.	NEW ALBANY,	37.15	.00	.00
IND000780544	FOUR COUNTY LANDFILL	ROCHESTER	2,453.81	.00	.00
IND005177050	FRANKE PLATING WORKS INC	FORT WAYNE	240.82	.00	.00
IND061574869	FRANKLIN ELECTRIC CO.,INC	BLUFFTON,	31.05	.00	.00
IND984868380	FREDA, INC.	ANGOLA,	17.08	.00	.00
IND007860901	FRICK SERVICES	INDIANAPOLIS	108.47	.00	.00
IND006419410	FRIGIDAIRE COMPANY	CONNERSVILLE	21.83	.00	.00
IND000715060	GCI, INCORPORATED	FORT WAYNE	45.99	.00	.00
IND005159603	GENCORP INC.	WABASH	61.72	.00	.00
IND121580542	GENCORP-VEHICLE SEALING	MARION	27.54	.00	.00
IND984867267	GENCORP, INC.	SHELBYVILLE	76.83	.00	.00
IND006418271	GENCORP, RP	MARION	103.13	.00	.00
IND074429895	GENERAL AMERICAN TRANSPORTATION COR	EAST CHICAGO	18.08	.00	.00
IND000717959	GENERAL BATTERY/EXIDE CORP.	MUNCIE	57,959.41	.00	.00
IND000803726	GENERAL ELECTRIC	BLOOMINGTON	118.69	.00	.00
IND005448683	GENERAL ELECTRIC CO.	FORT WAYNE	74.73	.00	.00
IND005448741	GENERAL ELECTRIC CO.	FORT WAYNE	15.95	.00	.00
IND006392773	GENERAL ELECTRIC CO.	TELL CITY	20.00	.00	.00
IND004557815	GENERAL ELECTRIC COMPANY	FORT WAYNE	35.19	.00	.00
IND006376362	GENERAL ELECTRIC COMPANY	MT VERNON	23,024.46	.00	.00
IND985048628	GENERAL ELECTRIC COMPANY	MARION	17.11	.00	.00
IND069763639	GEOCEL LIMITED, INC.	ELKHART	14.92	.00	.00
IND041855776	GK TECH/INDIANA STEEL & WIRE	MUNCIE	2,354.17	.00	.00
IND005081955	GLOBE VALVE CORP.	DELPHI	30.60	.00	.00
IND000715086	GM METAL FABRICATING DIV.MFD MARION	MARION	15.20	.00	.00
IND115304594	GM TRUCK GROUP FT.WAYNE ASSEMBLY	ROANOKE	1,062.06	.00	.00
IND069761195	GOLD SHIELD OF INDIANA	DECATUR	33.85	.00	.00
IND980683627	GOLD SHIELD OF INDIANA	DECATUR	35.60	.00	.00
IND990734766	GREAT DANE TRAILERS, INC.	BRAZIL,	252.17	.00	.00
INR000001636	GREAT DANE TRAILERS, INC.	TERRE HAUTE,	60.53	.00	.00
IND005212808	GREAT LAKES CHEMICAL CORP.	WEST LAFAYETTE	1,151.87	285.11	.00
IND067867911	GREENE MFG. CO., INC	CONNERSVILLE	113.83	.00	.00
IND052959525	GRIPCO FASTENERS DIV. BLACK & DECKE	MONTPELIER	2,185.22	.00	.00
IND020437521	GROTE INDUSTRIES	MADISON	13.72	.00	.00
IND984891366	GUARDIAN AUTOMOTIVE PRODUCTS	LIGONIER	14.67	.00	.00
IND007001050	GUARDIAN AUTOMOTIVE TRIM, INC.	EVANSVILLE	339.90	.00	.00
IND980998645	GUARDIAN INDUSTRIES CORP.	AUBURN	42.94	.00	.00
IND005081682	HAMILTON FOUNDRY & MACHINE CO. THE	DECATUR	67.39	.00	.00
IND000809236	HAMMOND LEAD PRODUCTS	HAMMOND	330.24	20.00	.00
IND984872705	HAPPICO	GREENCASTLE	66.75	.00	.00
IND980793624	HARD CHROME CO- DIV INDUSTRIAL RESE	EVANSVILLE	83.60	.00	.00
INT190010975	HARMAN- MOTIVE INC.	MARTINSVILLE	21.00	.00	.00
IND084580430	HARTER GRP.(THE)DIV. OF JAMI, INC.	MIDDLEBURY	25.91	.00	.00
IND980503775	HERITAGE ENVIRONMENTAL SERVICES	COLUMBUS	197.58	.00	.00
IND093219012	HERITAGE ENVIRONMENTAL SERVICES INC	INDIANAPOLIS	68,234.60	136,469,200.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
IND980503890	HERITAGE ENVIRONMENTAL SERVICES, IN	ROACHDALE	1,104.39	.00	.00
IND980501936	HERMASEAL COMPANY	ELKHART	26.38	.00	.00
IND000781609	HICKSON CORPORATION	VALPARAISO	22.36	.00	.00
IND990872806	HOMECREST CORPORATION	GOSHEN	19.08	.00	.00
IND980615678	HOSKINS MANUFACTURING COMPANY	NEW PARIS	20.14	.00	.00
IND078922762	HOUBA, INC.	CULVER	240.10	.00	.00
IND131521833	HURST MANUFACTURING	PRINCETON	32.54	.00	.00
IND984866541	HYDRITE CHEMICAL CO.	TERRE HAUTE	96.85	.00	.00
IND072078967	I.U.P.U.I.	INDIANAPOLIS	54.83	.00	.00
IND984894287	I/N KOTE	NEW CARLISLE	1,078.15	.00	.00
IND040291122	IMPERIAL WALLCOVERINGS, INC.	NEW CASTLE	31.27	.00	.00
IND984867960	IN TEK	NEW CARLISLE	132.05	.00	.00
IN0000553032	INDEPENDENT PACKAGING	BLOOMINGTON	55.52	.00	.00
IND006421085	INDIANA BRASS, INC.	FRANKFORT	50.79	.00	.00
IND005421623	INDIANA HEAT TRANSFER	PLYMOUTH,	59.78	.00	.00
IND982616559	INDIANA PRECISION TECHNOLOGY	GREENFIELD	14.29	.00	.00
IND000803890	INDOT FORT WAYNE DISTRICT	FORT WAYNE	25.35	.00	.00
IND000715185	INDOT GREENFIELD DISTRICT	GREENFIELD	13.67	.00	.00
INR000000349	INDOT NEW CASTLE TESTING LAB	NEW CASTLE	22.35	.00	.00
IND078918000	INDOT TOLL ROAD DIVISION	GRANGER	3,636.89	.00	.00
IND005421177	INDUSTRIAL PLATING INC	LAFAYETTE	112.72	.00	.00
IND005159199	INLAND STEEL COMPANY	EAST CHICAGO	8,487.44	325.00	.00
IND088738620	INTERPLASTIC CORP.MOLDING DIV.	SOUTH BEND	55.01	.00	.00
IND005420245	ITT AEROSPACE/COMMUNICATIONS	FORT WAYNE	52.44	6.00	.00
IND980825244	ITT AEROSPACE/COMMUNICATIONS	FORT WAYNE	19.30	.00	.00
IND985060276	IWC - BEECH GROVE TANK	BEECH GROVE	30.45	.00	.00
IND082393646	J.F.C. LAUNDRY	JASPER	26.68	.00	.00
IND004382842	J.L. MANTA, INC.	HAMMOND	40.46	.00	.00
IND009223728	JAMES RIVER CORP. PACKAGING	GREENSBURG	319.76	.00	.00
IND001845015	JASPER CHEMICAL COATINGS	JASPER	14.33	.00	.00
IND006398168	JASPER ENGINE EXCHANGE, INC.	JASPER	18.37	.00	.00
IND985063411	JASPER FURNITURE COMPANY	JASPER	39.67	.00	.00
IND055335715	JASPER PLASTICS	JASPER	21.53	.00	.00
IND006371330	JEFFBOAT, DIV. OF ACMS	JEFFERSONVILLE	40.02	.00	.00
IND040303471	JEFFERSON SMURFIT CORPORATION	MUNCIE	107.38	.00	.00
IND009549593	JOHNSON CONTROLS INC	GOSHEN	65.91	1.00	.00
IND074057662	K & I HARD CHROME, INC.	NEW ALBANY	29.33	.00	.00
IND006419477	K.C.L. CORP.	SHELBYVILLE	39.80	.00	.00
IND006062442	KAY CO., INC. THE	FRANKFORT	37.81	.00	.00
IND006370019	KELLER CRESCENT	EVANSVILLE	15.00	.00	.00
IND982625949	KEN-KOAT, INC	HUNTINGTON,	63.44	.00	.00
IND984886655	KENDALLVILLE WIRE	KENDALLVILLE	29.56	.00	.00
IND072081078	KERR MCGEE CHEMICAL	INDIANAPOLIS	87.95	.00	.00
IN0000038059	KEY PLASTICS, INC.	HARTFORD CITY	94.10	.00	.00
IND094205614	KIMBALL ELECTRONICS INC.	JASPER	19.96	.00	.00
IND094458288	KNAUF FIBER GLASS	SHELBYVILLE	32.66	.00	.00
IND043777549	KOCH LABEL CO.	EVANSVILLE	119.56	.00	.00
IND984894311	KOKOKU STEEL CORD CORP.	SCOTTSBURG	3,360.55	.00	.00
IND074320755	KOKOKU WIRE INDUSTRIES CORP	SOUTH BEND	258.19	.00	.00
IND064708845	KUNKLE FOUNDRY CO., INC.	ANDREWS	120.33	.00	.00
IND984894998	LACLEDE STEEL CO.	FREMONT	136.88	.00	.00
IND005105408	LANDIS & GYR METERING, INC.	LAFAYETTE	55.85	65.00	.00
IND000815498	LASALLE STEEL CO.	HAMMOND	24.08	.00	.00
IND077045680	LASALLE STEEL FLUID POWER DIV.	GRIFFITH	180.77	.00	.00
IN0000596031	LAWRENCEBURG GAS CO.	LAWRENCEBURG	125.00	.00	.00

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INDIANA

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
IND984866764	LEAR CORP.	GREENCASTLE	18.11	.00	.00
IND056041213	LEER	ELKHART	20.42	.00	.00
IND984873570	LIBBEY-OWENS-FORD CO.	SHELBYVILLE	14.37	.00	.00
IND006040117	LILLY INDUSTRIES (USA), INC.	INDIANAPOLIS,	1,729.53	.00	.00
IND006037543	LILLY INDUSTRIES (USA), INC.	INDIANAPOLIS	34.28	.00	.00
IND981952062	LILLY INDUSTRIES (USA), INC.	ELKHART	24.12	.00	.00
IND005070966	LINCOLN FOODSERVICE PRODUCTS INC.	FORT WAYNE	57.62	.00	.00
IND005462601	LTV STEEL COMPANY	EAST CHICAGO	7,747.93	.00	.00
IND078262276	LUBRICON	BEECH GROVE	16.03	.00	.00
IND006037741	MAB PAINTS INC.	TERRE HAUTE	239.87	.00	.00
IND078907672	MAGNAVOX ELECTRONIC SYSTEMS CO.	FORT WAYNE	24.36	.00	.00
IND984897231	MAGNETICS INTERNATIONAL, INC.	BURNS HARBOR	2,231.34	.00	.00
IND040294621	MALLINCKRODT VETERINARY, INC	TERRE HAUTE	20.71	5.00	.00
IND000715177	MARATHON OIL COMPANY-HAMMOND	HAMMOND	163.43	.00	.00
IND006417430	MARATHON OIL COMPANY-INDPLS	INDIANPOLIS	6,130.17	.00	.00
IND000714964	MARATHON OIL COMPANY-MUNCIE	MUNCIE	357.04	.00	.00
IND982641078	MARSHALL ELECTRIC CORP.	NORTH MANCHESTE	16.69	.00	.00
IND005461355	MATTHEW-WARREN INC.	LOGANSPORT	38.35	.00	.00
IND006419774	MAXON CORPORATION	MUNCIE	13.82	.00	.00
IND006370092	MEAD JOHNSON & CO.(EVANSVILLE)	EVANSVILLE	55.69	220.00	.00
IND039349238	MERCHANTS METALS	NEW PARIS	89.16	.00	.00
INR000003772	MICHIGAN CITY HIGH SCHOOL	MICHIGAN CITY	.29	268.81	.00
IND006049456	MID CITY PLATING	MUNCIE	65.10	.00	.00
IND016584641	MIDWEST STEEL DIVISION	PORTAGE	18,832.37	.00	.00
IND006365985	MILLER ELECTROPLATING INC	EVANSVILLE	371.60	.00	.00
IND052959640	ML-KS BEARINGS INC.	GREENSBURG	105.97	.00	.00
IND981191091	MODERN HARD CHROME OF INDIANA	EAST CHICAGO	299.02	.00	.00
IND005445143	MODINE MANUFACTURING COMPANY	LA PORTE	75.66	.00	.00
IND078904117	MODINE MANUFACTURING COMPANY	LOGANSPORT	16.52	.00	.00
IND005176326	MONON CORPORATON	MONON	64.63	.00	.00
IND001864073	NATL. RR PASSENGER CORP.	BEECH GROVE,	46.69	.00	.00
IN0000204032	NIPSCO-DON HALLS GAS HOME	FORT WAYNE	61.87	.00	.00
IND147079123	NISHIKAWA STANDARD CO. PLT. 1	TOPEKA	34.53	.00	.00
IND982634214	NISHIKAWA STANDARD CO. PLT. 2	BREMEN	14.07	.00	.00
IND072039860	NORTH AMERICA PACKAGING CORP.	INDIANAPOLIS	25.76	.00	.00
IND984976720	NTN DRIVESHAFT	COLUMBUS	50.31	.00	.00
IND181157009	NUCOR STEEL	CRAWFORDSVILLE	51,079.49	.00	.00
IND092039759	O'BRIEN CORP. THE	SOUTH BEND	41.71	.00	.00
IND089273338	OSRAM SYLVANIA INC.	SEYMOUR	707.35	.00	.00
IND006035653	OWEN BROCKWAY GLASS CONTAINER	LAPEL	17.95	.00	.00
IND984866285	P & J INDUSTRIES, INC	LIGONIER	121.67	.00	.00
IND161058508	PAINT AND ASSEMBLY CORP.	ELWOOD	35.34	.00	.00
IND064923410	PAOLI INC. DESK DIVISION	ORLEANS	48.76	.00	.00
IND980681316	PARKER HANNIFIN CORPORATION	LEBANON	29.16	.00	.00
IND005470521	PATRICK METALS	ELKHART	43.98	.00	.00
IND982625980	PATRICK METALS	MISHAWAKA	339.06	.00	.00
IND005107537	PERRY CHEMICAL AND MFG. CO., INC.	LAFAYETTE	163.51	.00	.00
IND005080288	PETERS-REVINGTON	DELPHI	14.53	.00	.00
IND006059075	PFIZER INC.	TERRE HAUTE	20.03	10.00	.00
IND078904729	PHELPS DODGE MAGNET WIRE CO.	FORT WAYNE	1,175.66	.00	.00
IND092009547	PHILLIPS PIPE LINE CO.	CLERMONT	60.88	.00	.00
IND985104736	PILOT INDUSTRIES	NORTH VERNON	226.39	.00	.00
IND074294919	PLYMOUTH TUBE COMPANY	WINAMAC	331.17	.00	.00
IND006063697	POTTER PAINT CO OF IN., INC.	CAMBRIDGE CITY	53.35	.00	.00
IND077001147	PRAXAIR	EAST CHICAGO	133.22	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
IND075960864	PRECISION FABRICATION TECHNOLOGIES,	MONON	19.85	.00	.00
IND006065403	PRECISION RUBBER PLATE COMPANY	INDIANAPOLIS	69.11	.00	.00
IND057389710	PRECOAT METALS	PORTAGE	1,064.08	.00	.00
IND069769164	PREFERRED INC.	FORT WAYNE	13.64	.00	.00
IND000816108	PREFERRED TECHNICAL GROUP	COLUMBIA CITY	968.65	.00	.00
IND005162607	PREFERRED TECHNICAL GROUP	ANDREWS	152.62	.00	.00
IND985049717	PRODUCTION PLATING CO., INC.	INDIANAPOLIS	32.00	.00	.00
IND072051394	PURDUE UNIVERSITY	WEST LAFAYETTE	93.85	38,850.20	.00
IND000714840	PVS TECHNOLOGIES, INC.	GARY	49.14	.00	.00
IND000199653	QUEMETCO, INC.	INDIANAPOLIS	5,596.17	875.73	.00
IND005479019	QUICK TANKS, INC.	KENDALLVILLE	42.40	.00	.00
IND005480710	R R DONNELLEY & SONS CO.	WARSAW	1,461.61	.00	.00
IND006061477	RAYBESTOS PRODUCTS COMPANY	CRAWFORDSVILLE	858.76	.00	.00
IND005478219	REA MAGNET WIRE CO.	LAFAYETTE	58.51	.00	.00
IND004320032	REA MAGNET WIRE CO, INC	FORT WAYNE	69.71	.00	.00
IND000780403	RECLAIMED ENERGY COMPANY, INC	CONNERSVILLE	6,184.58	.00	.00
IND990873499	RED SPOT PAINT & VARNISH	EVANSVILLE	939.18	.00	.00
IND000718130	REFINED METALS CORPORATION	INDIANAPOLIS	4,953.80	.00	.00
IND000807107	REILLY INDUSTRIES, INC.	INDIANAPOLIS	10,051.72	18,400.00	6,000.00
IND005226949	REMOTE CONTROLS, INC.	MISHAWAKA	19.84	.00	.00
IND001859032	RHONE-POULENC	HAMMOND	318.88	.00	.00
IND005161377	RIEKE CORPORATION	AUBURN	43.59	.00	.00
IND990873606	ROLL COATER, INC	KINGSBURY	704.81	.00	.00
IND006420087	ROLL COATER, INC.	GREENFIELD	603.53	.00	.00
IND094457660	ROSTONE CORPORATION	LAFAYETTE	275.22	.00	.00
IND045684354	RUST PRECISION CLEANING SERVICES	PORTAGE	16.33	.00	.00
IND984872846	SAFETY & EVNIROMENTAL RES., INC.	MISHAWAKA	49.94	.00	.00
IND000715466	SAFETY-KLEEN CORP	FORT WAYNE	315.78	.00	.00
IND000815894	SAFETY-KLEEN CORP	EVANSVILLE	89.49	.00	.00
IND984874776	SAFETY-KLEEN CORP	GREENWOOD	507.60	.00	.00
IND000715474	SAFETY-KLEEN CORP.	SOUTH BEND	62.55	.00	.00
IND077042034	SAFETY-KLEEN OIL RECOVERY CO.	EAST CHICAGO	3,041.31	.00	.00
IND020421905	SAMTEC INCORPORATED	NEW ALBANY	21.95	.00	.00
IND087032207	SANYO-VERBATIM CD COMPANY	RICHMOND	36.88	.00	.00
INR000002030	SCHOPMEYER FARM SUPPLY	ROSEDALE	19.86	.00	.00
IND006065601	SCHULLER INTERNATIONAL, INC.	RICHMOND	56.37	.00	.00
IND006398903	SCOTT MANUFACTURING	SCOTTSBURG	25.00	.00	.00
IND000821561	SELMER CO., VINCENT BACH DIV.	ELKHART,	162.01	.00	.00
IND094760444	SHELL OIL COMPANY	HAMMOND	41.10	.00	.00
IND984904789	SHERWIN WILLIAMS CO. THE	GREENCASTLE	422.04	.00	.00
IND098139900	SIGNATURE SKYLIGHTS, LLC	MOORESVILLE,	74.79	.00	.00
IND005449525	SILGAN CONTAINERS CORP.	HAMMOND	544.34	.00	.00
IND006370100	SILGAN CONTAINERS CORP.	EVANSVILLE	154.58	.00	.00
IND064710726	SILGAN CONTAINERS CORP.	LA PORTE	30.70	.00	.00
IND005447537	SLATER STEELS	FORT WAYNE	1,215.28	.00	.00
IND006421143	SOMMER METALCRAFT CORP.	CRAWFORDSVILLE	91.47	.00	.00
IND981528631	SPECTRONICS, INC	EVANSVILLE	115.20	.00	.00
IND006419352	STANT MANUFACTURING	CONNERSVILLE	129.94	.00	.00
IND984976746	STAR AMMUNITION, INC.	INDIANAPOLIS	18.40	.00	.00
IND057388266	STARCRAFT AUTOMOTIVE CORP.	GOSHEN	41.40	.00	.00
IND006035018	STATE PLATING INC.	ELWOOD	266.35	.00	.00
INR000001099	STEEL DYNAMICS, INC	BUTLER	42.49	.00	.00
IND005080965	STERLING CASTING CORPORATION	BLUFFTON	303.01	.00	.00
IND984869982	STEWART WARNER SOUTH WIND	TROY	16.69	.00	.00
IND021647045	STRICK CORPORATION	MONROE	53.49	.00	.00

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IND984866491	SUBARU-ISUZU AUTOMOTIVE INC.	LAFAYETTE	751.05	.00	.00
IND005545835	SULLAIR CORPORATION	MICHIGAN CITY	66.18	.00	.00
IND981955859	SUMCO INC	INDPLS	446.70	.00	.00
IND067867945	SUN CHEMICAL	FRANKFORD	34.12	.00	.00
IN0000887182	SUN CHEMICAL CORP	INDIANAPOLIS	17.90	.00	.00
IND981802598	SUPERIOR FIBERGLASS:RESINS	ELKHART	72.52	.00	.00
IND039994975	SUPERIOR OIL COMPANY	INDIANAPOLIS	156.21	.00	.00
IND064702988	SUPREME CORPORATION	GOSHEN	85.65	.00	.00
IND981788573	SURE START	INDIANAPOLIS	48.44	.00	.00
IND005130331	SYNDICATE STORE FIXTURES	MIDDLEBURY	338.18	.00	.00
IND981959000	T.E. PRODUCTS PIPELINE CO. LP	GRIFFITH	60.77	.00	.00
IND078911807	TECO INC	FORT WAYNE	13.42	.00	.00
IND006385389	TELL CITY CHAIR COMPANY	TELL CITY	30.30	.00	.00
IND046386009	TERRECORP, DIV. OF MIBA AM CORP.	CLINTON	41.32	.00	.00
IND081523284	TEXTRON AUTOMOTIVE COMPANY	MORRISTOWN	198.77	.00	.00
IND006417620	THOMSON CONSUMER ELECTRONICS	MARION	935.62	.00	.00
IND006932305	THOMSON CONSUMER ELECTRONICS	INDIANAPOLIS	359.68	.00	.00
IND982602617	THUNDERBIRD PRODUCTS INC.	DECATUR	72.25	.00	.00
INT190011981	TOKHEIM CORPORATION	FORT WAYNE	107.51	.00	.00
IND005159223	TORRINGTON COMPANY, THE	SOUTH BEND	15.00	.00	.00
INR000003392	TOWN OF WATERLOO	WATERLOO	18.10	.00	.00
IND984873257	TOYOTA INDUSTRIAL EQUIP. MFG., INC	COLUMBUS	36.44	.00	.00
IND042846592	TRI TECH MANUFACTURING INC.	FORT WAYNE	32.66	.00	.00
IND982612822	TRI-MANUFACTURING	TERRE HAUTE	48.91	.00	.00
IND070714258	TRIANGLE PACIFIC CORP.	UNION CITY	19.16	.00	.00
IND005261342	TRIPLEX PLATING, INC	MICHIGAN CITY	134.40	.00	.00
IND003934668	TRW COMMERCIAL STEERING DIV.	LAFAYETTE	19.07	.00	.00
IN9210020443	U.S. ARMY INDIANA AMMUNITION PLT.	CHARLESTOWN	252.59	.00	.00
IND078926029	U.S. CAN COMPANY	CHESTERTON	188.88	.00	.00
IN5170023498	U.S. NAVAL SURFACE WARFARE	CRANE	1,648.28	750.00	.00
IN4170023499	U.S. NAVAL/AIR WARFARE CENTER	INDPLS	63.19	.00	.00
IND005444062	U.S. STEEL - GARY WORKS	GARY	2,192.55	.00	.00
IND980702526	ULRICH CHEMICAL, INC.	INDIANAPOLIS	15.88	.00	.00
INT190010884	UNION CITY BODY COMPANY LP	UNION CITY	82.62	.00	.00
IND005456058	UNION TANK CAR, PLT. 1	EAST CHICAGO	127.16	.50	.00
IND005449830	UNIROYAL TECHNOLOGY CORP ENS. DIV	MISHAWAKA	156.18	.00	.00
IN0000055152	UNITED AIRLINES, INDPLS. M.C.	INDIANAPOLIS	21.23	.00	.00
IND981960313	UNITED RAIL SERVICE INC	EAST CHICAGO	19.42	.00	.00
IND152719878	UNITED TECHNOLOGIES AUTOMOTIVE	BERNE	443.56	.00	.00
IND016393555	UNITED TECHNOLOGIES CARRIER CORPORA	INDIANAPOLIS	19.37	.00	.00
IND075970673	UNIVERSAL FLAVOR CORPORATION	INDIANAPOLIS	55.90	.00	.00
IND000816116	UNIVERSAL TOOL & ENG. CO. INC.	INDIANAPOLIS	273.41	.00	.00
IND005461520	UNIVERSAL TOOL & STAMPING CO.	BUTLER	27.33	.00	.00
IND048994727	UNIVERSITY OF NOTRE DAME DULAC	NOTRE DAME	14.53	.00	.00
IND058958141	UR-BATH FURNITURE DIV UNIVERSAL-RUN	RENSSELAER	21.47	.00	.00
IND005068747	URSCHEL LABORATORIES, INC.	VALPARAISO	97.46	.00	.00
IN4210090003	US ARMY GARRISON	INDIANAPOLIS	23.02	.00	.00
IND098648033	UTILIMASTER	WAKARUSA	50.22	.00	.00
IND982641094	VALEO ENGINE COOLING	GREENSBURG	663.91	.00	.00
IND005178355	VALSPAR CORPORATION	FORT WAYNE	551.50	.00	.00
IND040295347	VAN WATERS & ROGERS INC	INDIANAPOLIS	14.67	.00	.00
INT190010611	VIKING FORMED PRODUCTS	MIDDLEBURY	49.78	.00	.00
IND000708545	VISKASE CORPORATION	KENTLAND	29.47	.00	.00
IND009422296	VON DUPRIN, INC.	INDIANAPOLIS	54.16	3,184.40	.00
IND058954827	VULCRAFT	ST JOE	41.80	.00	.00

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IND005460191	W & M MFG. INC.	PORTLAND	63.62	.00	.00
IND121581698	WABASH NATIONAL CORP.	LAFAYETTE	57.45	.00	.00
IND006032593	WABASH PRODUCTS	TERRE HAUTE	18.41	.00	.00
IN0000055210	WAL-MART RETURN CENTER	INDIANAPOLIS	124.45	.00	.00
IND005157144	WARSAW BLACK OXIDE, INC.	BURKET	170.87	.00	.00
IND005174263	WARSAW PLATING WORKS, INC.	WARSAW	100.80	.00	.00
IND005456173	WAYNE METAL PRODUCTS, INC.	MARKLE	210.92	.00	.00
IND980702278	WESTVILLE COR. CNTR.-PEN PROD.	WESTVILLE	26.96	20,784.66	.00
IND000708446	WHEELER/WASTE MANAGEMENT OF INDIANA	WHEELER	281.48	.00	.00
IND006383095	WHIRLPOOL CORP. EVANSVILLE DIV.	EVANSVILLE	81.82	2.20	.00
IND006032023	WILLIAMSON POLISHING & PLATING CO.,	INDIANAPOLIS	60.75	.00	.00
IND006418735	WITT CO., THE MUNCIE	MUNCIE	820.80	.00	.00
IND000821579	ZIMMER, INC., PLANT #5	WARSAW	21.96	252.01	.00
IND981093859	20TH CENTURY FIBERGLASS	ELKHART,	43.65	.00	.00
IND990850299	3M HARTFORD CITY	HARTFORD CITY	218.88	.00	.00

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REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
IND984868422	AE GOETZE	SOUTH BEND	5.60	.00	.00
IND016184608	ALAC SERVICES INC	ANDERSON	11.36	.00	.00
IND006414916	ALCAN ROLLED PRODUCTS COMPANY	TERRE HAUTE	11.38	.00	.00
IND072036114	ALLEGHENY LUDLUM CORPORATION	NEW CASTLE	3.23	.00	.00
IND984866079	ALLISON ENGINE COMPANY, INC.	INDIANAPOLIS	3.67	.00	.00
IND985049899	ALLISON ENGINE COMPANY, INC.	INDIANAPOLIS	8.29	.00	.00
IND980502074	ALPHA/OWENS-CORNING LLC	VALPARAISO	9.83	.00	.00
IND055206486	ALTEC INDUSTRIES,INC	INDIANAPOLIS	5.33	.00	.00
IN0000003228	AMCAST, WHEELTEK PLANT 2	MARION	12.44	.00	.00
IND161052766	AMERICAN TUBE & PIPE, KOKOMO	KOKOMO	12.75	.00	.00
IND984872671	AQUARIUS PLASTIC FINISHERS	SOUTH BEND	6.12	.00	.00
IND982608671	ARVIN SANGO, INC	MADISON	5.60	.00	.00
INT190011718	BATESVILLE CASKET COMPANY	BATESVILLE	11.77	.00	.00
IND990849390	BORG WARNER AUTOMOTIVE DTPC	MUNCIE	4.02	.00	.00
IND006421150	BOWES INDUSTRIES, INC.	INDIANAPOLIS	7.53	.00	.00
IND984874347	BP OIL PIPELINE COMPANY	MOORESVILLE,	1.83	.00	.00
IND985033307	BRAND MARKETING, ASHLAND INC	SALEM	3.96	.00	.00
IND980792709	BRIDON AMERICAN CORPORATION	OAKLAND CITY,	8.76	.00	.00
IND045099017	CANAM STEEL CORPORATION	LAFAYETTE	9.33	.00	.00
IND082295197	CAR BRITE, INC	INDIANAPOLIS	9.16	.00	.00
INR000000414	CASTER MAINTENANCE CO	GARY	10.56	.00	.00
IND000717991	CATERPILLAR INC.	LAFAYETTE	12.17	.00	.00
IND147086615	CFB REAL ESTATE	BRISTOL,	4.86	.00	.00
IND000718023	CHEMCENTRAL CORPORATION	FORT WAYNE	9.62	.00	.00
IND980677496	CHROME DEPOSIT CORPORATION	PORTAGE	11.21	.00	.00
IND000715490	CONRAIL ELKHART YARD	ELKHART	2.21	.00	.00
IND985063957	CONSOLIDATED RAIL CORP. COLEHOUR YD	HAMMOND	5.10	.00	.00
IND049307044	CONTINENTAL MACHINE & ENG. CO.,INC.	EAST CHICAGO	6.22	.00	.00
IND982204349	COVERMASTER, INC.	ELKHART	1.38	.00	.00
IND006375885	CRADDOCK FINISHING CORP	EVANSVILLE	3.56	.00	.00
INR000002105	CSX TRANSPORTATION	AURORA,	2.90	.00	.00
IND005460548	CTS CORP. RESISTOR NETWORKS	BERNE	10.25	.00	.00
IND003935236	DANA CORP, PERFECT CIRCLE DIV.	RICHMOND	8.00	.00	.00
IND094577095	DANA CORPORATION SPICER AXLE DIVISI	SYRACUSE	2.75	.00	.00
IND981101132	DANA TRANSPORT	HAMMOND,	10.34	.00	.00
IND980615587	DE KALB MOLDED PLASTICS CO.	BUTLER	9.67	.00	.00
INR000002253	DIVERSIFIED SYSTEMS, INC.	INDIANAPOLIS,	4.20	.00	.00
IND981954647	DOW CHEMICAL CO.	INDIANAPOLIS	7.29	.00	.00
IND985102326	E.R. SQUIBB & SONS, INC.	MOUNT VERNON	3.65	.00	.00
IND088738166	ELKHART PRODUCT CORP.	GENEVA	5.04	.00	.00
IND096555313	EXIDE CORPORATION, BATTERY	CORYDON	11.85	.00	.00
IN0000807008	FINISHING UNLIMITED	ELKHART	1.39	.00	.00
IND984896787	FIRST RECOVERY	TERRE HAUTE	7.52	.00	.00
IND982066128	FLEETWOOD MOTORHOMES OF IN #52	DECATUR	9.29	.00	.00
IND985047729	FLEETWOOD TRAVEL TRAILERS OF IN #42	CRAWFORDSVILLE	5.20	.00	.00
IND092046515	FOAMEX LP	AUBURN,	8.24	.00	.00
IND098650484	FOAMEX LP	LA PORTE	8.83	.00	.00
INT190010926	FORT WAYNE ANODIZING	FORT WAYNE	7.40	.00	.00
IND984976118	GALBREATH INC PLT 5	WINAMAC	3.15	.00	.00
IND005175237	GALBREATH INC.	WINAMAC	7.60	.00	.00
IND984976100	GALBREATH INC. PLT 2	WINAMAC	2.92	.00	.00
IND079583720	GM METAL FABRICATING DIV	INDIANAPOLIS	11.21	.00	.00
INT190010140	GODFREY CONVEYOR CO, INC.	ELKHART	1.84	.00	.00
INR000001115	HAGERMAN CONSTRUCTION	FORT WAYNE	1.51	.00	.00
IND005178025	HARRIS KAYOT INC.	FORT WAYNE	8.05	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
INR000000919	HERITAGE TRANSPORT, INC.	INDIANAPOLIS	7.87	.00	.00
IND006068985	HILL AND GRIFFITH COMPANY	INDIANAPOLIS	4.67	.00	.00
IND062431614	HOLIDAY RAMBLER LLC	WAKARUSA	11.19	.00	.00
IND006368815	INDIAN INDUSTRIES INC.	EVANSVILLE	7.56	.00	.00
IND006366108	INDIANA DESK CO., INC.	JASPER	9.78	.00	.00
IND001015536	INDIANA GAS CO.	WEST TERRE HAUT	10.43	.00	.00
IND980618854	INDIANAPOLIS/BELMONT CTY.WWTP	INDIANAPOLIS	2.59	19.00	.00
IND000715581	INDOT CRAWFORDSVILLE I 74	CRAWFORDSVILLE	1.90	.00	.00
IND000806943	INDOT DIV OF MATERIAL & TESTS	INDIANPOLIS	6.71	.00	.00
IN0000363036	INDOT I-70 LEWIS ST BRIDGE	INDIANPOLIS	2.37	.00	.00
IN0000632273	INDOT OSGOOD AREA TESTING LAB	OSGOOD	6.18	.00	.00
IND000714535	INDOT SEYMOUR DISTRICT	SEYMOUR	4.29	.00	.00
INR000001503	INDOT TIBBS AVENUE TESTING LAB	INDIANAPOLIS	6.47	.00	.00
IND079674677	INDOT VINCENNES DIST. COMPLEX	VINCENNES	8.20	.00	.00
IND174936062	JAMES RIVER PAPER COMPANY, INC.	KENDALLVILLE	5.22	.00	.00
IND981957327	KADET PRODUCTS INC.	ELWOOD	8.04	.00	.00
IND984895987	KEYSTONE SERVICE, INC.	LA PORTE	6.28	.00	.00
INR000002691	LA PORTE COUNTY HIGHWAY DEPT.	LA PORTE	7.05	.00	.00
INR000000307	LAFAYETTE CITY OF	LAFAYETTE,	2.00	.00	.00
IN0000351387	LIGHTING RESOURCES, INC.	GREENWOOD	6.90	.00	.00
IN0001005537	LUCENT TECHNOLOGIES INC	INDIANAPOLIS	10.24	.00	.00
IND075973511	LUCENT TECHNOLOGIES, INC.	INDIANAPOLIS	7.23	.00	.00
IND984868927	MAC-DEL, INC.	RICHMOND	1.76	.00	.00
IND981094238	MAGNAVOX ELECTRONIC SYSTEMS CO.	COLUMBIA CITY	9.70	.00	.00
IND064716905	MANCHESTER TANK AND EQUIPMENT	ELKHART	2.36	.00	.00
IND984972893	MASTERGUARD CORP	VEEDERSBURG	8.75	.00	.00
IND984873877	MCGILL MANUFACTURING CO., INC.	VALPARAISO	12.81	.00	.00
IND052952090	METHODIST HOSPITAL	INDIANAPOLIS,	2.89	.00	.00
INR000000133	MID-AMERICA ENERGY RES. INC.	INDIANAPOLIS	5.93	.00	.00
IND981955230	MILLENNIUM PRODUCTS	ELKHART	9.64	.00	.00
IND006422182	MITCHELL & SCOTT MACHINE CO., INC.	INDIANAPOLIS	3.38	.00	.00
IND072039001	NAVISTAR INTL. TRANS. CORP.	INDIANPOLIS	7.52	.00	.00
IND006066286	NEW VENTURE GEAR, INC.	MUNCIE	6.92	.00	.00
IN1210022272	NEWPORT CHEMICAL ACTIVITY	NEWPORT	3.51	.00	.00
IND005462890	NIMET INDUSTRIES, INC.	SOUTH BEND	5.72	.00	.00
IND150610905	NUCOR BUILDING SYSTEMS	WATERLOO	12.85	.00	.00
IND003938701	OTIS ELAVATOR	BLOOMINGTON	10.81	.00	.00
IND021644273	PAINTS & SOLVENTS	ELKHART	9.16	.00	.00
IND134652197	PANHANDLE EASTERN PIPE LINE CO	INDIANAPOLIS	1.87	.00	.00
IND980271142	PANHANDLE EASTERN PIPE LINE COMPANY	MONROEVILLE	8.59	.00	.00
IND072333909	PHILLIPS PIPE LINE EAST CHICAGO TER	EAST CHICAGO	7.40	.00	.00
IND981091929	PHILLIPS TECHNOLOGY	AUBURN	8.10	.00	.00
IND061560223	PPG INDUSTRIES, INC.	EVANSVILLE	7.90	.00	.00
IND006065924	PRECISION PLASTICS, INC.	CRAWFORDSVILLE	12.20	.00	.00
IND062811724	PROGRESSIVE PLATING CO., INC.	INDIANAPOLIS	13.00	.00	.00
IND000807065	PSI/COLUMBUS STORE ROOM	COLUMBUS	2.16	.00	.00
IND061158861	QUEENS GROUP INDIANA, INC.	INDIANAPOLIS	8.14	.00	.00
IND006420657	R R DONNELLEY	CRAWFORDSVILLE	5.11	.00	.00
IND064717291	RANCH FIBERGLAS INC.	ELKHART	1.66	.00	.00
IND074068610	ROBUR CORPORATION	EVANSVILLE	2.94	.00	.00
IND006382634	ROTARY LIFT A DOVER INDUSTRIES COMP	MADISON	8.07	.00	.00
IND042829945	SCHROCK CABINET CO.	RICHMOND	3.96	.00	.00
IND046395877	SHERWIN WILLIAMS	FT WAYNE	12.65	.00	.00
INR000001123	SMITH DAIRY/WAYNE	RICHMOND	3.21	.00	.00
IND040299828	SONOCO FLEXIBLE PACKAGING	EDINBURGH	11.81	.00	.00

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- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
IND006036180	STEEL PARTS CORPORATION	TIPTON	7.24	.00	.00
IND981091242	STOUT FIELD MDI-FE-EN	INDIANAPOLIS	7.70	.00	.00
IND981955834	T.E. PRODUCTS PIPELINE CO.LP	INDIANAPOLIS	1.44	.00	.00
IND004369096	TELEDYNE RODNEY METALS	ELKHART	12.43	.00	.00
IND984867382	TEXAS EASTERN TRANS. CORP./SEYMOUR	SEYMOUR	1.51	.00	.00
IND981200769	TEXAS EASTERN TRANSMISSION CORPORAT	FRENCH LICK	5.42	.00	.00
IND079586095	TEXAS GAS TRANSMISSION	BEDFORD	2.82	.00	.00
IND980271852	TEXAS GAS TRANSMISSION	AURORA	3.80	.00	.00
IND006037196	TUBE PROCESSING CORP.	INDIANAPOLIS	9.85	.00	.00
IN5210020454	U.S. ARMY JEFFERSON PROVING GROUND	MADISON	3.23	.00	.00
IN9570024472	U.S.A.F. GRISSOM ARB	GRISSOM ARB	12.87	14.00	.00
IND044198034	ULRICH CHEMICAL, INC	EVANSVILLE	9.66	.00	.00
IND072081169	ULRICH CHEMICAL, INC	TERRE HAUTE	6.65	.00	.00
IND173429903	UNION TANK CAR CO	EAST CHICAGO	10.28	.00	.00
IND005477278	UNITED TECHNOLOGIES AUTOMOTIVE	HUNTINGTON	5.25	.00	.00
IND006413959	UNITED TECHNOLOGIES AUTOMOTIVE	EDINBURG	10.25	.00	.00
IND064702160	UNIVERSAL FOREST PRODUCTS, INC.	GRANGER	4.00	.00	.00
IND981528326	V.C. TANK LINES, INC.	SCHERERVILLE	12.13	.00	.00
IND016627333	VAN WATERS & ROGERS INC.	SOUTH BEND	3.00	.00	.00
IND985102763	WARSAW ORTHOPEDIC, INC.	WINONA LAKE	2.75	.00	.00
IND006035307	WESTERN SELECT PROPERTIES, L.P.	INDIANAPOLIS	5.70	.00	.00
IND006421218	WESTINGHOUSE AIR BRAKE	INDIANAPOLIS,	6.48	.00	.00
IN0000132738	WESTVILLE CORRECTIONAL CENTER	WESTVILLE	5.95	.00	.00
IND173414160	WH CO LLC D/B/A CHEMCRAFT	ELKHART,	11.25	.00	.00
IND016296501	WHAYNE SUPPLY COMPANY	EVANSVILLE	8.57	.00	.00
IND005461298	WHITE-RODGERS LOGANSPORT DIVISION	LOGANSPORT	6.48	.00	.00
IND006379283	WILLIAMSON METAL WORKS	MADISON	7.76	.00	.00
INT190013508	WOLF LAKE TERMINALS, INC.	HAMMOND	9.70	.00	.00
IND985085919	WOODCREST MFG	PERU	6.75	.00	.00
IND006421887	ZIMMER PAPER PRODUCTS INC.	INDIANAPOLIS	7.91	.00	.00
IND981950827	20TH CENTURY FIBERGLASS PLANT # 4	ELKHART	1.87	.00	.00

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GENERATORS WHO CANNOT BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- LESS THAN 1.1 TONS RCRA HAZARDOUS WASTE, AND
- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
IND016389546	ACE BATTERY, INC.	INDIANAPOLIS,	.00	.00	.00
IND016360265	AMERICAN CHEMICAL SERVICE, INC.	GRIFFTH	1.03	.00	.00
IND041597014	ANCHOR GLASS CONTAINER	LAWRENCEBURG,	.72	.00	.00
INT190010389	ELI LILLY & CO. PARK FLETCHER	INDIANAPOLIS	.53	.00	.00
IND069763605	ESSEX GROUP INC.	KENDALLVILLE	.41	.00	.00
IND981002462	FASSON ROLL DIVISION	FORT WAYNE	.91	.00	.00
IND984867481	HAYNES INTERNATIONAL, INC	KOKOMO	.36	.00	.00
IND040419251	HOOSIER MAGNETICS, INC.	WASHINGTON	.23	.00	.00
IND000815423	INDIANA UNIV. SHOWERS WAREHOUSE	BLOOMINGTON	.00	.00	.00
IND000815431	INDIANA UNIVERSITY	BLOOMINGTON	.00	.00	.00
IND981199250	PCL PACKAGING	COLUMBUS	.76	.00	.00
IND000646943	POLLUTION CONTROL INDUSTRIES OF IND	EAST CHICAGO	.00	.00	.00
IND005215637	UNITED MUSICAL INSTRUMENTS U.S.A.,	ELKHART	.01	.00	.00

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IOWA

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- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
IA0000109827	A-TEC RECYCLING INC	DES MOINES	22.95	.00	.00
IAD053739256	ALEXANDER MFG. CO.	MASON CITY	32.53	.00	.00
IAD073489288	ALLIED SIGNAL LAMINATE SYSTEMS	POSTVILLE	116.28	.00	.00
IAD005270160	ALUMINUM CO OF AMERICA	RIVERDALE	207.68	.00	.00
IAD000610436	AMANA REFRIGERATION INC	AMANA	164.92	.00	.00
IAD001818327	AMERICAN NATIONAL CAN CO	DES MOINES	184.87	.00	.00
IA6890008950	AMES LAB#3-DOE;SPEDDING HALL,METALS	AMES	5.17	82.47	.00
IAD000688556	AMOCO OIL CO - DUBUQUE TERMINAL	DUBUQUE	15.10	.00	.00
IAD000688515	AMOCO OIL CO.	NORTH LIBERTY	99.46	.00	.00
IAD980688717	AY MCDONALD MFG. CO	DUBUQUE	724.70	.00	.00
IAD981719909	BARTON SOLVENTS INC	DES MOINES	32.41	.00	.00
IAD089570063	BARTON SOLVENTS INC - COUNCIL BLUFF	COUNCIL BLUFFS	78.72	.00	.00
IAD087125936	BARTON SOLVENTS- BETTENDOR BR.	BETTENDOR	50.31	.00	.00
IAD980688345	BLOOMFIELD FOUNDRY INC	BLOOMFIELD	34.07	.00	.00
IAD061322111	BLUE BIRD MIDWEST	MT PLEASANT	21.66	.00	.00
IAD005264940	BRAMMER MANUFACTURING CO	DAVENPORT	31.23	.00	.00
IAD089979264	BUD MULCAHYS' JEEP EAGLE, INC.	DES MOINES	18.92	.00	.00
IAD000688572	BURLINGTON NORTHERN SANTA FE	BURLINGTON	25.63	.00	.00
IAD980964316	CARGILL CORN MILLING DIVISION	EDDYVILLE	22.97	.00	.00
IAD057920605	CEDARAPIDS INC	CEDAR RAPIDS	44.66	.00	.00
IAD069624591	CENTRAL COLLEGE	PELLA	.47	75.06	.00
IAD000805143	CHAMPION SPARK PLUG	BURLINGTON	696.04	.00	.00
IAD000222794	CHICAGO AND N WESTERN - CAR SHOP	CLINTON	45.85	.00	.00
IAD984591834	CITY OF MUSCATINE, ORANGE ST. SITE	MUSCATINE	8.11	16,212.51	.00
IAP000001359	CLARENCE COOPERATIVE	LOST NATION	26.85	34.00	.00
IAD005145941	CLOW VALVE CO. FOUNDRY	OSKALOOSA	203.62	.00	.00
IAD078096732	COLOR CONVERTING INDUSTRIES CO	DES MOINES	98.51	.00	.00
IAD065228009	COMMERCIAL EQUIPMENT CO INC	CARROLL	13.20	.00	.00
IAD049474380	CRANE CO.	WASHINGTON,	42.03	.00	.00
IAD022047112	CRYOVAC-DIV. OF WR GRACE	CEDAR RAPIDS	269.80	.00	.00
IAD005289806	DEER, JOHN - WATERLOO WORKS	WATERLOO	2,194.98	.00	.00
IAD005277249	DELAVAN INC - GAS TURBINE PLANT	WEST DES MOINES	15.21	.00	.00
IAD000830018	DEXTER	FAIRFIELD	420.55	.00	.00
IAD981126873	DIAMOND D TRAILER MFG.	SHENNANDOAH	17.00	.00	.00
IAD005291257	DONALDSON CO INC	OELWEIN	18.40	.00	.00
IAD006224661	DONALDSON CO INC	CRESCO	18.44	.00	.00
IAD005272398	E I DUPONT DE NEMOURS AND CO	FORT MADISON	3,221.90	.00	.00
IAD098716251	EAGLE WINDOW & DOOR	DUBUQUE	126.23	.00	.00
IAT200011187	EATON CORP	BELMOND	138.81	.00	.00
IAD005279039	ELECTRO-COATINGS OF IOWA INC	CEDAR RAPIDS	27.48	.00	.00
IAD062245089	ERICKSON DISPLAY	DES MOINES	23.34	.00	.00
IAD005102017	ERTL COMPANY PLANT TWO	DYERSVILLE	28.44	.00	.00
IAD007263650	EVEREADY BATTERY CO INC	RED OAK	26.74	.00	.00
IAD087267175	EXIDE CORPORATION	BURLINGTON	122.54	.00	.00
IAD069619765	EXIDE GENERAL BATTERY	MANCHESTER	217.96	.00	.00
IAD065218737	FANSTEEL/WELLMAN DYNAMICS CORP	CRESTON	44.65	.00	.00
IAD005292172	FAWN ENGINEERING CORPORATION	DES MOINES	72.00	.00	.00
IAD980739981	FIELDSTONE CABINETRY INC	NORTHWOOD	34.69	.00	.00
IAD005287768	FISHER CONTROLS - GOVERNOR ROAD	MARSHALLTOWN	4,594.83	.00	.00
IAD000610592	FLEETGUARD INC	LAKE MILLS	30.76	.00	.00
IAD078039880	FMC CORPORATION	SERGEANT BLUFF	39.69	79,264.47	.00
IAD005290259	FORT DODGE ANIMAL HEALTH	FORT DODGE	189.98	425.00	.00
IAD065222986	FORT DODGE ANIMAL HEALTH	FORT DODGE	26.75	.00	.00
IAD042450304	FREUHAUF DIVISION	FORT MADISON	40.06	.00	.00
IAD010256923	FURNACE ELECTRIC CO	OSCEOLA,	30.92	.00	.00

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- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
IAD075836130	GENERAL ELECTRIC CO APPL CONTROL DE	CARROLL	13.87	.00	.00
IAD005272703	GENREAL ELECTRIC EC&C SWITCHGEAR OP	WEST BURLINGTON	31.63	.00	.00
IAD096526108	GLACIER VANDERVELL INC	ATLANTIC	204.31	.00	.00
IAD115075475	GRAND LABORATORIES	LARCHWOOD	77.83	.00	.00
IAD040610529	GRIFFIN WHEEL COMPANY	KEOKUK	53.02	.00	.00
IAD091385294	HACH COMPANY	AMES	82.86	1,005.00	.00
IAD000678144	HELENA CHEMICAL COMPANY	DES MOINES	74.07	137,871.00	.00
IAD000829911	HON COMPANY OAK STREET PLANT	MUSCATINE	68.43	.00	.00
IAD184106243	IES RAILCAR SERVICE	CEDAR RAPIDS	22.49	.00	.00
IAD005268115	INTERNATIONAL PAPER	CLINTON	26.68	.00	.00
IA7213820445	IOWA ARMY AMMUNITION PLANT	MIDDLETOWN	82.46	3,000.00	.00
IAD107375263	IOWA DEPT OF TRANSPORTATION	AMES	28.05	.00	.00
IAD000805150	IOWA IRON WORKS INC.	CEDAR RAPIDS	34.40	.00	.00
IAD005286539	IOWA MOLD TOOLING COMPANY INC	GARNER	25.38	.00	.00
IAD981504285	IOWA NATIONAL GUARD-CAMP DODGE	JOHNSTON	16.60	.00	.00
IAT200010098	IOWA PAINT MANUFACTURING CO INC	DES MOINES	175.49	.00	.00
IAD984621383	IOWA STATE UNIVERSITY - MAIN CAMPUS	AMES	29.85	88.86	.00
IAD000156422	IOWA STEEL AND WIRE CO INC	CENTERVILLE	63.43	.00	.00
IAR000000216	IPSCO STEEL INC	MUSCATINE	.05	110.00	.00
IAD005266887	IPSCO TUBULARS INC	CAMANCHE	56.46	.00	.00
IAD073489726	JOHN DEERE - DAVENPORT WORKS	DAVENPORT	15.34	.00	.00
IAD000805168	JOHN DEERE - TRACTOR WKS	WATERLOO	615.29	.00	.00
IAD069624500	JOHN DEERE DES MOINES WORKS	ANKENY	460.83	.00	.00
IAD005269527	JOHN DEERE DUBUQUE WKS	DUBUQUE	19.74	.00	.00
IAD981707953	JOHN DEERE FOUNDRY - WATERLOO	WATERLOO	172.01	760.03	.00
IAD005291182	JOHN DEERE OTTUMWA WORKS	OTTUMWA	39.25	.00	.00
IAD981717804	JSJ INC.	WEST BURLINGTON	14.75	.00	.00
IAD984621300	JULIEN DUBUQUE BRIDGE	DUBUQUE	56.10	.00	.00
IAD980318133	KEOKUK STEEL CASTINGS	KEOKUK	23.37	.00	.00
IAD000651265	KLINGER PAINT COMPANY	CEDAR RAPIDS	39.15	.00	.00
IAR000001578	LLOYD TABLE CO	LISBON	13.53	.00	.00
IAD984567743	MAGNAFLUX CORPORATION	DEWITT	22.07	.00	.00
IAD073478166	MERCY HOSPITAL MED CENTER	DES MOINES	5.13	4,775.00	.00
IAD085824688	MID AMER TAN / US TAN CO INC	SERGEANT BLUFF	23.18	.00	.00
IAD161016613	MILSOLV IOWA CORPORATION	DES MOINES	31.79	.00	.00
IAD096515440	MODINE MFG. CO.	WASHINGTON	82.92	.00	.00
IAD005273594	MONSANTO COMPANY	MUSCATINE	7,576.20	.00	.00
IAD052461225	MOOG AUTOMOTIVE	OTTUMWA	16.60	.00	.00
IAD005285689	NEWTON LAUNDRY PRODUCTS PLANT 2	NEWTON	114.11	.00	.00
IAD984599308	NICHOLS HOMESHIELD CASTING	DAVENPORT	32.96	.00	.00
IAD000223354	NORTH STAR STEEL IOWA	WILTON	4,912.81	.00	.00
IAD065202707	NORTHER ENGRAVING CORP LANSING	LANSING	32.56	.00	.00
IAD045621232	NORTHERN ENGRAVING CORP WAUKON	WAUKON	26.82	.00	.00
IAD981506934	OMEGA CABINETS	WATERLOO	50.83	.00	.00
IAD984568154	PARR MANUFACTURING CO.	WINTERSET	23.80	.00	.00
IAD005278502	PELLA CORPORATION, PELLA	PELLA	287.70	.00	.00
IAP000001390	PIRELLI ARMSTRONG TIRE CORP.	DES MOINES	44.50	.00	.00
IAD981506298	PURETHANE, INC., WEST BRANCH	WEST BRANCH	331.09	.00	.00
IAD045372836	QUANTUM CHEMICAL COMPANY	CLINTON	1,908.07	.00	.00
IAD022096028	R V HOPKINS INC.	DAVENPORT	33.53	.00	.00
IAD050691617	REXAM RELEASE	IOWA CITY	231.94	.00	.00
IAD054235460	RILEY PAINT CO.	BURLINGTON	48.60	.00	.00
IAD000610733	ROCKWELL INTERNATIONAL	CEDAR RAPIDS	23.89	.00	.00
IAD065205056	ROCKWELL INTERNATIONAL CORP	CEDAR RAPIDS	187.32	.00	.00
IAD984591891	SALSBURY CHEMICALS INC.	CHARLES CITY	1,894.30	.00	.00

Note: Please refer to the introduction for an explanation of this list.

IOWA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
IAD078092962	SEABEE CORPORATION	HAMPTON	30.43	.00	.00
IAD005267745	SHEAFFER INC.	FORT MADISON	43.34	.00	.00
IAD000669960	SIEGWERK, INC.	GREENFIELD	15.66	.00	.00
IAD981504780	SIOUXLAND GALVANIZING	SIOUX CITY	491.49	.00	.00
IAD053737532	SOCKET SCREW PRODUCTS DIV CAMCAR/TE	DECORAH	123.20	.00	.00
IAD984621920	SOLARIS GROUP, UNIT OF MO	FORT MADISON	101.09	.00	.00
IAD005275540	SOLVAY ANIMAL HEALTH INC	CHARLES CITY	45.44	950.03	.00
IAD096526298	UNION TANK CAR COMPANY	MUSCATINE	41.88	.00	.00
IAD006537237	UNITED TECHNOLOGIES AUTOMOTIVE ENG	IOWA CITY	72.89	.00	.00
IAD984568204	UNIVERSAL CIRCUITS INC	LAKE MILLS	138.55	.00	.00
IAD005283023	UNIVERSAL MFG. CO., INC.	ALGONA	16.11	.00	.00
IAD057925570	UNIVERSAL RUNDLE CORP	OTTUMWA	15.20	.00	.00
IAD062761671	UNIVERSITY OF IOWA	IOWA CITY	141.45	69.24	.00
IAD005314117	VAN DIEST SUPPLY CO.	WEBSTER CITY	188.82	.00	.00
IAD041580721	VISKASE CORPORATION	CENTERVILLE	81.26	.00	.00
IAD007276728	VOGEL PAINT AND WAX CO., INC.	ORANGE CITY	307.84	.00	.00
IAD005277959	WATERLOO INDUSTRIES INC.	WATERLOO	15.44	.00	.00
IAT200011096	WELLBORN INDUSTRIES, LTD.	MASON CITY	424.78	.00	.00
IAD022034433	WILFARM L.L.C.	WEST BURLINGTON	46.19	600.00	.00
IAD005300751	WINNEBAGO INDUSTRIES INC.	FOREST CITY	173.43	.00	.00
IAD040611121	YOUNG RADIATOR COMPANY	CENTERVILLE	51.17	.00	.00
IAD089979058	3M AMES-INDUSTRIAL ABRASIVES DIV.	AMES	19.05	.00	.00
IAD980686323	3M DISTRIBUTION CENTER	FOREST CITY	37.68	.00	.00
IAD075846824	3M KNOXVILLE	KNOXVILLE	850.26	.00	.00

Note: Please refer to the introduction for an explanation of this list.

IOWA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
IAD005480561	ANTENNACRAFT CO	WEST BURLINGTON	9.78	.00	.00
IAD005264049	BLACK HAWK FOUNDRY & MACHINE CO	DAVENPORT	6.01	.00	.00
IAD005476932	CASE CORP	BURLINGTON	5.71	.00	.00
IAD061322087	CECO BULDING SYSTEMS	MT PLEASANT	8.21	.00	.00
IAD000222653	CLIMAZ MOLYBDENUM CO	FORT MADISON	7.71	.00	.00
IAD093108637	COOK COMPOSITES & POLYMER CO.	BURLINGTON	2.03	8.00	.00
IAD007275753	DETHMERS MANUFACTURING CO	BOYDEN	11.33	.00	.00
IAD005298591	DONALDSON CO	GRINNELL	10.10	.00	.00
IAD093107795	FRC COMPONENTS PRODUCTS	MASON CITY	5.37	.00	.00
IAD080291081	FRIGIDAIRE COMPANY	WBVSTER CITY	9.64	.00	.00
IAD054763404	GENERAL ELECTRIC RAILCAR SVCS CORP	WATERLOO	3.52	.00	.00
IA0000575902	IMPERIAL INC	HAMPTON	3.89	.00	.00
IAD007492085	IMPERIAL. INC.	SHENANDOAH	4.13	.00	.00
IAT200010601	IOWA STATE UNIVERSITY	AMES	2.46	.00	.00
IAD000678094	JOHN DEERE ENGINE WORKS	WATERLOO	3.68	.00	.00
IAD005268420	LITTON INSTRUMENTS & LIFE SUPP	DAVENPORT	10.08	.00	.00
IAD984566430	NEWTON LAUNDRY PRODUCTS, NEMC	NEWTON	12.20	.00	.00
IAD005264338	NICHOLS ALUMINUM	DAVENPORT	7.25	.00	.00
IAD000082057	NORTH STAR RECYCLING	CEDAR RAPIDS	6.54	.00	.00
IAD000678243	PHILLIPS PIPELINE COMPANY	BETTENDORF	10.63	.00	.00
IAD005279245	PROCTER AND GAMBLE MFG. CO.	IOWA CITY	3.88	.00	.00
IAD005279799	R.R. DONNELLEY PRINTING CO. LP	DES MOINES	3.90	.00	.00
IAD981702673	ROCKWELL INTERNATIONAL CORALVILLE	CORALVILLE	11.67	.00	.00
IAD005136023	SCHLEGEL KEOKUK PLANT	KEOKUK	12.41	.00	.00
IAD000819110	SQUARE D COMPANY	CEDAR RAPIDS	3.80	.00	.00
IAT200010924	THE UNIVERSITY OF IOWA	OAKDALE	8.65	18.30	.00
IAD000829978	UNION PACIFIC RAILROAD CO.	COUNCIL BLUFFS	8.75	.00	.00
IAD984589085	UNITED TECHNOLOGIES AUTOMOTIVE	KEOKUK	6.13	.00	.00
IAD981121486	VET MED INCINERATOR/IOWA STATE UNIV	AMES	8.31	.00	.00
IAD984566018	WILLIAMSBURG MFG. CO.	WILLIAMSBURG	6.76	.00	.00

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IOWA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO CANNOT BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- LESS THAN 1.1 TONS RCRA HAZARDOUS WASTE, AND
- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
IAD075848085	BLACK HAWK COUNTY LANKFILL	WATERLOO	.00	.00	.00
IAD984620997	FORT DODGE ANIMAL HEALTH	FORT DODGE	1.04	.00	.00
IAT200010593	HYDRITE CHEMICAL CO	WATERLOO	.57	.00	.00
IAD000805473	MUSSER STORAGE AREA (DSA)	MUSCATINE	.00	.00	.00
IAD981718000	SAFETY KLEEN CORP	DES MOINES	.00	.00	.00
IAD098027592	SAFETY-KLEEN CORP.	DAVENPORT	.00	.00	.00

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KANSAS

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
KSD981495567	ABBOTT LABORATORIES, INC.	WICHITA	37.50	.00	.00
KSD009203712	ABCO WIRE & METAL PRODUCTS INC	RUSSELL	22.59	.00	.00
KSD984967034	AFG INDUSTRIES, INC.	SPRING HILL	24.12	.00	.00
KSD984968172	AIR CAPITAL MODIFICATION CENTER	WICHITA	41.33	.00	.00
KSD073323081	AIR CAPITOL PLATING INC	WICHITA	15.20	.00	.00
KSD007237746	AIR PRODUCTS MFG CORP	WICHITA	860.88	.00	.00
KSD041142902	ALLIEDSIGNAL GAA	OLATHE	87.80	.00	.00
KSD981121197	ALLIEDSIGNAL JAYHAWK PLANT	GALENA	4,543.96	.00	.00
KSD981506025	APTUS INC	COFFEYVILLE	13,468.15	23,136,321.00	4,644.00
KSD031203318	ASH GROVE CEMENT PLANT	CHANUTE	73.68	.00	.00
KSD000203638	ASHLAND CHEMICAL CO	KANSAS CITY	23.78	.00	.00
KSR000001743	ASTOR UNIVERSAL NATIONAL FACILITY	LAWRENCE	82.83	.00	.00
KSD000690099	ATCHISON TOPEKA & SANTA FE RR CO	TOPEKA	90.37	.00	.00
KSD007166853	AUTOMOTIVE CONTROLS CORPORATION	INDEPENDENCE	232.13	.00	.00
KSD096537857	BARTON SOLVENTS INC	VALLEY CENTER	25.56	.00	.00
KSD984969238	BARTON SOLVENTS INC	KANSAS CITY	18.17	.00	.00
KSD007162407	BAYER CORP AGRICULTURE DIV	SHAWNEE	30.62	.00	.00
KSD054085600	BERWIND RAILWAY SVC CO	NEODESHA	19.13	.00	.00
KSD093503498	BINNEY & SMITH INC	WINFIELD	205.80	.00	.00
KSD007237241	BOEING WICHITA	WICHITA	3,305.32	9,650.00	.00
KSD000651307	CERTAINTEED CORP PLANT 7	KANSAS CITY	169.55	.00	.00
KSD000809673	CESSNA AIRCRAFT CO MID-CONTINENT FA	WICHITA	319.53	.00	.00
KSD007233596	CESSNA AIRCRAFT CO PAWNEE FAC	WICHITA	264.71	.00	.00
KSD007238744	CHANCE OPERATIONS INC	WICHITA	28.10	7,500.00	.00
KSD000687541	CHASE TERMINAL CO	GREAT BEND	100.70	.00	.00
KSD000687699	CHASE TERMINAL CO	SCOTT CITY	122.72	.00	.00
KST210010203	CHASE TERMINAL CO	EL DORADO	39.00	.00	.00
KS0000046607	CLEVELAND TECHNICAL CENTER	KANSAS CITY	18.81	.00	.00
KSD000610543	COASTAL REFINING & MARKETING INC	WICHITA	25.37	.00	.00
KSD000829846	COASTAL REFINING & MKT CO	EL DORADO	148.40	.00	.00
KSD980320386	COLEMAN CO INC BEACON	MAIZE	18.09	.00	.00
KSD000610485	COLEMAN CO INC NORTHEAST	WICHITA	30.75	.00	.00
KSD007157696	COLGATE PALMOLIVE COMPANY	KANSAS CITY	29.34	.00	.00
KSD116030909	COLT TECHNOLOGY CORPORATION	LENEXA	18.50	.00	.00
KSD065764995	CONTAINER RECYCLING INC	KANSAS CITY	23.66	.00	.00
KSD084891696	CR INDUSTRIES	SENECA	13.62	.00	.00
KSD981713522	DUPONT KANSAS CITY FASCIA	KANSAS CITY	71.06	.00	.00
KSD067952994	DYMON INC	KANSAS CITY	51.74	.00	.00
KSD007233638	EATON HYD DIV HUTCHINSON PLANT	HUTCHINSON	73.90	.00	.00
KSD007249980	ELF ATOCHEM NORTH AMERICA INC	WICHITA	144,966.61	1,326.00	.00
KSD065768277	EMERSON ELECTRIC CO	INDEPENDENCE	75.39	.00	.00
KSD985004670	ENGINEERED RECOVERY SYSTEMS, INC.	NEWTON	13.20	.00	.00
KSD033774670	ENRON GAS PROCESSING CO	BUSHTON	22,532.56	.00	.00
KSD073314593	EXIDE CORP	SALINA	431.68	.00	.00
KSD007127327	EXLINE INC	SALINA	23.51	.00	.00
KSD007138605	FARMLAND INDUSTRIES, INC.	COFFEYVILLE	1,743.72	.00	.00
KSD067925347	FERMENTA ANIMAL HEALTH CO	ELWOOD	35.47	36.00	.00
KSO000205856	FIBERGLASS ENGINEERING INC.,	NEODESHA	46.78	.00	.00
KSD007124506	FMC CORPORATION	LAWRENCE	471.10	3,200.00	.00
KS4213720499	FORT LEAVENWORTH & COMBINED ARMS CE	FORT LEAVENWORT	32.46	6.00	.00
KSD980633366	GEC PRECISION CORP. MIDWEST DIV.	WELLINGTON	67.46	.00	.00
KSD041917501	GENERAL ELECTRIC CO	ARKANSAS CITY	393.07	.00	.00
KSD007145907	GENERAL MOTORS CORP.-DELPHI	OLATHE	402.37	.00	.00
KSD981126253	GMC FAIRFAX ASSEMBLY PLANT	KANSAS CITY	400.58	.00	.00
KSD058924689	GNB TECHNOLOGIES	KANSAS CITY	114.13	.00	.00

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KANSAS

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
KSD007129695	GOODYEAR TIRE & RUBBER CO	TOPEKA	82.35	.00	.00
KSD093807774	GRAPHIC TECHNOLOGY INC	NEW CENTURY	78.13	.00	.00
KSD043066737	GREIF BROTHERS CORP	WINFIELD	32.45	.00	.00
KSD003951977	GRIFFIN WHEEL COMPANY, KANSAS CITY	KANSAS CITY	206.64	.00	.00
KSD065767782	H.E.S. INTERNATIONAL	KANSAS CITY	25.02	.00	.00
KSD062737770	HACKNEY & SONS (MIDWEST), INC.	INDEPENDENCE	15.61	.00	.00
KSD007150568	HALLMARK CARDS, INC.	LEAVENWORTH	18.05	41.70	.00
KST210010062	HARCROS CHEMICALS, INC.	KANSAS CITY	50.79	17,627.87	.00
KSD980739999	HERCULES CEMENT CO DBA/HEARTLAND	INDEPENDENCE	388.33	.00	.00
KSD007246846	HYDROCARBON RECYCLERS INC OF WICHIT	WICHITA	317.47	82,058.00	.00
KSD007148380	INDUSTRIAL CHROME INC	TOPEKA	36.50	.00	.00
KS0000200964	INDUSTRIAL SERVICE CORPORATION, INC	NEWTON	36.00	.00	.00
KSD069259117	INTERX RESEARCH	LAWRENCE	7.79	35.00	.00
KSD045087566	INX INTERNATIONAL INK CO	KANSAS CITY	51.66	.00	.00
KS0213820467	KANSAS ARMY AMMUNITION PLANT	PARSONS	28.19	.00	.00
KSD007234859	KANSAS PAINT & COLOR CO	WICHITA	54.78	.00	.00
KSD007233323	KANSAS PLATING INC	WICHITA	30.00	.00	.00
KSD980632772	KANSAS STATE UNIVERSITY	MANHATTAN	15.17	.00	.00
KSD007127236	KC COATINGS	LENEXA	49.59	.00	.00
KSR000001404	KC COATINGS	SHAWNEE	47.17	.00	.00
KSD981126832	KENDALL PKG PITTSBURG DIV	PITTSBURG	45.00	.00	.00
KSD007235146	KOCH INDUSTRIES, INC.	WICHITA	16.96	.00	.00
KSD007250764	LAMAR ELECTRO-AIR CORPORATION	WELLINGTON	17.80	.00	.00
KSD000809707	LANDOLL CORPORATION	MARYSVILLE	17.40	.00	.00
KSD007234313	LEARJET INC.	WICHITA	907.38	20.00	.00
KSD007127046	LOCTITE CORP	KANSAS CITY	69.19	.00	.00
KSD007236193	LOWEN CORPORATION	HUTCHINSON	13.29	.00	.00
KSD007162225	MARLEY COOLING TOWER COMPANY, THE	OLATHE	17.51	.00	.00
KS1571924140	MCCONNELL AIR FORCE BASE	WICHITA	81.34	.00	.00
KSD007241185	METAL FINISHING CO INC	WICHITA	22.20	.00	.00
KSD055402721	MIDLAND BRAKE INC.	IOLA	15.02	.00	.00
KS6214020756	MILITARY INSTALLATION FT RILEY	FORT RILEY	271.41	143.00	.00
KSD981504970	MISSOURI M P P CORP	KANSAS CITY	84.80	.00	.00
KSD065755100	MODINE MANUFACTURING CO.	EMPORIA	75.26	.00	.00
KSD007145956	NATIONAL COOPERATIVE REFINERY ASSOC	MCPHERSON	145.08	.00	.00
KSD984971291	NEI/GTEL ENVIRONMENTAL LABS, INC.	WICHITA	28.26	.00	.00
KSD007120751	NELLCOR PURITAN BENNETT	LENEXA	44.77	.00	.00
KSD984971168	NORTHERN NATURAL GAS	MULLINVILLE	40.86	.00	.00
KSD030692057	OTTAWA TRUCK, INC.	OTTAWA	50.16	.00	.00
KSD000610725	OWENS CORNING	KANSAS CITY	107.94	.00	.00
KS0000011726	P C BOARDS INC	CHANUTE	53.65	.00	.00
KSD062721956	PACKAGING PRODUCTS CORP.	MISSION	150.40	.00	.00
KSD084845023	PALMER MFG & TANK INC	GARDEN CITY	27.10	.00	.00
KSD097709968	PARAGON NDT & FINISHES, INC	WICHITA	60.32	.00	.00
KSD007124357	PBI/GORDON CORPORATION	KANSAS CITY	6.53	13,055.00	.00
KSD007128846	PEERLESS PRODUCTS INC.	FORT SCOTT	28.32	.00	.00
KS0000837633	PESTER BURN POND SITE	EL DORADO	30,299.00	.00	.00
KSD043941590	PHILIPS LIGHTING COMPANY	SALINA	100.91	.00	.00
KSD984970426	PIONEER BALLOON CO INC	EL DORADO	67.10	.00	.00
KSD007233257	PLASTIC FABRICATING CO., INC.	WICHITA	36.37	.00	.00
KSD981711260	PLASTIC PACKAGING CORPORATION	KANSAS CITY	40.20	.00	.00
KSD000203711	PQ CORPORATION KANSAS CITY	KANSAS CITY	175.52	.00	.00
KSD056577810	PRATT & LAMBERT	ANDOVER	478.44	.00	.00
KSD042387142	PRESTIGE INC	NEODESHA	21.01	.00	.00
KSD007130032	PROCTER & GAMBLE MANUFACTURING CO	KANSAS CITY	329.63	.00	.00

Note: Please refer to the introduction for an explanation of this list.

KANSAS

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
KSD007146855	PROSOCO, INC.	KANSAS CITY	45.51	.00	.00
KSD000819086	PUEBLO CHEMICAL & SUPPLY CO	GARDEN CITY	347.04	694,071.00	.00
KSD007482011	RAYTHEON AIRCRAFT CO	WICHITA	650.26	.00	.00
KSD981713597	RIGID FORM, INC.	PAOLA	17.50	.00	.00
KSD981712854	SABRELINER INDEPENDENCE	INDEPENDCENCE	14.41	.00	.00
KSD980965966	SAFELITE GLASS COPRORATION	WICHITA	188.00	.00	.00
KSD030606222	SANOFI WINTHROP, INC.	MCPHERSON	18.38	480.02	.00
KSD007163355	SHERWIN-WILLIAMS COMPANY, THE	COFFEYVILLE	13.64	.00	.00
KSD094338084	SMITH FIBERGLASS PRODUCTS INC	WICHITA	85.25	.00	.00
KSD096747027	SNORKEL-ECONOMY	ELWOOD	22.37	.00	.00
KSD007233422	TEXACO REFINING AND MARKETING, INC.	EL DORADO	1,331.07	.00	.00
KSD980967756	TOPEKA CAPITAL-JOURNAL DIV.	TOPEKA	17.61	.00	.00
KSD087418695	TOTAL PETROLEUM INC	ARKANSAS CITY	81.57	.00	.00
KSD980688733	UNISON TRANSFORMER SERVICES	KANSAS CITY	80.00	.00	.00
KSD984967372	UNIVERSAL ENGRAVING	OVERLAND PARK	350.42	.00	.00
KSD980852669	UNIVERSITY OF KANSAS	LAWRENCE	13.88	.00	.00
KSD076274737	UNIVERSITY OF KANSAS MEDICAL CENTER	KANSAS CITY	26.26	.00	.00
KS7680090001	US EPA REGIONAL LABORATORY	KANSAS CITY	7.41	179.00	.00
KSD007482029	VULCAN MATERIALS COMPANY	WICHITA	1,484,816.75	35,907.00	.00
KSD984969790	WESTINGHOUSE AIR BRAKE CO	KANSAS CITY	35.21	.00	.00
KSD980687958	WILKO PAINT INC	WICHITA	25.00	.00	.00
KSD984968628	WILLIAMS NATURAL GAS	OTTAWA	35.10	.00	.00
KSD985014851	YAGGY FIELD/WESTERN RESOURCES	HUTCHINSON	158.66	.00	.00
KSD043933266	YUASA EXIDE INC	HAYS	1,491.22	.00	.00

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KANSAS

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
KSD980632814	ALLIEDSIGNAL GAA	LAWRENCE	10.70	.00	.00
KSD057889313	ASHLAND CHEMICAL CO	KANSAS CITY	2.00	.00	.00
KSD095824546	ATCHISON TOPEKA & SANTA FE RR CO	TOPEKA	6.03	.00	.00
KSD007832249	ATKINSON INDUSTRIES	PITTSBURG	10.10	.00	.00
KSD984988535	BAYER CORP AG DIV	KANSAS CITY	4.81	.00	.00
KSD095816500	BAYER CORP AGRICULTURE DIV	STILWELL	11.18	.00	.00
KSD007168834	CHARLOMA INC	CHERRYVALE	1.80	.00	.00
KSD980966501	CHEMSYN SCIENCE LABORATORIES	LENEXA	5.24	.40	.00
KSD980861728	COLLINS BUS CORPORATION	SOUTH HUTCHINSO	12.17	.00	.00
KSD007141468	COLUMBIAN STEEL TANK CO	KANSAS CITY	8.43	.00	.00
KSD007990211	CONSOLIDATED MANUFACTURING INC	HUTCHINSON	10.38	.00	.00
KSD043575315	COOPERS PITMAN-MOORE, INC	KANSAS CITY	5.97	.00	.00
KSD007240286	CROSS MFG INC	LEWIS	6.05	.00	.00
KSD981713001	DEARBORN MID-WEST CONVEYOR KC KS	KANSAS CITY	8.16	.00	.00
KSD108593203	DEELLIOTTE CO INC	NEW CENTURY	10.54	.00	.00
KSD068433317	ESSEX GROUP INC-HOISINGTON	HOISINGTON	12.48	.00	.00
KSD046744629	FIBERGLASS ENGINEERING PRODUCTS	NEODESHA	10.78	.00	.00
KSD052296274	FLEXEL INC	TECUMSEH	10.29	.00	.00
KSD076280478	GATES RUBBER CO	IOLA	11.57	.00	.00
KSD058107285	GORDON-PIATT ENERGY GROUP, INC.	WINFIELD	12.94	.00	.00
KSD086056637	HALLMARK CARDS INC	LAWRENCE	10.24	.00	.00
KSD092856525	HALLMARK CARDS INC	LEAVENWORTH	4.13	.00	.00
KSD000610618	HAVENS STEEL COMPANY	OTTAWA	4.20	.00	.00
KSD984987867	HEATRON	LEAVENWORTH	11.46	.00	.00
KSD000610675	HUTCHINSON/MAYRATH	CLAY CENTER	5.46	.00	.00
KSD086799913	INLAND NEWSPAPER MACHINERY CORPORAT	LENEXA	5.50	.00	.00
KSD980632756	KANSAS CORRECTIONAL INDUSTRIES	LANSING	9.55	.00	.00
KSD073309726	KBK INDUSTRIES, INC.	RUSH CENTER	2.24	.00	.00
KSD058107269	KEYSTONE RAILWAY EQUIPMENT COMPANY	MCPHERSON	2.86	.00	.00
KSD981505027	LOWEN CORPORATION	HUTCHINSON	7.70	.00	.00
KSD147474795	NATIONAL BEEF PACKING CO., L.P.	LIBERAL	8.79	.00	.00
KSD104081542	NORCRAFT COMPANIES INC	NEWTON	9.65	.00	.00
KSD981706039	NORCRAFT COMPANIES, INC	NEWTON	9.09	.00	.00
KSD984969246	OREAD LABORATORIES INC	LAWRENCE	5.90	.00	.00
KSD980686737	PANENERGY FIELD SERVICES	LIBERAL	2.49	.00	.00
KSD984972737	PANHANDLE EASTERN PIPE LINE CO	OLPE	2.05	.00	.00
KSD980321889	PANHANDLE EASTERN PIPE LINE COMPANY	LOUISBURG	2.58	.00	.00
KSD984972711	PANHANDLE EASTERN PIPE LINE COMPANY	GREENSBURG	2.32	.00	.00
KSD984972729	PANHANDLE EASTERN PIPELINE COMPANY	HAVEN	11.95	.00	.00
KSD062710868	PARSONITT CO. INC.	INDUSTRIAL AIRP	1.20	.00	.00
KSD041143918	PHILLIPS PLATING WORKS INC	KANSAS CITY	4.30	.00	.00
KSD065735912	PLATING INC	GREAT BEND	4.30	.00	.00
KSD067964700	PMI FOOD EQUIPMENT GROUP	KANSAS CITY	2.50	.00	.00
KSD007171192	POWER VAC, INC.	SALINA	2.40	.00	.00
KSD984992750	QUALITY AUTO PLAZA	OLATHE	4.03	.00	.00
KSD980964118	RAYTHEON AIRCRAFT SERVICES, INC.	WICHITA	12.62	.00	.00
KSD007118144	REICHHOLD CHEMICALS INC.	KANSAS CITY	2.96	.00	.00
KSD056389711	RIMPULL CORPORATION	OLATHE	9.64	.00	.00
KSD000809723	SAFETY-KLEEN CORP	WICHITA	1.26	.00	.00
KSD980851208	SCHOOL SERVICE CENTER	WICHITA	9.16	.00	.00
KSD056789126	SCHULLER INTERNATIONAL INC	MCPHERSON	3.19	.00	.00
KSD007120876	STANLEY TOOLS - GOLDBLATT PLANT	KANSAS CITY	4.91	.00	.00
KS3213820878	SUNFLOWER ARMY AMMUNITION PLANT	DE SOTO	4.56	.00	.00
KSD052903234	THERMO DYNAMICS INC.	MERRIAM	11.10	.00	.00
KSD007168677	TOPEKA METAL SPECIALTIES, INC.	TOPEKA	11.99	.00	.00

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- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
KST210010724	TREASURE CHEST ADVERTISING INC.	LENEXA	7.98	.00	.00
KSD985015791	UNION PACIFIC RAILROAD	COFFEEVILLE	3.25	.00	.00
KS0000028258	UNION PACIFIC RAILROAD	HOISINGTON	1.98	.00	.00
KSD065737868	UNION TANK CAR COMPANY	EL DORADO	12.09	.00	.00
KSD007145105	VILE GOLLER FINE ARTS PRINT & LIT	KANSAS CITY	2.93	.00	.00
KSD043950773	VITA CRAFT CORP	SHAWNEE	8.68	.00	.00
KSD981123144	WATC-GROVE CAMPUS	WICHITA	2.11	.00	.00
KSD053078127	WICHITA STATE UNIVERSITY	WICHITA	3.31	.00	.00
KSD006871669	WILDE TOOL CO, INC	HIAWATHA	11.50	.00	.00
KSD000003483	WILLIAMS NATURAL GAS	SHAWNEE MISSION	2.70	.00	.00
KSD984987818	WINNING WAYS INC.	LENEXA	3.63	.00	.00
KSD007234941	WITCO CORP SOUTHWEST DIV	OLATHE	11.45	.00	.00
KSD000686956	WOLF CREEK NUCLEAR OPERATING CORP	BURLINGTON	9.89	.00	.00

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KANSAS

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO CANNOT BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- LESS THAN 1.1 TONS RCRA HAZARDOUS WASTE, AND
- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
KSD070902952	CHEMICAL WASTE MGMT OF KS INC	VALLEY CENTER	.03	.00	.00
KSD044625010	FARMLAND INDUSTRIES INC.	DODGE CITY	.88	.00	.00
KSD981720923	KPL GAS SVC CALISTA COMP STATION	KINGMAN	.36	.00	.00
KSD981506264	OUTLOOK PACKAGING INC	WICHITA	.02	.00	.00
KSD980686844	SAFETY-KLEEN CORP	DODGE CITY	.38	.00	.00
KSD980973515	SAFETY-KLEEN CORP	EDWARDSVILLE	.33	.00	.00
KSD980633259	SYSTECH ENVIRONMENTAL CORPORATION	FREDONIA	.00	.00	.00
KSD000809715	VAN WATERS & ROGERS INC	WICHITA	.16	.00	.00

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KENTUCKY

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GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
KYD006384168	AAF INTERNATIONAL REED PLANT	LOUISVILLE	25.33	.00	.00
KYD985092006	ADVANCED CHEMTECH	LOUISVILLE	59.88	.00	.00
KYD055831838	AIR PRODUCTS AND CHEMICALS, INC.	CALVERT CITY	1,745.42	.00	.00
KYD005013032	AK STEEL CORPORATION (COKE PLANT)	ASHLAND	468.51	.00	.00
KYD070814033	AKZO NOBEL RESINS	LOUISVILLE	1,821.03	.00	.00
KYD058692526	ALCAN INGOT, SEBREE ALUMINUM PLANT	HENDERSON	2,822.79	.00	.00
KYD041167396	ALLIED DRUM SERVICE, INC.	LOUISVILLE	144.65	.00	.00
KYD041171257	ALLIED SIGNAL AUTOMOTIVE	FRANKFORT	14.23	.00	.00
KYD981021363	ALLWASTE CONTAINER SERVICES	LOUISVILLE	60.63	.00	.00
KYD056819287	ALUCOBOND TECHNOLOGIES, INC.	BENTON	53.95	.00	.00
KYD981806458	ALUMINUM WHEEL TECHNOLOGY INC.	SOMERSET	61.52	.00	.00
KYD981753197	AMBRAKE CORPORATION	ELIZABETHTOWN	869.45	.00	.00
KYD980843429	AMERICAN GREETINGS	BARDSTOWN	31.04	.00	.00
KYD045739471	AMERICAN GREETINGS CORPORATION	CORBIN	577.30	.00	.00
KYR000003806	AMERICAN RACING EQUIPMENT	WARSAW	77.22	.00	.00
KYD004270237	AMERICAN SIGN & MARKETING SERVICES	FLORENCE	21.01	.00	.00
KYD049461270	AMERICAN STANDARD INC.	PAINTSVILLE	44.83	1,200.00	.00
KYD006382857	AMERICAN SYNTHETIC RUBBER CORP.	LOUISVILLE	151.78	.00	.00
KYD058688284	ANGELL MFG. CO.	LEBANON	22.32	.00	.00
KYD985070614	AP TECHNOGLASS CORPORATION	ELIZABETHTOWN	25.33	.00	.00
KYD092825538	ARISTECH CHEMICAL CORP.	FLORENCE	22.29	.00	.00
KYD005003181	ARMCO STEEL COMPANY, L.P.-WEST WORK	ASHLAND	16.61	.00	.00
KYD985116565	ASHLAND BRANDED MARKETING #575-000	WEST LIBERTY	13.84	.00	.00
KYD000615906	ASHLAND PETROLEUM CO. VINEY BRANCH	CATLETTSBURG	42.13	.00	.00
KYD985097591	ASHLAND PETROLEUM CO. 428-000	MT. STERLING	24.36	.00	.00
KYD041376138	ASHLAND PETROLEUM COMPANY	CATLETTSBURG	408.07	.00	.00
KYD074053281	ASHLAND PETROLEUM COMPANY	LOUISVILLE	328.27	.00	.00
KYD085512069	ASHLAND PETROLEUM COMPANY DIV OF AS	COVINGTON	16.83	.00	.00
KYD066899766	ATR WIRE & CABLE CO INC	DANVILLE	498.84	.00	.00
KYD084274778	AUTOSTYLE PLASTICS, INC.	HOPKINSVILLE	39.51	.00	.00
KYD006370167	B.F. GOODRICH	CALVERT CITY	2,140.07	.00	.00
KYD006371314	B.F. GOODRICH COMPANY (THE)	LOUISVILLE	69.21	.00	.00
KYD006372254	BASF CORPORATION	LOUISVILLE	114.14	.00	.00
KYR000001735	BATH HOUSE	HENDERSON	15.45	.00	.00
KYD985079797	BEKAERT CORPORATION	SHELBYVILLE	2,411.25	.00	.00
KYD084265727	BLACK & DECKER-SHELBYVILLE	SHELBYVILLE	177.89	.00	.00
KYD006376818	BLATZ PAINT CO.INC.	LOUISVILLE	91.58	.00	.00
KY0210020509	BLUEGRASS ARMY DEPOT LEXINGTON	LEXINGTON	235.50	.00	.00
KY8213820105	BLUEGRASS ARMY DEPOT RICHMOND	RICHMOND	371.69	10.00	.00
KYD980837777	BLUEGRASS PLATING CO.	RICHMOND	303.29	.00	.00
KYD055832091	BORDEN PACKAGING & IND. PRODUCTS	LOUISVILLE	223.01	.00	.00
KYD006372502	BOYLES GALVANIZING CO.	LOUISVILLE	437.99	.00	.00
KYD062986336	BP OIL LOUISVILLE TERMINAL	LOUISVILLE	19.60	.00	.00
KYD004267480	BP OIL PIPELINE COMPANY BROMLEY	BROMLEY	100.89	.00	.00
KYD981003155	BRIGGS & STRATTON CORP.	MURRAY	14.60	.00	.00
KYD094203213	BROWN PRINTING CO., FRANKLIN DIVISI	FRANKLIN	414.61	.00	.00
KYD024143711	BROWN'S PLATING SERVICE, INC.	PADUCAH	143.78	.00	.00
KYD985097088	BROWNING FERRIS INDUSTRIES	LOUISVILLE	1,066.91	.00	.00
KYD048878805	BROWNING MFG.-DIV. OF EMERSON ELECT	MAYSVILLE	190.67	100.00	.00
KYD981806714	BROWNING MFG., DIV. OF EMERSON ELEC	MAYSVILLE	21.26	.00	.00
KYD006379945	BTR PRECISION DIE CASTING, INC.	RUSSELLVILLE	33.21	.00	.00
KYD006557011	BUNDY CORPORATION	CYNTHIANA	109.13	.00	.00
KYD981852585	C & M CARBIDE COMPANY	MADISONVILLE	39.87	.00	.00
KYD985113240	CAE VANGUARD INC	GREENUP	28.51	.00	.00
KYD005009923	CALGON CARBON CORPORATION	CATLETTSBURG	724.78	.00	.00

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- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
KYD049937832	CARPENTER COMPANY	RUSSELLVILLE	29.14	.00	.00
KYD981472616	CENTRAL KENTUCKY PROCESSING INC.	LEXINGTON	106.65	.00	.00
KYD175598267	CENTRAL MANUFACTURING COMPANY	PARIS	33.51	.00	.00
KYD067646737	CERAMICHROME INC	STANFORD	53.02	.00	.00
KYD055830129	CHALLENGER LIFTS INC.	LOUISVILLE	21.35	.00	.00
KYD092563675	CHEVRON USA LEXINGTON TERMINAL	LEXINGTON	16.26	.00	.00
KYD074098484	CHEVRON USA PRODUCTS CO	LOUISVILLE	45.23	.00	.00
KYD982121071	CLARK MATERIAL HANDLING COMPANY	LEXINGTON	23.61	.00	.00
KYD068934967	CLEVELAND TWIST DRILL COMPANY	CYNTHIANA	31.96	.00	.00
KYD057591133	COLLIS INC.	ELIZABETHTOWN	123.82	.00	.00
KYD058688664	COLTEC INDUSTRIES HOLLEY RPD	BOWLING GREEN	156.92	.00	.00
KYD985082494	COLUMBIA GAS OF KENTUCKY, INC.	LEXINGTON	21.76	.00	.00
KYD058691031	COMMONWEALTH ALUMINUM CORPORATION	LEWISPORT	4,245.92	.00	.00
KYD981753833	COMMUNITY TOWEL & UNIFORM COMPANY	BOWLING GREEN	102.60	.00	.00
KYD042596981	CONCO, INC.	LOUISVILLE	15.16	.00	.00
KYD981923147	CONTECH CONSTRUCTION PRODUCTS, INC.	WINCHESTER	312.51	.00	.00
KYD006371074	CONTINENTAL GENERAL TIRE INC.	MAYFIELD	13.99	.00	.00
KYD006388797	CORNING INCORPORATED	HARRODSBURG	188.18	.00	.00
KYD006382253	COURTAULDS COATINGS INC	LOUISVILLE	258.00	.00	.00
KYD990737066	COURTAULDS COATINGS, FKA-PORTER PAI	LOUISVILLE	429.75	.00	.00
KYD131524407	CREST PRODUCTS, INC.	LEXINGTON	130.55	.00	.00
KYD985066653	CSX TRANSPORTATION	RACELAND	16.59	.00	.00
KYD042943423	CW MAGNET WIRE CO	LAGRANGE	49.08	.00	.00
KYD038911632	DART POLYMERS INC.	OWENSBORO	157.80	.00	.00
KYD006365340	DEHART PAINT & VARNISH CO INC	LOUISVILLE	20.30	.00	.00
KYD985070622	DERBY CITY TANK WASH, INC.	LOUISVILLE	16.51	.00	.00
KYD041980764	DESA INTERNATIONAL, INC.	BOWLING GREEN	24.86	.00	.00
KYD092568815	DEVOE COATINGS CO./DEVOE & RAYNOLDS	LOUISVILLE	21.03	.00	.00
KYD095386462	DONALDSON CO., INC.	NICHOLASVILLE	32.66	.00	.00
KYD006397491	DOW CORNING CORPORATION	ELIZABETHTOWN	85.32	.00	.00
KYD042943985	DOW CORNING CORPORATION	CARROLLTON	1,504.93	.00	.00
KYD003924198	E.I. DU PONT DE NEMOURS & CO., INC.	LOUISVILLE	3,345.24	.00	.00
KYD985077502	EASTERDAY TIE & TIMBER COMPANY	MAYFIELD	1,731.76	.00	.00
KYD098950306	EATON CORPORATION PCD	BOWLING GREEN	73.50	.00	.00
KYD074060039	EBONITE INTERNATIONAL, INC.	HOPKINSVILLE	143.83	.00	.00
KYD005005160	EI DUPONT WURTLAND PLANT	WURTLAND	24.22	.00	.00
KYD006373922	ELF ATOCHEM NORTH AMERICA	CARROLLTON	2,567.98	.00	.00
KYD006370159	ELF ATOCHEM NORTH AMERICA INC.	CALVERT CITY	2,382.54	50.00	.00
KYD985116573	EMS TOGO CORPORATION	HOPKINSVILLE	20.75	.00	.00
KYD006384531	ENGELHARD CORPORATION	LOUISVILLE	300.25	.00	.00
KYD061557054	ENSIGN-BICKFORD COMPANY (THE)	GRAHAM	75.33	.00	.00
KYD000770313	ENVIRONMENTAL CONSERVATION SYSTEMS,	BROOKS	9,330.98	.00	.00
KYD003937463	EQUITABLE BAG COMPANY, INC.	FLORENCE	39.29	.00	.00
KYD092570407	ESTRON CHEMICAL, INC.	CALVERT CITY	50.22	7.00	.00
KYD981029457	EXCEL MANUFACTURING OF KENTUCKY	FULTON	464.18	.00	.00
KYD985116409	FELKER BROTHERS CORPORATION	GLASGOW	175.43	.00	.00
KYD981853187	FET ENGINEERING INC.	BARDSTOWN	19.81	.00	.00
KYD004257200	FISCHER SPECIAL MANUFACTURING	COLD SPRING	19.66	.00	.00
KYD045735305	FLORIDA TILE INDUSTRIES INC.	LAWRENCEBURG	578.31	.00	.00
KYD053351227	FORD MOTOR CO. - KY. TRUCK PLANT	LOUISVILLE	2,664.63	.00	.00
KYD071315899	FORD MOTOR COMPANY-LOU. ASSEMBLY PL	LOUISVILLE	1,078.50	.00	.00
KYR000004176	FORMER ACCU-PRO SITE	LOUISVILLE	31.28	.00	.00
KYD985115237	GALLATIN STEEL COMPANY	WARSAW	7,632.46	.00	.00
KYD005383385	GAMCO PRODUCTS COMPANY	HENDERSON	226.15	.00	.00
KYD980847602	GATES RUBBER COMPANY	ELIZABETHTOWN	20.60	.00	.00

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- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
KYD006383665	GATEWAY PRESS INC.	LOUISVILLE	20.29	.00	.00
KYD074047556	GE AIRCRAFT ENGINES	MADISONVILLE	28.80	.00	.00
KYD071335590	GENERAL CABLE COMPANY	LAWRENCEBURG	17.22	.00	.00
KYD006387021	GENERAL ELECTRIC CO. - APPLIANCES	LOUISVILLE	317.70	.00	.00
KYD991276932	GENERAL ELECTRIC MOTOR PLANT	OWENSBORO	33.40	.00	.00
KYD000622993	GENERAL MOTORS CORP NAO GROUP	BOWLING GREEN	371.52	.00	.00
KYR000003848	GIBBS DIE CASTING CORPORATION	HENDERSON	61.72	.00	.00
KYD062951801	GREEN RIVER STEEL CORPORATION	OWENSBORO	1,201.67	.00	.00
KYD056824147	GULF STATES PAPER CO.	NICHOLASVILLE	23.91	.00	.00
KYD985114966	HAMPSHIRE CHEMICAL CORP.	OWENSBORO	331.33	.00	.00
KYD981014608	HAUSNER HARD-CHROME OF KY., INC.	OWENSBORO	33.76	.00	.00
KYD981804776	HESCO PARTS CORPORATION	LOUISVILLE	26.99	.00	.00
KYD006392344	HILLERICH & BRADSBY CO.	LOUISVILLE	17.78	.00	.00
KYD981003494	HITACHI AUTOMOTIVE PRODUCTS, USA	HARRODSBURG	24.91	.00	.00
KY5210020140	HQ,101ST AIRBORNE DIV., FORT CAMPBE	FORT CAMPBELL	108.20	.00	.00
KYD985094879	HUGHES LEXINGTON INC.	LEXINGTON	21.36	.00	.00
KYD981806847	HVC INC.	LUDLOW	101.31	.00	.00
KYD981853633	ICHIKOH MANUFACTURING, INC.	SHELBYVILLE	132.11	.00	.00
KYR000000620	ICI EXPLOSIVES USA INC.	FRANKFORT	14.60	.00	.00
KYD049465255	INCO ALLOYS INTERNATIONAL, INC.	CATLETTSBURG	514.32	.00	.00
KYD985113810	INTERNATIONAL PAPER LABEL DIVISION	BOWLING GREEN	30.24	.00	.00
KYD066051913	INTERPLASTIC CORPORATION	FT. WRIGHT	39.20	.00	.00
KYD006370175	ISP CHEMCIALS INC.	CALVERT CITY	6,585.31	.00	.00
KYR000000240	JAMES GRAHAM BROWN FOUNDATION (TRAC	LOUISVILLE	5,365.17	.00	.00
KYD006367593	JELLICO COMPANY INC.	LOUISVILLE	15.32	.00	.00
KY0000199612	JMT INC.	BARDSTOWN	57.92	.00	.00
KYD006382394	JOHNSON CONTROLS BATTERY GROUP, INC	LOUISVILLE	60.93	.00	.00
KYD006367528	KELLEY TECHNICAL COATINGS, INC.	LOUISVILLE	34.55	.00	.00
KYD985111939	KELLEY TECHNICAL COATINGS, INC.	LOUISVILLE	18.88	.00	.00
KYD049064017	KEN DEC INC.	HORSE CAVE	192,742.38	.00	.00
KYD980515688	KENTECH PLASTICS INC.	HOPKINSVILLE	24.36	.00	.00
KYD985071703	KENTUCKY DEPARTMENT OF HIGHWAYS/TRA	ERLANGER	25.16	.00	.00
KY0000468181	KENTUCKY DEPARTMENT OF MILITARY AFF	LEXINGTON	29.89	.00	.00
KYD985071802	KENTUCKY DEPT OF HIGHWAYS DISTRICT	MANCHESTER	17.78	.00	.00
KYD000207282	KENTUCKY ELECTRIC STEEL, INC.	ASHLAND	3,955.68	.00	.00
KYD006378632	KENTUCKY MANUFACTURING COMPANY	LOUISVILLE	83.02	.00	.00
KYD043774975	KERR-MCGEE REFINING CORPORATION	LOUISVILLE	42.53	.00	.00
KYD006383392	KOPPERS INDUSTRIES	GUTHRIE	85.15	.00	.00
KYR000002527	KROGER STORE L-327	LOUISVILLE	22.52	.00	.00
KYD006378764	KURFEES COATINGS INC.	LOUISVILLE	113.64	.00	.00
KYD981472400	LAWSON MARDON FLEXIBLE	SHELBYVILLE	256.92	.00	.00
KYD074051202	LEXINGTON CLINIC	LEXINGTON	24.45	.00	.00
KYD006375737	LEXMARK INTERNATIONAL INC	LEXINGTON	128.02	.00	.00
KYD068342708	LINK-BELT CONSTRUCTION EQUIPMENT CO	LEXINGTON	51.29	.00	.00
KYD980600787	LOGAN ALUMINUM, INC.	RUSSELLVILLE	130.79	.00	.00
KYD074049727	LORD CORPORATION	BOWLING GREEN	39.10	.00	.00
KYD088438817	LWD INC CALVERT CITY	CALVERT CITY	11,598.78	.00	.00
KYD985073196	LWD SANITARY LANDFILL, INC.	CALVERT CITY	401.96	.00	.00
KYD049622939	MACKAY INC.	FLORENCE	33.07	.00	.00
KYD084758069	MALLINCKRODT BAKER, INC.	PARIS	102.37	508.00	.00
KYD006383202	MARCUS PAINT COMPANY	LOUISVILLE	58.26	.00	.00
KYD985080027	MASCOTECH INDUSTRIAL COMPONENTS	NICHOLASVILLE	90.90	.00	.00
KYD981467269	MAZAK CORPORATION	ELSMERE	44.42	.00	.00
KYD985082270	METHODIST HOSPITAL OF KENTUCKY	PIKEVILLE	42.92	.00	.00
KYD026014522	MID STATE AUTOMOTIVE PARTS	FERGUSON	19.11	.00	.00

Note: Please refer to the introduction for an explanation of this list.

KENTUCKY

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
KYD000821942	MIDWEST ENVIRONMENTAL SERVICES, INC	LOUISVILLE	1,004.74	.00	.00
KYD026007450	MOUSER KITCHENS INC.	ELIZABETHTOWN	26.66	.00	.00
KYD050048636	NATIONAL DUST CONTROL SERVICE	FRANKLIN	61.16	.00	.00
KYD985112747	NATIONAL PRINTING INK COMPANY	LOUISVILLE	23.56	.00	.00
KY5170024173	NAVAL ORDNANCE STATION	LOUISVILLE	146.41	.00	.00
KYD991277112	NEWPORT STEEL CORP WILDER PLANT	WILDER	4,665.12	.00	.00
KYD004262192	NIELSEN COMPANY	FLORENCE	13.29	.00	.00
KYD049062375	NSA, DIVISION OF SOUTHWIRE COMPANY	HAWESVILLE	5,901.47	.00	.00
KYD006396246	OLIN CORPORATION	BRANDENBURG	673.55	.00	.00
KYD004255402	OSRAM SYLVANIA INC.	WINCHESTER	17.89	.00	.00
KYD006399000	OSRAM SYLVANIA INC.	VERSAILLES	443.45	.00	.00
KYD062969290	OUTOKUMPU AMERICAN BRASS	FRANKLIN	37.59	.00	.00
KYD046655064	OWENS-ILLINOIS LABELS, INC.	BARDSTOWN	121.49	.00	.00
KYD041977729	PARKER KALON	CAMPBELLSVILLE	143.93	.00	.00
KYD981020159	PB & S CHEMICAL CO., INC.	HENDERSON	40.92	376.00	.00
KYD985094150	PEPSI COLA	LOUISVILLE	13.82	.00	.00
KYD042595074	PHELPS DODGE MAGNET WIRE COMPANY	HOPKINSVILLE	340.71	.00	.00
KYD006395644	PHILIPS LIGHTING COMPANY	DANVILLE	36.80	.00	.00
KYD084270461	PLYMOUTH TUBE - EXTRUSION PLANT	HOPKINSVILLE	172.20	.00	.00
KYD062979158	POLYKEN TECHNOLOGIES	FRANKLIN	821.97	.00	.00
KYD053349593	PPG ARCHITECTURAL FINISHES	LOUISVILLE	302.82	.00	.00
KYD006516348	PREMINUM ALLIED TOOL INC.	PHILPOT	48.15	.00	.00
KYD006386684	PROGRESS PAINT MFG CO	LOUISVILLE	15.52	.00	.00
KYD981807175	QUALITY BEARING SERVICE	LOUISVILLE	246.16	.00	.00
KYD006366843	QUEENS GROUP KENTUCKY, INC.	LOUISVILLE	19.64	.00	.00
KYR000001982	R.J. REYNOLDS TOBACCO CO.	LEXINGTON	96.63	.00	.00
KYR000001305	RACELAND MALL PROPERTIES	LOUISVILLE	13.34	.00	.00
KYD990876021	RAYLOC	MORGANFIELD	174.32	.00	.00
KYR000001370	REDKEN LABORATORIES INC.	HEBRON	66.35	.00	.00
KYD985083146	REGIONAL AIRPORT AUTHORITY OF LOUIS	LOUISVILLE	16.77	.00	.00
KYD006396089	REYNOLDS METALS CO. PLANT #3	LOUISVILLE	19.63	.00	.00
KYD062958889	REYNOLDS METALS COMPANY	LOUISVILLE	35.32	.00	.00
KYD092567908	RIGO COMPANY	BUCKNER	9.34	18,677.00	.00
KYD006390017	ROHM & HAAS KY, INC.	LOUISVILLE	13,195.99	128.00	.00
KYD006366926	ROLLER DIE & FORMING COMPANY INC	LOUISVILLE	166.94	.00	.00
KYD985081660	SACHS AUTOMOTIVE OF AMERICA	FLORENCE	124.63	.00	.00
KYD985072610	SAFETY KLEEN CORPORATION	LOUISVILLE	27.10	.00	.00
KYD053348108	SAFETY-KLEEN CORP.	SMITHFIELD	83,575.94	.00	.00
KYD981027469	SAFETY-KLEEN CORP. (-4-090-01)	LEXINGTON	1,112.39	.00	.00
KYD981027451	SAFETY-KLEEN CORP. (4-075-01)	ASHLAND	448.40	.00	.00
KYD981923089	SEALED POWER TECHNOLOGIES, L.P.	FRANKLIN	2,349.11	.00	.00
KYD059569061	SEALED POWER TECHNOLOGIES, LIMITED	FRANKLIN	36.28	.00	.00
KYD049059579	SHAWNEE PLASTICS INCORPORATED	KUTTAWA	68.90	.00	.00
KY0001002435	SHEPARDS MINING SUPPLY & EQUIPMENT	MANCHESTER	116.14	.00	.00
KYD082390394	SHERWIN WILLIAMS CO	RICHMOND	2,709.37	.00	.00
KY0001002450	SHERWIN-WILLIAMS AUTOMOTIVE DIST	RICHMOND	100.22	.00	.00
KYD006390421	SIEMENS ELECTROMECHANICAL COMPONENT	FRANKLIN	28.23	.00	.00
KYD000206417	SIGNET SYSTEMS INC	HARRODSBURG	70.33	.00	.00
KYD001737683	SKF USA INC.	GLASGOW	33.09	.00	.00
KYD079674016	SMC INC.	LEXINGTON	43.60	.00	.00
KYD089227227	SOMERSET REFINERY, INC.	SOMERSET	48.93	.00	.00
KYD006377030	SOUTHERN GRAPHIC SYSTEMS INC.	LOUISVILLE	808.66	.00	.00
KY0000887067	SOUTHERN WIRE REEL INC.	HOPKINSVILLE	32.51	.00	.00
KYD981806367	SPD MAGNET WIRE CO.	EDMONTON	43.43	.00	.00
KYD006386056	SQUARE D COMPANY	LEXINGTON	412.90	.00	.00

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KENTUCKY

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
KY0000693424	STEEL TECHNOLOGIES INC.	GHENT	21.10	.00	.00
KYD006371868	STONE CONTAINER CORPORATION	LOUISVILLE	62.20	.00	.00
KYD981025059	SUN MANUFACTURING	WILLIAMSTOWN	51.11	.00	.00
KYD985071661	SUN MANUFACTURING	WILLIAMSTOWN	27.76	.00	.00
KYD980843247	SUPERIOR COATINGS GEORGETOWN LLC	GEORGETOWN	113.14	.00	.00
KYD070814777	SUPERIOR GRAPHITE CO.	HOPKINSVILLE	1,826.50	.00	.00
KYD058684804	SYNTECHNICS INC.	PADUCAH	29.61	.00	.00
KYD980516348	T.E. GAS PIPELINE CO/DANVILLE	DANVILLE	18.08	.00	.00
KYD054272554	TECUMSEH PRODUCTS COMPANY	SOMERSET	592.57	.00	.00
KYD055573125	TENNESSEE GAS PIPELINE CO.-STATION	CATLETTSBURG	287.95	.00	.00
KYD980516173	TEXAS EASTERN GAS PIPELINE COMPANY	OWINGSVILLE	15.54	.00	.00
KYD006379325	THOMAS INDUSTRIES, INC.	HOPKINSVILLE	24.53	.00	.00
KYD000648279	THOMPSON INTERNATIONAL	NICHOLASVILLE	113.02	.00	.00
KYD985078781	THOMPSON STEEL PIPE CO.	PRINCETON	13.28	.00	.00
KYD981806144	THURMAN/KLEMPNER BROTHERS INC.	COLESBURG	44.19	.00	.00
KYD981803554	TOKICO (USA) INC.	BEREA	212.44	.00	.00
KYD981471279	TOPY CORPORATION	FRANKFORT	993.56	.00	.00
KYD161955380	TOYOTA MOTOR MANUFACTURING USA. INC	GEORGETOWN	3,370.54	.00	.00
KYD006379986	TRANE COMPANY THE#	LEXINGTON	15.18	.00	.00
KYR000002741	TRANSITION, INC.	COVINGTON	18.31	.00	.00
KYD068328848	TREMCO, INC.	BARBOURVILLE	82.37	.00	.00
KYD985082791	TRIM MASTERS INC.	BARDSTOWN	44.51	.00	.00
KYD045738127	TRINITY INDUSTRIES, INC.	ELIZABETHTOWN	770.20	.00	.00
KYD092573351	TUNGO INC.	HANSON	17.56	.00	.00
KYD006375414	UNITED CATALYST INC., WEST PLT	LOUISVILLE	436.05	.00	.00
KYD089226815	UNITED CATALYSTS INC., SOUTH PLANT	LOUISVILLE	97.97	.00	.00
KYD001851567	UNITED PARCEL SERVICE	LOUISVILLE	28.41	.00	.00
KY0000920074	UNITED PARCEL SERVICE	LOUISVILLE	33.86	.00	.00
KYD096551346	UNITED TECHNOLOGIES AUTOMOTIVE	MORGANFIELD	13.50	.00	.00
KYD044914356	UNIVERSAL FASTENERS INC.	LAWRENCEBURG	11,246.33	.00	.00
KYD000830851	UNIVERSITY OF KENTUCKY	LEXINGTON	89.71	.00	.00
KYD982818619	UNIVERSITY OF LOUISVILLE	LOUISVILLE	3.51	55.00	.00
KY8890008982	US DOE PADUCAH GAS DIFFUSION PLT	PADUCAH	472.05	9.00	.00
KY6210020479	USAARMC AND FORT KNOX	FORT KNOX	133.48	276.00	.00
KY5211890004	USPFO FOR KENTUCKY	FRANKFORT	3.98	57.00	.00
KYD006388441	VALSPAR CORPORATION	LOUISVILLE	39.67	.00	.00
KYD052154333	VAN LEER CONTAINERS INC.	FLORENCE	65.72	.00	.00
KYD053350229	VANDERBILT CHEMICAL CORPORATION	MURRAY	781.96	525.00	.00
KYD981753155	VMV ENTERPRISES	PADUCAH	530.43	.00	.00
KYD004255022	WALD MANUFACTURING CO., INC.	MAYSVILLE	43.47	.00	.00
KYD981806573	WESTERN KENTUCKY UNIVERSITY OGDEN C	BOWLING GREEN	7.40	1,149.00	.00
KYD985072008	WESTLAKE MONOMERS CORPORATION	CALVERT CITY	716,377.42	.00	.00
KYD050027192	WHAYNE SUPPLY COMPANY - CORBIN	CORBIN	40.34	.00	.00
KYD006945802	WHAYNE SUPPLY COMPANY - LOUISVILLE	LOUISVILLE	35.48	.00	.00
KYD985084862	WOODWORK OF MIDAMERICA	BOWLING GREEN	27.94	.00	.00
KYD985072156	WORLDSOURCE COIL COATING, INC.	HAWESVILLE	656.06	.00	.00
KYD070219571	YUASA-EXIDE, INC.	RICHMOND	579.63	.00	.00
KYD103537700	3M CYNTHIANA	CYNTHIANA	207.84	.00	.00

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KENTUCKY

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GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
KYD066908211	AHLSTROM FILTRATION INC	MADISONVILLE	5.39	.00	.00
KYR000003087	ALPHA CORPORATION	PADUCAH	5.77	.00	.00
KYD006375489	AMERICAN STANDARD, INC.	LOUISVILLE	2.13	.00	.00
KYD985078468	ANDALEX RESOURCES, INC.	MADISONVILLE	1.16	.00	.00
KYD985114891	ASHLAND BRANDED MARKETING #579-000	WHITESBURG	7.88	.00	.00
KYD985086628	ASHLAND BRANDED MARKETING 326-003	ASHLAND	4.52	.00	.00
KYD024041063	ASHLAND CHEMICAL COMPANY	LOUISVILLE	1.60	.00	.00
KYD985102961	ASHLAND PETROLEUM CO BM018-000	GREENVILLE	2.71	.00	.00
KYD985086461	ASHLAND PETROLEUM CO 026-000	JACKSON	13.02	.00	.00
KYD985086503	ASHLAND PETROLEUM CO 261-000,261-00	GLASGOW	2.07	.00	.00
KYD985086560	ASHLAND PETROLEUM CO 374-000	MAYFIELD	5.27	.00	.00
KYD985087840	ASHLAND PETROLEUM CO. 037-000	MADISONVILLE	2.20	.00	.00
KY0000708321	ASHLAND PETROLEUM CO. 128-000	BENTON	2.61	.00	.00
KYD985097609	ASHLAND PETROLEUM COMPANY	ELIZABETHTOWN	1.36	.00	.00
KYD985103399	ASHLAND PETROLEUM COMPANY	BULAN	9.09	.00	.00
KYD985116011	ASHLAND PETROLEUM COMPANY #460-000	OWENTON	10.97	.00	.00
KY0000708008	ASHLAND PETROLEUM COMPANY #470-000	PAINTSVILLE	12.17	.00	.00
KYD985096734	ASHLAND PETROLEUM 067-000	WARSAW	2.91	.00	.00
KYD006372197	ATKEMIX TEN INC.	LOUISVILLE	5.97	.00	.00
KYD006364582	ATLAS MACHINE & SUPPLY INC.	LOUISVILLE	2.65	.00	.00
KYR000002519	BAKER PETROLEUM COMPANY	WARSAW	2.26	.00	.00
KYD980600720	BATESVILLE CASKET CO INC	CAMPBELLSVILLE	6.77	.00	.00
KYR000000273	BEN BRAODHURST DBA BRIARCLIFF FOOD	LOUISVILLE	9.86	.00	.00
KYD042947622	BENEKE WIRE COMPANY	LOUISVILLE	4.24	.00	.00
KYD006375794	BUNTON COMPANY	LOUISVILLE	7.64	.00	.00
KYR000002972	CAMERON & BARKLEY CO	LOUISVILLE	4.82	.00	.00
KYD006385132	CHARLES W LEWIS	LOUISVILLE	6.42	.00	.00
KYD980579403	COLUMBIA GULF TRANS. CO.	CLEMENTSVILLE	2.09	.00	.00
KYD980579452	COLUMBIA GULF TRANS. STANTON STATIO	STANTON	1.21	.00	.00
KYD981852502	COOPER INDUSTRIES/NATIONAL ELECTRIC	DAYHOIT	5.00	.00	.00
KYD006366306	CORNETT MACHINE INC	SOMERSET	2.91	.00	.00
KYR000002774	DAIRY MART CONVENIENCE STORE	HODGENSVILLE	3.30	.00	.00
KYR000000224	DANA CORPORATION	ELIZABETHTOWN	2.63	.00	.00
KYD006394225	DARAMIC INC	OWENSBORO	12.00	.00	.00
KYD059564385	DAYTON WALTHER CORPORATION	CARROLLTON	4.69	.00	.00
KYD980730055	DEVOE & RAYNOLDS CO.	LOUISVILLE	6.45	.00	.00
KYD985116755	EAGLE INDUSTRIES INC.	BOWLING GREEN	6.57	.00	.00
KYD006369722	EMERSON ELECTRIC COMPANY	RUSSELLVILLE	9.94	.00	.00
KYD045733789	FLOORPRO INC.	LOUISVILLE	5.20	.00	.00
KYR000001719	FT THOMAS SHELL	FT THOMAS	1.15	.00	.00
KYD080957459	GENERAL ELECTRIC COMPANY	SCOTTSVILLE	6.60	.00	.00
KYD985116144	GEON COMPANY	LOUISVILLE	3.71	.00	.00
KYD079653549	HALL'S BODY SHOP	LOUISVILLE	7.80	.00	.00
KYD144303864	HARDIN MEMORIAL HOSPITAL	ELIZABETHTOWN	1.99	.00	.00
KYD985080480	HENNEGAN	FLORENCE	8.36	.00	.00
KYR000000109	HENRY A PETTER SUPPLY	PADUCAH	1.14	.00	.00
KYD006376792	HENRY VOGT MACHINE COMPANY	LOUISVILLE	4.99	.00	.00
KY0000707836	HOUSING AUTHORITY OF HOPKINSVILLE	HOPKINSVILLE	3.88	.00	.00
KYD006376735	HY-KLAS PAINTS, INC.	LOUISVILLE	11.74	.00	.00
KYD055003206	INGERSOLL-RAND COMPANY	MAYFIELD	10.10	.00	.00
KYD985105980	INLAND CONTAINER CORPORATION	MAYSVILLE	8.09	.00	.00
KYD000604298	ITAPCO PADUCAH TERMINAL INC.	PADUCAH	11.92	.00	.00
KYD000733428	ITAPCO RIVERWAY TERMINAL INC.	PADUCAH	11.43	.00	.00
KYR000004366	ITEM 7998 (HIGHWAYS)	NICHOLASVILLE	1.58	.00	.00
KYR000000091	JUNCTION TRAVEL PLAZA	LEBANON JUNCTIO	5.96	.00	.00

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- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
KYD007009053	KDC REMANUFACTURED PRODUCTS CENTER	LEXINGTON	3.15	.00	.00
KYD981806003	KENTUCKIANA TANK WASH INC.	LOUISVILLE	11.24	.00	.00
KYD006398416	KENTUCKY ASSN OF ELEC CO-OPERATIVES	LOUISVILLE	8.88	.00	.00
KYD006386395	KENTUCKY GLASS PLANT	LEXINGTON	11.12	.00	.00
KYD004862439	KENTUCKY POWER CO BIG SANDY STEAM	LOUISA	1.86	.00	.00
KYD059568220	KENTUCKY SOLITE CORPORATION	BROOKS	6.18	.00	.00
KYD024111981	KOSMOS CEMENT COMPANY	LOUISVILLE	7.25	.00	.00
KYR000003095	KYTC DISTRICT 4 OFFICE	ELIZABETHTOWN	3.90	.00	.00
KYR000003483	LALLY PIPE & TUBE	COVINGTON	4.25	.00	.00
KYD981853310	LAN INC.	CARROLLTON	2.00	.00	.00
KYR000004184	LEXINGTON CENTER CORPORATION	LEXINGTON	2.70	.00	.00
KYD980840300	LIQUID TRANSPORTERS, INC.	LOUISVILLE	6.00	.00	.00
KYD980847198	LIVERMORE BRASS & SILVER SHOP INC.	LIVERMORE	7.85	.00	.00
KYD006378822	LOUISVILLE CHEMICAL COMPANY	LOUISVILLE	6.79	.00	.00
KYD006386254	LOUISVILLE FORGE AND GEAR WORKS INC	LOUISVILLE	10.80	.00	.00
KYD071316095	MARATHON OIL COMPANY	LOUISVILLE	2.83	.00	.00
KYD098098171	MATLACK, INC.	LOUISVILLE	4.75	.00	.00
KYD049999030	METOKOTE CORPORATION	JEFFERSONTOWN	6.30	.00	.00
KYD006394423	MPD INC.	OWENSBORO	8.06	.00	.00
KYD006371991	NATIONAL STANDARD WOVEN PRODUCTS	CORBIN	5.55	.00	.00
KYD006945687	NATIONAL UNIFORM SERVICES	LOUISVILLE	7.52	.00	.00
KYD131533895	NELSON B BOONE COMPANY	LOUISVILLE	2.17	.00	.00
KYD006385850	NELSON B. BOONE CO.	LOUISVILLE	7.22	.00	.00
KYR000001008	NEWPORT STEEL CORPORATION	NEWPORT	4.99	.00	.00
KYD136936366	NORTHERN KENTUCKY UNIVERSITY	HIGHLAND HEIGHT	4.19	.00	.00
KYD006364558	OHIO VALLEY ALUMINUM CO INC	SHELBYVILLE	3.30	.00	.00
KYD047537824	OKONITE COMPANY	RICHMOND	8.02	.00	.00
KYD068339217	OSRAM SYLVANIA INC.	VERSAILLES	10.13	.00	.00
KYD985085166	OUR LADY BELLEFONTE HOSPITAL	ASHLAND	2.32	.00	.00
KYD985080530	OWENSBORO DAVIESS CO HOSPITAL	OWENSBORO	7.07	25.00	.00
KYD985066125	OWENSBORO GRAIN CO. INC.	OWENSBORO	1.56	.00	.00
KY0000966358	OWENSBORO GRAIN EDIBLE OILS INC.	OWENSBORO	5.40	.00	.00
KYR000000596	PACKAGING PLUS INC/ASPLUNDH TREE EX	WILLIAMSTOWN	6.37	.00	.00
KYD006371843	PHILIP MORRIS USA	LOUISVILLE	4.07	.00	.00
KYD006386049	PHILIPS LIGHTING CO	RICHMOND	5.57	.00	.00
KYD981805310	PIKEVILLE EQUIPMENT GARAGE NO 16	PIKEVILLE	3.75	.00	.00
KYD006368021	PREMIUM FOIL PRODUCTS, INC.	LOUISVILLE	13.01	.00	.00
KYD985079680	PTRL EAST INC.	RICHMOND	8.65	.00	.00
KY0000058867	QUALITY CABINETS	MT. STERLING	3.61	.00	.00
KYD991276833	RAIL SERVICES, INC.	CALVERT CITY	4.55	.00	.00
KYR000003640	RAINBO BAKING COMPANY	LOUISVILLE	3.09	.00	.00
KYD084757178	REDKEN LABORATORIES INC	FLORENCE	11.79	.00	.00
KYD006398002	REXROTH CORPORATION, PNEUMATICS DIV	LEXINGTON	8.54	.00	.00
KYD985081132	ROLLER BEARING INDUSTRIES INC.	ELIZABETHTOWN	2.75	.00	.00
KYR000001768	ROTEK INC	FLORENCE	5.63	.00	.00
KYR000003905	ROUGH RIVER LAKE	FALLS OF ROUGH	2.08	.00	.00
KYD108813916	RUST INDUSTRIAL CLEANING INC	ASHLAND	2.80	.00	.00
KYD091514653	SAFETY-KLEEN CORP. (4-091-01)	LOUISVILLE	1.84	.00	.00
KYD089703474	SCHLUMBERGER INDUSTRIES, GAS DIVISI	OWENTON	11.59	.00	.00
KY0000998906	SCHNEIDER NATIONAL BULK CARRIERS IN	PRESTONSBURG	2.71	.00	.00
KYD985080837	SCOTT PAPER COMPANY	OWENSBORO	3.61	.00	.00
KYD985113893	SCREW MACHINE TECHNOLOGIES INC	LEXINGTON	6.88	.00	.00
KYD006382717	SIEMENS ELECTROMECHANICAL COMPONENT	MARION	11.82	.00	.00
KYD097267413	SMITH'S FARM CERCLA NPL SITE (SUPER	SHEPHERDSVILLE	11.99	.00	.00
KY0001012053	SOUTH MAIN CHEVRON	SOMERSET	3.35	.00	.00

Note: Please refer to the introduction for an explanation of this list.

KENTUCKY

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
KYD985098060	SUPERAMERICA #5604	LEXINGTON	2.44	.00	.00
KYR000001602	SUPERAMERICA #5656	ELIZABETHTOWN	1.15	.00	.00
KYD981473572	SWECO INC.	FLORENCE	9.42	.00	.00
KYD024058877	TECHNICAL PRODUCTS INC	LOUISVILLE	5.51	.00	.00
KYD061557559	TELEDYNE PACKAGING	CARROLLTON	10.20	.00	.00
KYD980514665	TEXAS EASTERN GAS PIPELINE	TOMPKINSVILLE	4.72	.00	.00
KYD980603831	TEXAS GAS - JEFFERSONTOWN STATION	LOUISVILLE	5.01	.00	.00
KYD980589196	TEXAS GAS TRANSMISSION CORP	PALMA	5.99	.00	.00
KYD980589311	TEXAS GAS TRANSMISSION CORP	SLAUGHTERS	1.39	.00	.00
KYD000822015	TEXAS GAS TRANSMISSION CORPORATION	GREENVILLE	1.83	.00	.00
KYD980579650	TEXAS GAS TRANSMISSION CORPORATION	HARDINSBURG	2.46	.00	.00
KYD091512467	THERM-O-DISC	LONDON	6.95	.00	.00
KY1640013156	TVA PARADISE FOSSIL PLANT	DRAKESBORO	7.46	.00	.00
KYD980840029	UNIVERSITY OF LOUISVILLE	LOUISVILLE	11.73	20.00	.00
KYD985082015	WALKER BOAT YARD	PADUCAH	3.83	.00	.00
KYD000327213	WAYNE FLOYD GATE CO	LIBERTY	3.45	.00	.00
KYD985085174	WESTLAKE CUMBERLAND HOSPITAL	COLUMBIA	1.42	.00	.00
KYD045736402	WESTVACO CORP	WICKLIFFE	4.20	.00	.00
KYD046757985	WHAYNE SUPPLY COMPANY - PIKEVILLE	PIKEVILLE	3.65	.00	.00
KYD009826686	WHAYNE SUPPLY COMPANY ASHLAND	ASHLAND	6.04	.00	.00
KYD085047736	WILLAMETTE INC., KY MEDIUM MILL	HAWESVILLE	1.64	.00	.00
KYD046655643	WILLAMETTE INDUSTRIES, INC.	HAWESVILLE	7.83	.00	.00
KYD981805070	YA AMERICA, INC.	VERSAILLES	6.26	.00	.00
KYD985072149	ZEON CHEMICALS KENTUCKY, INC.	LOUISVILLE	5.96	.00	.00

Note: Please refer to the introduction for an explanation of this list.

KENTUCKY

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO CANNOT BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- LESS THAN 1.1 TONS RCRA HAZARDOUS WASTE, AND
- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
KY4210400004	ARMED FORCES RESERVE CENTER	LEXINGTON	.07	.00	.00
KYD985114339	ASHLAND PETROLEUM CO 024-000	HOPKINSVILLE	.66	.00	.00
KYD985094978	ASHLAND PETROLEUM CO 239-001	FLEMINGSBURG	1.00	.00	.00
KY0000708263	ASHLAND PETROLEUM CO 251-000	FREDONIA	.93	.00	.00
KYD985086719	ASHLAND PETROLEUM CO 341-028	LEXINGTON	.04	.00	.00
KY0000707844	ASHLAND PETROLEUM CO 475-000	PARIS	.66	.00	.00
KYD024015877	ASHLAND PETROLEUM COMPANY DIV OF AS	LEXINGTON	.44	.00	.00
KYD980845424	ASHLAND PETROLEUM, MARINE TERMINAL	CATLETTSBURG	.23	.00	.00
KYR000002980	BROADWAY SHELL	BARDSTOWN	.92	.00	.00
KYR000003152	FOX HARDWARE	LOUISVILLE	.11	.00	.00
KY0000991489	GREENWOOD SUNOCO	BOWLING GREEN	.23	.00	.00
KYR000001222	HARLAN PHASE 3 LOCAL PROTECTION PRO	LOYALL	.55	.00	.00
KYD985085257	HIGH TECH CHROME PLATING, INC.	MADISONVILLE	.59	.00	.00
KYD068135516	HIGHLANDS REGIONAL MEDICAL CENTER	PRESTONSBURG	.70	.00	.00
KYD980845671	HOECHST-CELANESE CORP.	FLORENCE	.30	.00	.00
KYD985080043	ITAPCO-HENDERSON TERMINAL INC.	HENDERSON	1.00	.00	.00
KYD985086032	LEGGETT & PLATT INC.	SIMPSONVILLE	1.08	.00	.00
KYD079661146	LOUISVILLE ENVIRONMENTAL SERVICES I	LOUISVILLE	.25	.00	.00
KYR000002055	LOUISVILLE JEFFERSON METRO SEWER DI	LOUISVILLE	1.00	.00	.00
KYD006380125	MAGNA GRAPHIC INC.	LEXINGTON	.00	.00	.00
KYD095373270	MATLACK INC.	CALVERT CITY	.18	.00	.00
KYD980803803	MATLACK INC.	OWENSBORO	.13	.00	.00
KYD981852916	NHK-ASSOC. SPRING SUS. COMPINENTS I	BOWLING GREEN	.91	.00	.00
KYR000002477	PERRY COUNTY HIGH SCHOOL	HAZARD	.61	.00	.00
KYD985116169	PINELAKE MEDICAL CENTER	MAYFIELD	.66	.00	.00
KYD985114669	REGIONAL MEDICAL CENTER	MADISONVILLE	.23	.00	.00
KYD006396071	REYNOLDS METALS COMPANY PLANT #1	LOUISVILLE	.06	.00	.00
KYR000000653	SCHWARTES SERVICE CENTER	CRESCENT SPRING	.92	.00	.00
KYR000001362	SHELL ONE STOP	BOWLING GREEN	.61	.00	.00
KYD981854987	ST. JOSEPH HOSPITAL	LEXINGTON	.37	.00	.00
KYD000828582	TEXAS GAS TRANSMISSION	CORYDON	.40	.00	.00
KYD000828574	TEXAS GAS TRANSMISSION CORPORATION	GRAHAM	.62	.00	.00
KY0640006656	TVA KENTUCKY HYDRO PLANT	GRAND RIVERS	.13	.00	.00
KYD042593368	VAN WATERS & ROGERS, INC.	LOUISVILLE	.00	.00	.00
KYD024032856	WHAYNE SUPPLY COMPANY - LEXINGTON	LEXINGTON	.93	.00	.00
KYD024150641	WHAYNE SUPPLY COMPANY - PADUCAH	PADUCAH	.17	.00	.00
KYR000000737	WURTLAND WASTEWATER TREATMENT FACIL	WURTLAND	.49	.00	.00
KYD981852890	13TH & OAK GARAGE	LOUISVILLE	.85	.00	.00

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LOUISIANA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
LAD981522295	ADVANCED POLYMER SYSTEMS	LAFAYETTE	141.40	.00	.00
LAD062119771	AFCO INDUSTRIES, INC.	ALEXANDRIA	3,973.97	.00	.00
LAD085551877	AIR PRODUCTS AND CHEMICALS, INC.	ST. GABRIEL	101.00	.00	.00
LAD000757286	ALBEMARLE CORPORATION, PDC	BATON ROUGE	841.76	.00	.00
LAD046748463	ALBEMARLE TECHNICAL CENTER	BATON ROUGE	17.00	60.00	.00
LAD041519067	ALLIED SIGNAL CHEMICALS	CARVILLE	26.81	.00	.00
LAD000802868	ALLIED SIGNAL INC,. BRSW	BATON ROUGE	46.58	.00	.00
LAD020597597	ANGUS CHEMICAL COMPANY	STERLINGTON	106,295.09	.00	.00
LAD043193374	ARCADIA REFINING COMPANY	LISBON	109.42	.00	.00
LAD000802967	ASHLAND CHEMICAL COMPANY	BATON ROUGE	17.82	.00	.00
LAD001809896	AT&T	SHREVEPORT	23.60	.00	.00
LAD000740712	AVONDALE INDUSTRIES, INC. MAIN YARD	AVONDALE	250.60	.00	.00
LAD083546028	BAKER HUGHES INTEQ	BROUSSARD	105.20	.00	.00
LAD008173585	BAKER MANUFACTURING CO.	PINEVILLE	60.64	.00	.00
LA0000023903	BAKER OIL TOOLS, INC.	LAFAYETTE	20.10	.00	.00
LAD000778324	BAKER PERFORMANCE CHEMICALS	RAYNE	92.78	.00	.00
LA9571924050	BARKSDALE AIR FORCE BASE	BARKSDALE AIR F	21.70	.00	.00
LAD985176049	BASF CORP @ DELTA COMMODITIES	HARVEY	28.91	.00	.00
LAD040776809	BASF CORPORATION	GEISMAR	466,795.69	.00	.00
LAD094919339	BAYOU STEEL CORPORATION	LAPLACE	9,850.82	.00	.00
LAD045756996	BOISE CASCADE DERIDDER PAPER MILL	DERIDDER	19.88	.00	.00
LAD008163842	BOLLINGER SHIPYARDS,INC.	LOCKPORT	17.40	.00	.00
LAD003913449	BORDEN CHEMICALS & PLASTICS	GEISMAR	1,368.24	.00	.00
LAD094916491	BORDEN CHEMICALS & PLASTICS ADDIS P	ADDIS	18.05	.00	.00
LAD056024391	BP OIL COMPANY- ALLIANCE REFINERY	BELLE CHASSE	3,136,989.62	.00	.00
LAD985190396	BRITE-SOL SERVICES	BATON ROUGE	177.39	.00	.00
LAD981584725	BRITE-SOL SERVICES, INC.	SULPHUR	121.76	.00	.00
LAD099393225	CALCASIEU REFINING CO.	LAKE CHARLES	56,261.86	.00	.00
LAD045761731	CALCASIEU SHIPYARD, INC.	SULPHUR	76.33	.00	.00
LAD008103111	CARBOLINE COMPANY	LAKE CHARLES	197.50	.00	.00
LAD982289514	CARLINE TANK SERVICES, INC.	GEISMAR	42.74	.00	.00
LAD980622161	CATALYST RECOVERY OF LA, INC.	LAFAYETTE	294.00	.00	.00
LAD980621379	CAVENHAM FOREST INDUSTRIES, INC.	URANIA	319.10	.00	.00
LAD000618256	CECOS INTERNATIONAL	WESTLAKE	50,613.15	2,174,835.00	.00
LAD000618298	CECOS INTERNATIONAL, INC.	LIVINGSTON	3,121.40	.00	.00
LAD056022387	CF INDUSTRIES, INC.	DONALDSONVILLE	14.60	.00	.00
LAD980621353	CHEMICAL LEAMAN TANK LINES, INC.	LULING	23.78	.00	.00
LAD000777201	CHEMICAL WASTE MANAGEMENT	SULPHUR	103,433.45	.00	.00
LAD055010078	CHEVRON CHEMICAL CO	ST JAMES	51.90	.00	.00
LAD034199802	CHEVRON CHEMICAL COMPANY- BELLE CHA	BELLE CHASSE	205.32	.00	.00
LAD980698369	CHEVRON USA, INC-INTRACOASTAL CITY	ABBEVILLE	33.91	.00	.00
LAD075069567	CHUGOKU PAINT COMPANY	BELLE CHASSE	47.62	.00	.00
LAD053783445	CIBA-GEIGY CORPORATION	ST. GABRIEL	188,760.06	.00	.00
LAD008080350	CITGO PETROLEUM CORPORATION	LAKE CHARLES	112,987.96	400.00	.00
LAD985193192	CLEMENT INDUSTRIES, INC.	MINDEN	24.32	.00	.00
LAD034145235	COASTAL CHEMICAL CO., INC.	ABBEVILLE	15.74	.00	.00
LAD008184616	COLFAX CREOSOTING COMPANY	PINEVILLE	51.85	.00	.00
LAD000792309	COLONIAL PIPELINE CO.- B.R. TF#1	JACKSON	90.02	.00	.00
LAD000792317	COLONIAL PIPELINE CO.- BATON ROUGE	JACKSON	247.18	.00	.00
LAR000001826	COLONIAL PIPELINE CO.-KROTZ SPRINGS	KROTZ SPRINGS	28.90	.00	.00
LAD069536407	COLUMBIA GULF TRANS CO.- RAYNE COMP	RAYNE	21.56	.00	.00
LAD985203181	COLUMBIA GULF TRANS. CO.-ALEX. COMP	DEVILLE	50.77	.00	.00
LAD990683716	CONOCO, INC.	WESTLAKE	35,434.80	.00	.00
LAD020877361	COSMAR COMPANY	CARVILLE	649,995.61	.00	.00
LAD010385847	CP LOUISIANA, INC.	NEW ORLEANS	45.80	.00	.00

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LOUISIANA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
LAD092101906	CRESCENT TECHNOLOGY, INC.	BELLE CHASSE	22.57	.00	.00
LAD982552994	CUMMINS MID-SOUTH, INC.	KENNER	32.40	.00	.00
LAD081651119	CUSTOM LABELS, INC.	BOSSIER CITY	26.89	.00	.00
LAR000005926	CXY CHEMICALS, U.S.A.	HAHNVILLE	3,960.95	.00	.00
LAD008175390	CYTEC INDUSTRIES INC.	WAGGAMAN	1,743,005.59	145,220.00	24.00
LAR000000034	D.L. MUD #2 SITE THE DOW CHEMICAL C	ABBEVILLE	197.90	.00	.00
LAD980621387	DELTA DISTRIBUTORS, INC.	ST. GABRIEL	68.20	.00	.00
LAD008188583	DELTECH CORPORATION	BATON ROUGE	1,370.77	1,800.00	.00
LAD008187080	DOW CHEMICAL COMPANY LOUISIANA DIVI	PLAQUEMINE	2,115,655.61	.00	.00
LAD071940233	DRESSER VALVES AND CONTROLS	ALEXANDRIA	82.55	.00	.00
LAD070672605	DSI TRASPORTS, INC.	BATON ROUGE	10,266.86	.00	.00
LAD008182990	DSM COPOLYMER, INC.	BATON ROUGE	25.89	.00	.00
LAD059130831	DSM COPOLYMER, INC.- ADDIS PLANT	ADDIS	98.45	.00	.00
LAD069524981	DURAWOOD TREATING COMPANY	ALEXANDRIA	36.01	.00	.00
LAD001890367	E.I. DUPONT DE NEMOURS & CO., INC.	LAPLACE	507,362.13	103,447,673.00	.00
LAD037970217	EAST JEFFERSON GENERAL HOSPITAL	METAIRIE	24.85	.00	.00
LAD981514441	ECOVA CORPORATION	LAKE CHARLES	364.97	.00	.00
LAD099643199	ENTERPRISE TRANSPORTATION COMPANY	PORT ALLEN	54.25	.00	.00
LAD985175918	EVANS CONTAINER CORPORATION	HARVEY	38.91	.00	.00
LAD008158289	EVANS COOPERAGE COMPANY, INC.	HARVEY	253.20	.00	.00
LA0000181800	EVANS COOPERAGE COMPANY, INC.	HARVEY	220.50	.00	.00
LAD000812818	EXXON CHEMICAL AMERICAS	BATON ROUGE	7,665.99	.00	.00
LAD000778381	EXXON CHEMICAL CO B.R. PLASTICS PLA	BATON ROUGE	9,790.65	.00	.00
LAD084662535	EXXON CHEMICAL CO- RESIN FINISHING	BATON ROUGE	17.29	.00	.00
LAD000757237	EXXON CO. USA- MARYLAND TANK FARM	BATON ROUGE	25.20	.00	.00
LAD062662887	EXXON COMPANY USA BATON ROUGE REFIN	BATON ROUGE	6,614.72	.00	.00
LAD000778365	EXXON COMPANY USA- ANCHORAGE TANK F	PORT ALLEN	78.00	.00	.00
LAD985198852	EXXON PORT ALLEN LUBRICANTS PLANT	PORT ALLEN	15.93	.00	.00
LAD092104389	FERRO CORP. GRANT CHEMICAL DIVISION	ZACHARY	315.74	496.00	.00
LAD980875603	FINA OIL AND CHEMICAL COMPANY	CARVILLE	126.50	.00	.00
LAD008073439	FIRESTONE SYNTHETIC RUBBER & LATEX	SULPHUR	1,091.20	.00	.00
LAD000777169	FORMER CHARLOTTE CHEMICAL SITE	BATON ROUGE	684.28	.00	.00
LAD041224932	FORMOSA PLASTICS CORPORATION	BATON ROUGE	11,433.48	.00	.00
LAD062644778	GATX TERMINALS CORPORATION	NORCO	369.66	.00	.00
LAD981900418	GAYLORD CONTAINER CORPORATION	BOGALUSA	56.99	.00	.00
LAD043197284	GENERAL ELECTRIC	SHREVEPORT	21.10	.00	.00
LAD089317341	GENERAL MOTORS CORP.- SHREVE. ASSEM	SHREVEPORT	795.49	.00	.00
LAD057117434	GEORGIA GULF CORPORATION	PLAQUEMINE	40,497.28	.00	.00
LAD058530510	GNB TECHNOLOGIES	SHREVEPORT	8,273.20	.00	.00
LAD092476126	GOLD LINE REFINING, LTD.	LAKE CHARLES	271.28	.00	.00
LAD062123609	GROENDYKE TRANSPORT, INC.	LAKE CHARLES	139.96	.00	.00
LAD985218742	GRUMMAN LOUISIANA	LAKE CHARLES	94.72	.00	.00
LAD139240618	GULF ISLAND FABRICATION, INC.- MAIN	HOUMA	50.54	.00	.00
LAD055018717	HALL-BUCK MARINE	BATON ROUGE	5,165.40	.00	.00
LAD081654295	HAYNES INTERNATIONAL INC	ARCADIA	240.31	.00	.00
LAD008158404	HAYWILK GALVANIZING, INC.	HARVEY	285.74	.00	.00
LAD985223270	ICI AMERICAS, INC.	ST. GABRIEL	14.47	.00	.00
LAD980748859	ICO TUBULAR SERVICES	AMELIA	31.27	.00	.00
LAD008077315	INTERNATIONAL PAPER	DERIDDER	64.64	.00	.00
LAD000631630	INTERNATIONAL PAPER MANSFIELD MILL	MANSFIELD	14.56	.00	.00
LAD008167819	INTERNATIONAL PAPER- LOUISIANA MILL	BASTROP	32.00	.00	.00
LAD982294068	INTERNATIONAL-MATEX TANK TERMINALS	ST. ROSE	72.72	.00	.00
LAD000757526	J. RAY MCDERMOTT, INC.	AMELIA	167.87	.00	.00
LAD985214758	J. RAY MCDERMOTT, INC.	VINTON	32.53	.00	.00
LAD067023333	JAMES RIVER CORPORATION	SHREVEPORT	177.12	.00	.00

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LOUISIANA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

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- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
LAD008187692	KAISER ALUMINUM AND CHEMICAL CORPOR	BATON ROUGE	580.18	.00	.00
LAD985171594	KOPPERS INDUSTRIES, INC.	LOGANSPORT	99.58	.00	.00
LAD087721924	LAIDLAW ENVIR. SERVICES RECOVERY, I	JENNINGS	771.90	.00	.00
LAD079464095	LAIDLAW ENVIRONMENTAL SERVICES	RAYNE	22,280.77	.00	.00
LAD981598451	LAIDLAW ENVIRONMENTAL SVCS (RECOVER	JENNINGS	274.90	.00	.00
LAD981055791	LAIDLAW ENVIRONMENTAL SVCS. INC	COLFAX	19.60	.00	.00
LAD982560955	LAROCHE INDUSTRIES INC. GRAMERCY FA	GRAMERCY	3,032.50	.00	.00
LAD982284218	LEONARD J CHABERT MEDICAL CENTER	HOUMA	15.10	.00	.00
LAD008050726	LIBBEY GLASS, INC.	SHREVEPORT	42.56	.00	.00
LAD048104608	LIQUID CARBONIC PROCESS PLANTS	GEISMAR	160.10	.00	.00
LA0213820533	LOUISIANA ARMY AMMUNITION PLANT	DOYLINE	23.11	7.00	.00
LAD020605705	LOUISIANA PACIFIC CORP- URANIA COMP	URANIA	32.00	.00	.00
LAD985185149	LOUISIANA PIGMENT COMPANY, L.P.	WESTLAKE	59,870.09	980.00	.00
LAT230012833	LOUISIANA STATE UNIVERSITY	BATON ROUGE	54.11	2,685.00	.00
LAD981598543	LOUISIANA TECH UNIVERSITY	RUSTON	3.63	54.68	.00
LAD069745073	LSU EDICAL CENTER - SHREVEPORT	SHREVEPORT	11.50	2,560.00	.00
LAD052739778	LSU MEDICAL CENTER	NEW ORLEANS	9.02	445.00	.00
LAD077914075	LSU SCHOOL OF DENTISTRY	NEW ORLEANS	3.65	137.00	.00
LAD008050676	LUDLOW CORPORATION	HOMER	14.63	.00	.00
LAD092096056	MACKENZIE CORPORATION	BUSH	40.40	.00	.00
LAD980810212	MALLINCKRODT VETERINARIAN OPER., IN	BATON ROUGE	15.87	.00	.00
LAD000631754	MARATHON OIL COMPANY	GARYVILLE	437.42	.00	.00
LAD081999724	MARATHON OIL COMPANY	GARYVILLE	3,851.41	.00	.00
LAD008198319	MARCANN, INC.	OPELOUSAS	85.48	.00	.00
LAD981057706	MARINE SHALE PROCESSORS, INC.	AMELIA	5,143.40	.00	.00
LAD079449179	MATLACK, INC.	ST. ROSE	505.07	.00	.00
LAD000757534	MCDERMOTT SHIPYARD INC.	AMELIA	59.49	.00	.00
LAD072619646	MEDICAL CENTER OF LOUISISANA NEW OR	NEW ORLEANS	50.85	.00	.00
LAD008179707	MOBILE OIL COMPANY CHALMETTE REFINE	CHALMETTE	15,346.58	.00	.00
LAD001700756	MONSANTO COMPANY LULING PLANT	LULING	816,788.60	.00	.00
LAD008080541	MONTELL USA INC	WESTLAKE	124.50	.00	.00
LAD982560914	MORTON INTERNATIONAL ADVANCED MATER	NEW IBERIA	113.49	.00	.00
LAD008058471	MURPHY OIL USA, INC MERAUX REFIN	MERAUX	885.24	44.00	.00
LAD050901669	NALCO CHEMICAL COMPANY	GARYVILLE	77,796.52	1,180.00	.00
LAD122615560	NALCO/EXXON ENERGY	SCOTT	60.35	.00	.00
LA6170022788	NAVAL AIR STATION NEW ORLEANS	BELLE CHASSE	43.58	.00	.00
LAD069733798	NORTHWESTERN STATE UNIVERSITY	NATCHITOCHES	6.99	2,290.00	.00
LAD098168206	OCCIDENTAL CHEMICAL CORP.	CONVENT	950.60	.00	.00
LAD003913316	OCCIDENTAL CHEMICAL GROUP	TAFT	522.78	.00	.00
LAD077900207	OCHSNER FOUNDATION HOSPITAL	NEW ORLEANS	16.26	10.00	.00
LAD008080681	OLIN CORPORATION	WESTLAKE	314,181.35	.00	444.00
LAD052528965	OLIN CORPORATION, SHREVEPORT PLANT	SHREVEPORT	93.26	.00	.00
LAD981052376	OXYCHEM PETROCHEMICALS	SULPHUR	136.49	200.00	.00
LAD084670652	PAKTANK CORP- WESTWEGO TERMINAL	WESTWEGO	88.01	.00	.00
LAD096040712	PETROUNITED TERMINALS, INC	SUNSHINE	124.30	.00	.00
LAD081407850	PHIBRO ENERGY USA, INC.	KROTZ SPRINGS	141.40	.00	.00
LAD062666540	PIONEER CHLOR ALKALI CO., INC.	ST. GABRIEL	368.80	.00	.00
LAD053783353	PLACID REFINING COMPANY	PORT ALLEN	38.20	.00	.00
LAD098167422	PLAQUEMINE POINT SHIPYARD	SUNSHINE	567.44	.00	.00
LAD008086506	PPG INDUSTRIES, INC.	WESTLAKE	41,153.43	.00	.00
LAD985176007	PRIDE AVIATION, INC.	NEW IBERIA	105.61	.00	.00
LAD981512627	PURE SOLVE, INC.	PORT ALLEN	1,359.17	.00	.00
LAD072630254	RAPIDES REGIONAL MEDICAL CENTER	ALEXANDRIA	48.50	.00	.00
LA0000028753	REGIONAL FABRICATORS, INC.	NEW IBERIA	16.03	.00	.00
LAD985170851	RHONE POULENC	LULING	264.50	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
LAD008161234	RHONE-POULENC, INC. BATON ROUGE PLA	BATON ROUGE	4,074.40	1,349,642.00	.00
LAD008193567	RIVERWOOD INTERNATIONAL USA, INC.	WEST MONROE	117.29	.00	.00
LAD000778514	ROLLINS ENVIRONMENTAL SERV OF LA. I	PLAQUEMINE	235.50	.00	.00
LAD010395127	ROLLINS ENVIRONMENTAL SERVICES (LA)	BATON ROUGE	1,272,393.55	.00	.00
LAD008213191	RUBICON INC	GEISMAR	1,484,310.40	.00	.00
LAD037455425	RUSKIN MFG.	MINDEN	42.00	.00	.00
LAD981057441	SAFETY-KLEEN CORP	PINEVILLE	43.28	.00	.00
LAD985188234	SAR PROTECTORS & SUPPLY COMPANY, IN	LAFAYETTE	13.91	.00	.00
LAD067019802	SCAPA FORMING FABRICS	SHREVEPORT	78.26	.00	.00
LAD008184137	SCHYLKILL METALS CORPORATION	BATON ROUGE	21,243.44	.00	.00
LAD985211176	SHAW PIPE- A DIV. OF SHAW RESOURCES	NEW IBERIA	36.49	.00	.00
LAD980622104	SHELL CHEMICAL CO. SHELL CHEMICAL P	NORCO	21,343.70	.00	.00
LAD003913183	SHELL CHEMICAL-GEISMAR PLANT	GEISMAR	220.18	.00	.00
LAD008186579	SHELL OIL COMPANY	NORCO	1,666.81	.00	.00
LAD094904513	SHELL OIL COMPANY-ST. ROSE SITE	ST. ROSE	33.90	.00	.00
LAR000004598	SHELL POLYPROPYLENE COMPANY	NORCO	29.72	.00	.00
LAD985171685	SHIELD COAT INCORPORATED	HOUMA	17.70	.00	.00
LAD985211564	SIGMA COATINGS, USA, B.V.	HARVEY	499.71	85.00	.00
LAR000007641	SIMMONS PLATING AND GRINDING	HARAHAN	103.24	.00	.00
LAD985203686	SPECIALTY PLASTICS, INC.	BATON ROUGE	21.08	.00	.00
LAD980874093	SPECTRUM CONTROL TECHNOLOGIES	NEW ORLEANS	88.06	.00	.00
LAD077115897	ST PATRICK HOSPITAL	LAKE CHARLES	20.65	.00	.00
LAD043429182	ST. FRANCES CABRINI HOSPITAL	ALEXANDRIA	33.23	.00	.00
LAD094191236	ST. MARY GALVANIZING CO.	BAYOU VISTA	458.10	.00	.00
LAD065485146	STAR ENTERPRISE LOUISIANA PLANT	UNION	922.83	.00	.00
LAD985188440	STEEL FABRICATORS OF MONROE, INC.	MONROE	15.50	.00	.00
LAD985209840	SUBSEA INTERNATIONAL INC.	BELLE CHASSE	21.18	.00	.00
LAD980622054	SUPERIOR TIE AND TIMBER COMPANY	VIVIAN	19.20	.00	.00
LAR000004812	SUPREME SUGAR COMPANY	LABADIEVILLE	1.25	50.10	.00
LAD086560612	T. T. BARGE CLEANING	HARAHAN	56.99	.00	.00
LAD985169457	T.L. JAMES & CO. DREDGE GROUP	HOUMA	18.07	.00	.00
LAD980870794	T.T. BARGE CLEANING, MILE183, INC.	MODESTE	2,672.36	.00	.00
LAD034533133	TENNESSEE GAS PIPELINE	WEST MONROE	22.84	.00	.00
LAR000002188	TENNESSEE GAS PIPELINE COMP STAT 82	KINDER	24.75	.00	.00
LAD980866339	TEXACO EXPLORATION AND PRODUCTION I	MORGAN CITY	36.26	.00	.00
LAD000728881	TEXACO PIPELINE INC.	JACKSON	168.04	.00	.00
LAR000006981	TEXACO PIPELINE- TEMP. LAROSE WORKS	LAROSE	25.80	.00	.00
LAD982302812	TEXAS EASTERN TRANS CORP MONROE-LA	WEST MONROE	20.38	.00	.00
LAT230013773	TEXAS EASTERN TRANS CORP-ST.FRANCIS	JACKSON	31.30	.00	.00
LAD982552978	TEXAS EASTERN TRANS. CORP. -LOGGY B	HALL SUMMIT	17.20	.00	.00
LAT230013104	THE KANSAS CITY SOUTHERN RAILWAY CO	SHREVEPORT	14.97	.00	.00
LAD058959123	TIFTON ALUMINUM CO., INC.	DELHI	58.02	.00	.00
LAD985216266	TIMBALIER SALES & RENTAL, INC.	HOUMA	109.30	.00	.00
LAD000225862	TRANSAMERICAN REFINING CORPORATION	NEW SARPY	626.40	.00	.00
LAD065459463	TRINITY INDUSTRIES EQUITABLE/HALTER	NEW ORLEANS	61.43	.00	.00
LAD057113599	TRINITY MARINE GROUP #84	LOCKPORT	13.47	.00	.00
LAD985167196	TRUNKLINE GAS COMPANY	EPPS	118.52	.00	.00
LAD985191089	TRUNKLINE GAS COMPANY	PATTERSON	19.56	.00	.00
LAD980796635	TUBOSCOPE VETCO INTERNATIONAL- AMEL	AMELIA	26.21	.00	.00
LAD980622138	TUBOSCOPE VETCO INTERNATIONAL, INC.	HARVEY	29.61	.00	.00
LA0214022725	U.S. ARMY FORT POLK	FORT POLK	106.80	756.00	.00
LAD010388254	UNIFAB	NEW IBERIA	6,175.40	.00	.00
LAD041581422	UNION CARBIDE CORP. TAFT PLANT	TAFT	3,564,280.57	940.00	.00
LAD069531275	UNION TANK CAR COMPANY	VILLE PLATTE	59.79	.00	.00
LAD981149750	UNION TEXAS PRODUCTS CORPORATION	GEISMAR	15.00	.00	.00

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LAD008194060	UNIROYAL CHEMICAL COMPANY, INC.	GEISMAR	4,634.74	.00	1,100.00
LAD057109449	UOP SHREVEPORT PLANT	SHREVEPORT	59.10	30,000.00	.00
LA4800014587	US NASA/MARTIN MARIETTA	NEW ORLEANS	262,846.74	.00	.00
LAD086478047	VISTA CHEMICAL COMPANY-LCCC	WESTLAKE	15,367.50	.00	.00
LAD092681824	VULCAN CHEMICALS GEISMAR, LA.	GEISMAR	5,815.94	.00	.00
LAD008211542	VULCAN FOUNDRY CORP	DENHAM SPRINGS	17.10	.00	.00
LAD985184761	WESTLAKE PETROCHEMICALS CORP.	SULPHUR	519.95	.00	.00
LAD981522048	WESTLAKE POLYMERS CORP.	SULPHUR	38.00	.00	.00
LAD985213313	WESTLAKE STYRENE CORP	SULPHUR	77.62	.00	.00
LAD098598360	WESTSIDE GALVANIZING	PORT ALLEN	2,172.41	.00	.00
LAD010390599	WESTVACO CORPORATION	DERIDDER	4,063.01	.00	.00
LAD043426006	WITCO CORPORATION	HARVEY	70.26	.00	.00
LAD065470916	WITCO TAFT	TAFT	3,512.50	.00	.00
LAD034199323	YOUNGER BROTHERS INC.	BATON ROUGE	418.87	.00	.00
LAD034313858	YOUNGER BROTHERS INC.	LAKE CHARLES	273.46	.00	.00
LAD980627061	ZENECA INC.	ST GABRIEL	498.35	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
LAD985221621	ADELL COMPOUNDING, INC.	DENHAM SPRINGS	10.18	.00	.00
LAD041222365	AIR PRODUCTS AND CHEMICALS, INC.	NEW ORLEANS	2.58	.00	.00
LA0000353003	ALLEN TANK, INC.	NEW IBERIA	9.90	.00	.00
LAD985175207	ALPHA TECHNICAL SERVICES	HARVEY	4.40	.00	.00
LAD102440468	ANADRILL/SCHLUMBERGER	SCOTT	3.80	.00	.00
LAD980875934	ARCADIAN FERTILIZER, L.P.	GEISMAR	8.80	.00	.00
LAD070132717	ARIZONA CHEMICAL	OAKDALE	7.93	.00	.00
LAD081419418	ASHLAND CHEMICAL COMPANY	PLAQUEMINE	1.68	.00	.00
LAD118977552	BAKER HUGHES INTEQ	BROUSSARD	11.40	.00	.00
LAD147729966	BEAIRD INDUSTRIES	SHREVEPORT	1.10	.00	.00
LAD000719096	BETZ LABORATORIES, INC.	RESERVE	7.00	.00	.00
LAD981608300	BILL LEWIS LURES	ALEXANDRIA	6.70	.00	.00
LAD021019922	BOLLINGER SHIPYARDS, INC.	LAROSE	2.30	.00	.00
LAD000757690	BRIDGELINE SEA ROBIN GAS	ERATH	1.61	.00	.00
LAD000726406	CEN. LA. ELEC CO.- DOLET HILLS STAT	MANSFIELD	1.17	.00	.00
LAD056522667	CEN. LA. ELEC. CO.- TECHE STATION	BALDWIN	1.82	.00	.00
LAD071941611	CENTRAL LA. ELECTRIC CO., INC.	LENA	1.45	.00	.00
LAD008161481	CENTURY GRAPHICS CORPORATION	METAIRIE	5.60	.00	.00
LAR000007146	COLONIAL PIPELINE CO.- WELSH STATIO	WELSH	7.84	.00	.00
LAR000001776	COLONIAL PIPELINE CO- CHURCH POINT	CHURCH POINT	9.35	.00	.00
LAD096603865	COLONIAL PIPELINE CO- LAKE CHARLES	SULPHUR	11.15	.00	.00
LAD067039479	COLUMBIA GULF TRANS CO- DELHI COMP	DELHI	1.20	.00	.00
LAD985218502	COLUMBIA GULF TRANS CO-INTRACOASTAL	INTRACOASTAL CI	3.70	.00	.00
LAR000004937	CONSTRUCTION MATERIALS,INC.	BATON ROUGE	6.00	.00	.00
LAD059151225	DELTA DISTRIBUTORS, INC.	SHREVEPORT	1.20	.00	.00
LAD034522136	DICKSON GMP INTERNATIONAL	NEW ORLEANS	11.97	.00	.00
LAR000001768	DIS-TRAN WOOD PRODUCTS,INC.	PINEVILLE	4.71	.00	.00
LAD000803296	DOW CHEMICAL CO.- GRAND BAYOU PLANT	PAINCOURTVILLE	3.49	.00	.00
LAD985193606	DYNAMIC INDUSTRIES, INC.	NEW IBERIA	2.34	.00	.00
LAD083451856	ELDER WOOD PRESERVING CO INC.	MANSURA	2.88	.00	.00
LA9572124452	ENGLAND AIR FORCE BASE	ALEXANDRIA	4.75	.00	.00
LAD079460895	ETHYL CORPORATION BATON ROUGE PLANT	BATON ROUGE	2.34	.00	.00
LAD985173707	FIBREBOND CORPORATION	MINDEN	8.57	.00	.00
LA0000188136	FLUID CRANE AND CONSTRUCTION, INC.	NEW IBERIA	1.32	.00	.00
LAD008157414	FORMER TULLOS LUMBER SITE	TROUT	3.88	.00	.00
LAD985171123	FRENCH JORDAN, INC.	HOUMA	7.50	.00	.00
LAD062643853	GEORGIA-PACIFIC COPR.- PORT HUDSON	ZACHARY	7.48	.00	.00
LAD985212158	GULF ISLAND FABRICATION, INC.- WEST	HOUMA	3.17	.00	.00
LAD982552028	GULF WIRE CORPORATION	NEW ORLEANS	12.40	.00	.00
LAD000757518	J. RAY MCDERMOTT, INC.	AMELIA	7.45	.00	.00
LAD981154230	KNOLL PHARMACEUTICAL COMPANY	SHREVEPORT	9.93	.00	.00
LAD985218411	KOCH NITROGEN COMPANY	STERLINGTON	2.46	.00	.00
LAD981144165	LA DEPT OF TRANSPORTATION & DEVELOP	BOSSIER CITY	9.93	.00	.00
LA0000365668	LAMP RECYCLERS OF LOUISIANA, INC	HAMMOND	3.37	.00	.00
LAD008213985	LSU MEDICAL SCHOOL	NEW ORLEANS	1.11	16.00	.00
LAR000002048	MCINNIS BROTHERS CONSTRUCTION INC	MINDEN	10.55	.00	.00
LAD985195916	OFS, INC.	HARVEY	9.54	.00	.00
LAD040773129	OUR LADY OF THE LAKE REGIONAL MEDIC	BATON ROUGE	3.81	.00	.00
LAD096947411	PAXON POLYMER COMPANY	BATON ROUGE	6.80	.00	.00
LAD980865364	PETROLITE CORP., BROUSSARD WAREHOUS	BROUSSARD	5.40	.00	.00
LAD000726224	PLANTATION PIPE LINE CO. MD FAC	BATON ROUGE	11.25	.00	.00
LAR000007898	PRIDE AVIATION, INC.	NEW IBERIA	5.00	.00	.00
LAD985191238	PRISON ENTERPRISES/ALLEN CORRECTION	KINDER	8.79	.00	.00
LAD981592322	PRISON ENTERPRISES/LA STATE PENITEN	ANGOLA	10.85	.00	.00
LAD985224237	QUALA SYSTEMS, INC. GEISMAR, LA.	ST. GABRIEL	4.42	.00	.00

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LAD985224245	QUALA SYSTEMS, INC- LULING	LULING	7.23	.00	.00
LAD077904324	QUALITY SHIPYARD - YARD 1	HOUMA	5.00	.00	.00
LAD985171271	QUALITY SHIPYARD-SHIPYARD II	HOUMA	6.80	.00	.00
LAD089841902	SAFETY-KLEEN CORPORATION	KENNER	1.72	.00	.00
LAD037259769	SEARS UNIT #8136	JEFFERSON	3.59	.00	.00
LAR000006031	SHAW PIPE- A DIVISION OF SHAW RESOU	NEW IBERIA	2.28	.00	.00
LAD000726372	SHELL CHEMICAL COMPANY TAFT PLANT	TAFT	2.18	.00	.00
LA0000094102	SHERWIN WILLIAMS CO #7117	BOSSIER CITY	4.13	.00	.00
LAD980796791	SOUTHERN NATURAL GAS COMPANY- TOCA	ST BERNARD	3.84	.00	.00
LAD118093020	STINGRAY PIPELINE COMPANY COMP. STA	CAMERON	1.83	.00	.00
LAD985224443	STRIP-EASE OF NEW ORLEANS	NEW ORLEANS	10.85	.00	.00
LAD065471112	SUN DRILLING PRODUCTS	BELLE CHASSE	1.61	.00	.00
LAD081648966	TENNESSEE GAS PIPELINE	NATCHITOCHES	3.51	.00	.00
LAD117423277	TERREBONNE GENERAL MED. CENTER	HOUMA	2.37	.00	.00
LAD982564023	TEXAS EASTERN TRANS CO.-CASTOR	CASTOR	7.39	.00	.00
LAD982553034	TEXAS EASTERN TRANS CORP.-GILLIS, L	RAGLEY	2.06	.00	.00
LAD981912611	TEXAS EASTERN TRANS CORP-WHITE CAST	WHITE CASTLE	2.23	.00	.00
LAT230013781	TEXAS EASTERN TRANS. CORP-LAROSE	CUT OFF	3.61	.00	.00
LAD085134971	TEXAS GAS TRANSMISSION- BASTROP	BASTROP	11.04	.00	.00
LAD980333371	TEXAS GAS TRANSMISSION- EUNICE	EUNICE	2.72	.00	.00
LAD981146186	TEXAS GAS TRANSMISSION- GUTHRIE	STERLINGTON	9.42	.00	.00
LAD120250030	TEXAS GAS TRANSMISSION- MORGAN CITY	AMELIA	12.34	.00	.00
LAD081413973	TEXAS GAS TRANSMISSION- PINEVILLE	PINEVILLE	7.37	.00	.00
LAD980864037	TEXAS GAS TRANSMISSION- SHARON	DUBACH	5.66	.00	.00
LAD048811442	THE GEON COMPANY	PLAQUEMINE	6.78	.00	.00
LAD000778506	THE PROCTER & GAMBLE MFG. CO.	PINEVILLE	4.44	.00	.00
LAD065474942	TUBE-ALLOY CORPORATION	HOUMA	2.88	.00	.00
LAD084663962	TULANE UNIVERSITY MEDICAL SCHOOL	NEW ORLEANS	6.10	.00	.00
LA2890032582	U.S.DEPT.OF ENERGY WEST HACKBERRY S	HACKBERRY	3.13	.00	.00
LAD008213936	UNIVERSITY HOSPITAL	NEW ORLEANS	10.50	.00	.00
LAD071952154	UNOCAL-INTRASCOASTAL CITY SHORE BAS	INTRACOASTAL	7.81	.00	.00
LAR000003798	USPFO FOR LA WAREHOUSE	PINEVILLE	5.11	.00	.00
LAD008080434	W.R.GRACE & CO.-CONN. GRACE DAVISON	SULPHUR	3.40	.00	.00
LAD985174887	WEATHERFORD ENTERRA	LAKE CHARLES	5.17	.00	.00
LAD985221951	WESTLAKE STYRENE CORP, MARINE TERM	SULPHUR	2.70	.00	.00
LAD038802922	WESTLAND OIL COMPANY	SHREVEPORT	7.01	.00	.00
LAD985176015	WONDER PRODUCTS INC.	BOSSIER CITY	11.01	.00	.00
LAD198533705	ZENECA SPECIALTY INKS	WEST MONROE	4.82	.00	.00
LAD037455649	ZENITH GOLDLINE SHREVEPORT, INC.	SHREVEPORT	10.20	.00	.00
LAD020601118	ZWOLLE RAIL CAR COMPANY	ZWOLLE	8.30	.00	.00

Note: Please refer to the introduction for an explanation of this list.

LOUISIANA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO CANNOT BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- LESS THAN 1.1 TONS RCRA HAZARDOUS WASTE, AND
- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
LAD058472721	AMAX METALS RECOVERY, INC.	BRAITHWAITE	.92	.00	.00
LAD069744670	BOB POST CPJE	SHREVEPORT	.07	.00	.00
LAD028213122	BOISE CASCADE CORP. FLORIEN PLYWOOD	FLORIEN	.42	.00	.00
LAD052531506	BOISE CASCADE CORPORATION FISHER SA	FISHER	.24	.00	.00
LAD000209700	BROWNING-FERRIS INDTRS. CHEM. SERV.	BATON ROUGE	.00	.00	.00
LAD034483651	CEN. LA. ELEC. CO.- COUGHLIN STATIO	ST. LANDRY	.82	.00	.00
LAD008210635	DIXIE WEB GRAPHICS	NEW ORLEANS	.13	.00	.00
LAD985205582	ENTERGY SYSTEMS & SERVICES, INC.	HARAHAN	.00	.00	.00
LAR000006395	ENTERGY SYSTEMS AND SERVICES, INC.	ST. ROSE	.00	.00	.00
LAD981903487	FRYMASTER CORPORATION	SHREVEPORT	.38	.00	.00
LAD044496362	INTERNATIONIAL PAPER PINEVILLE MILL	PINEVILLE	.76	.00	.00
LAD985170281	KEROTEST MANUFACTURING	MANSURA	.54	.00	.00
LAD034477646	NEWMAN FORD, INC.	RAYVILLE	.40	.00	.00
LAD034353565	PATTERSON TRUCK LINE INC	MORGAN CITY	.80	.00	.00
LAD008156226	PELLERIN MILNOR CORPORATION	KENNER	.10	.00	.00
LAD985211762	PREFERRED INDUSTRIES	HOUMA	.67	.00	.00
LAD985193713	PRODUCTION MANAGEMENT INDUSTRIES, I	HARVEY	.37	.00	.00
LAD980809982	SHELL OFFSHORE INC. MORGAN CITY TER	MORGAN CITY	.00	.00	.00
LAD982557449	SHELL PIPE LINE CORP. CAPLINE TERMI	ST JAMES	.21	.00	.00
LAR000000950	SHELL POLYPROPYLENE COMPANY	NORCO	.21	.00	.00
LAD020871455	STAMM-SCHEELE, INC.	RAYNE	.35	.00	.00
LAD085157618	TEXAS GAS TRANSMISSION- COLUMBIA	COLUMBIA	.68	.00	.00
LAD985197441	TEXAS GAS TRANSMISSION- HAUGHTON	HAUGHTON	.33	.00	.00
LAD985170968	TEXAS GAS TRANSMISSION- WOODLAWN	IOWA	.57	.00	.00
LAD980699300	TEXAS GAS TRANSMISSION- YOUNGSVILLE	YOUNGSVILLE	1.10	.00	.00
LAD000777102	TUBOSCOPE VETCO INTL (MORGAN CITY C	MORGAN CITY	.85	.00	.00
LAD982557373	TURNER'S PAINT AND BODY SHOP	LAKE CHARLES	.52	.00	.00
LAD077914018	UNIVERSITY OF NEW ORLEANS-LAKEFRONT	NEW ORLEANS	.49	.00	.00

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MAINE

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MED980913883	AVX TANTALUM CORPORATION	BIDDEFORD	18.01	20.00	.00
MED041460247	BATH IRON WORKS CORPORATION	BATH	198.69	.00	.00
MED980523146	BATH IRON WORKS CORPORATION	PORTLAND	23.03	.00	.00
MED985467679	BATH IRON WORKS CORPORATION	BRUNSWICK	21.87	.00	.00
MED001095041	BOISE CASCADE RUMFORD MILL	RUMFORD	37.58	.00	.00
MED040249096	CYRO INDUSTRIES	SANFORD	792.67	.00	.00
MED046217352	EASTERN FINE PAPER INC	BREWER	99.43	.00	.00
MED019051069	ENVIRONMENTAL COMPLIANCE CORP	SOUTH PORTLAND	162.93	.00	.00
MED051431906	GENERAL ELECTRIC COMPANY DIST & CON	AUBURN	376.61	.00	.00
MED071742225	GEORGIA-PACIFIC CORPORATION	WOODLAND	116.13	.00	.00
MED000841015	GETTY PETROLEUM CORP	PORTLAND	227.19	.00	.00
MED001107051	GREAT NORTHERN PAPER INC	MILLINOCKET	25.39	.00	.00
MED000242701	HOLTRACHEM MANUFACTURING CO	ORRINGTON	958.10	.00	.00
MED001099076	JONES & VINING INC	LEWISTON	23.12	.00	.00
MED001095629	KIMBERLY CLARK CORPORATION	WINSLOW	13,205.34	.00	.00
MED045113495	L & I ATLANTIC INC	BANGOR	93.64	.00	.00
MED037714441	LEMFORDER CORPORATION	BREWER	14.60	.00	.00
ME9570024522	LORING AIR FORCE BASE	LIMESTONE	30.57	.00	.00
MED985466614	LOUISIANA PACIFIC CORP	NEW LIMERICK	5.84	150.00	.00
ME6572890022	MAINE AIR NATIONAL GUARD 101ARW	BANGOR	31.97	.00	.00
MED097731806	MAINE CENTRAL RAILROAD	WATERVILLE	24.00	.00	.00
MEP000010897	MAINE ELECTRONICS	LISBON	19.00	.00	.00
MED000841049	MOBIL OIL 18029 BANGOR TERMINAL	BANGOR	40.03	.00	.00
MED001098458	NATIONAL SEMICONDUCTOR CORPORATION	SOUTH PORTLAND	275.72	.00	.00
ME8170022018	NAVAL AIR STATION	BRUNSWICK	41.54	.00	.00
MED001099746	OSRAM SYLVANIA INC	WALDOBORO	264.14	.00	.00
MED086875887	OTIS SPECIALTY PAPERS INC	JAY	16.48	.00	.00
MED985471911	OXFORD AVIATION INC	OXFORD	21.42	.00	.00
MED001097203	PHILIPS ELMET	LEWISTON	69.42	3.00	.00
MED040228983	PIONEER PLASTICS CORP	AUBURN	50.91	.00	.00
MED000791681	PRATT & WHITNEY	NORTH BERWICK	474.48	.00	.00
MED985467638	PRECIS INC	WESTBROOK	47.87	.00	.00
MED001096395	PRIME TANNING CO INC	BERWICK	99.10	.00	.00
MED042141408	S D WARREN COMPANY	WESTBROOK	94.22	40.00	.00
MED001096791	SACO DEFENSE INC	SACO	44.23	.00	.00
MED093625358	SCI TECHNOLOGY INC	AUGUSTA	13.62	.00	.00
MED985467562	SERMATECH INT INC	BIDDEFORD	252.00	.00	.00
MED980910053	SILVEX INC	WESTBROOK	61.92	.00	.00
MED985469279	SOUTHERN MAINE INDUSTRIES CORP	GORHAM	34.59	.00	.00
MED054608179	SPENCER PRESS INC	WELLS	115.29	.00	.00
MED077469864	SPRAGUE SANFORD INC	SANFORD	266.16	3.00	.00
MED086875382	TEXACO/STAR ENTERPRISE SALES TERMIN	SOUTH PORTLAND	173.21	.00	.00
MED001099308	THE MEARL CORPORATION	EASTPORT	86.09	.00	.00
ME5000000380	UNITED TECHNOLOGIES CORP	WINTHROP	13.50	.00	.00
MED060996451	UNIVERSITY OF MAINE	ORONO	14.14	.00	.00
ME3971524324	US DOD DEFENSE FUEL	SEARSPORT	22.83	.00	.00
MED093624526	WATTS FLUIDAIR	KITTERY	21.51	.00	.00

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MAINE

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MED985469048	ACCENT DRY CLEANERS	PORTLAND	2.24	.00	.00
MED018975821	ADVANCE AUTO SALES	AUBURN	2.16	.00	.00
MED000841064	AMERICAN TOOL COMPANIES	GORHAM	4.03	.00	.00
MED002578409	AUBURN SHOE COMPANY	AUBURN	2.46	.00	.00
MED985472117	BABCOCK ULTRAPOWER	JONESBORO	1.85	.00	.00
MED057385619	BANGOR HYDRO-ELECTRIC CO-MAIN ST FA	BANGOR	1.72	.00	.00
MED000841056	BATH IRON WORKS CORPORATION	BRUNSWICK	10.61	.00	.00
MED018978791	BLOUIN MOTORS INC	AUGUSTA	1.18	.00	.00
MED001095371	CHAMPION INTERNATIONAL CORP	BUCKSPORT	5.60	.00	.00
MED985466358	CIANBRO CORPORATION PAINT/FAB SHOP	PITTSFIELD	7.14	.00	.00
MED097738363	CONTROL DEVICES INC	CARIBOU	1.36	.00	.00
MED985472240	CORNING COSTAR CORP-SCARBOROUGH	SCARBOROUGH	1.69	.00	.00
MED001111103	CORNING COSTAR CORPORATION	KENNEBUNK	2.00	.00	.00
MED000840983	CORNWALL INDUSTRIES	OXFORD	1.76	.00	.00
MED981889009	CSMS, MAINE ARMY NATIONAL GUARD	AUGUSTA	7.06	.00	.00
MED037719846	DEPARTMENT OF VETERANS AFFAIRS	TOGUS	2.71	.00	.00
MED001094473	DIELETRIC COMMUNICATIONS	RAYMOND	9.45	.00	.00
MED985467877	FIBER EXTRUSION INC	EASTPORT	5.00	.00	.00
MED048268890	FIBER MATERIALS INC	BIDDEFORD	2.51	.00	.00
MED001102508	G H BASS AND CO	WILTON	10.87	.00	.00
MED001106293	G S BUILDING SYSTEMS CORP	PITTSFIELD	9.38	.00	.00
MED043252253	GENERAL ELECTRIC COMPANY	BANGOR	3.73	.00	.00
MED058951047	GTE OPERATIONS SUPPORT INCORPORATED	STANDISH	1.65	.00	.00
MED985731306	HAAS CENTER	ROCKPORT	2.00	.00	.00
MED051430239	HACKETT MACHINE COMPANY	BREWER	2.92	.00	.00
MED001109685	HOWELL LABORATORIES INC	BRIDGTON	4.63	.00	.00
MED001095777	HUSSEY SEATING COMPANY	NORTH BERWICK	6.17	.00	.00
MED985474576	IMAGESET INC	PORTLAND	5.63	.00	.00
MED001095470	INERNATIONAL PAPER	JAY	5.50	.00	.00
MED001065580	IRVING TANNING COMPANY	HARTLAND	4.85	.00	.00
MED980671796	JAMES RIVER PAPER CO INC	OLD TOWN	9.90	.00	.00
MED046218574	KINGFIELD WOOD PRODUCTS	KINGFIELD	2.78	.00	.00
MED071730220	KNOX SEMICONDUCTOR INC	ROCKPORT	4.11	.00	.00
MED980671465	L L BEAN INC	FREEPORT	1.24	.00	.00
MED043249283	LINCOLN PULP & PAPER CO INC	LINCOLN	3.16	.00	.00
MED981889223	MAINE ARMY NATIONAL GUARD, UTES 1	AUBURN	1.75	.00	.00
MED071732663	MAINE MEDICAL CENTER	PORTLAND	2.80	.00	.00
MED985469154	MAINE PHOTOGRAPHIC WORKSHOPS UNION	ROCKPORT	4.66	.00	.00
MED071749329	MAINE YANKEE ATOMIC POWER COMPANY	WISCASSET	2.42	.00	.00
MED985467406	MDOT MOTOR TRANSPORT SERVICES	AUGUSTA	3.99	.00	.00
MED981889066	MEARNG MAINT SHOP OMS#4 BLDG #35	AUGUSTA	5.18	.00	.00
MED065037491	MEGA INDUSTRIES	RAYMOND	4.80	.00	.00
MED071732499	MERCY HOSPITAL	PORTLAND	1.25	.00	.00
MED071747919	NATIONAL WOOD PRODUCTS	OXFORD	6.22	.00	.00
MED097734388	NAUTEL MAINE INC	BANGOR	1.54	.00	.00
ME5170024355	NAVAL COMPUTER & TELECOMMUNICATIONS	CUTLER	12.51	.00	.00
ME4170024539	NAVAL SECURITY GROUP ACTIVITY	WINTER HARBOR	4.54	.00	.00
MED980731384	NEW BALANCE ATHLETIC SHOE	NORRIDGEWOCK	1.41	.00	.00
MED982194102	NEW ENGLAND ANTIGENICS	SOUTH WINDHAM	1.58	.00	.00
MED042143297	NICHOLS PORTLAND	PORTLAND	4.45	.00	.00
MED981215080	NORTHEAST GEOCHEMICAL & ASSAY COMPA	YARMOUTH	4.53	.00	.00
MED018980235	OCONNOR GMC INC	AUGUSTA	6.50	.00	.00
MED985471879	OOC1D MOBIL OIL CORP-SOI	SACO	3.23	.00	.00
ME5000000810	PRATT-ABBOTT CLEANERS	WESTBROOK	3.31	.00	.00
MED980670616	PRATT-ABBOTT INC	SOUTH PORTLAND	3.22	.00	.00

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MAINE

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MED060996204	S D WARREN SOMERSET PLANT	SKOWHEGAN	8.14	.00	.00
MED001095231	SAUNDERS BROTHERS	WESTBROOK	2.32	.00	.00
MED000649863	SEBAGO INC	WESTBROOK	5.47	.00	.00
MED001094218	SEBAGO INC	WESTBROOK	2.13	.00	.00
MED000650002	SEBAGO INC PLEASANT MOUNTAIN MOC	BRIDGTON	3.23	.00	.00
MED058953498	SPOT-BILT INC	BANGOR	8.04	.00	.00
MED047364799	TAMBRANDS INC	AUBURN	2.74	.00	.00
MED985467448	THE CHINET COMPANY MACHINE SHOP	WATERVILLE	4.50	.00	.00
MED985467927	THE DIAMOND PHOENIX CORP	LEWISTON	3.37	.00	.00
MED982546673	THE DINGLEY PRESS	LISBON	1.58	.00	.00
MED042140483	THE JACKSON LABORATORY	BAR HARBOR	7.97	4.00	.00
MED001094051	TIBBETTS INDUSTRIES INC	CAMDEN	4.34	.00	.00
MED981062474	UNION ST NORGE LAUNDRY	BANGOR	1.88	.00	.00
MED083184051	UNITRODE CORPORATION	WESTBROOK	8.37	.00	.00
MED071738272	UNIVERSITY OF NEW ENGLAND	BIDDEFORD	2.06	.00	.00
ME5000000828	US POSTAL SERVICE	PORTLAND	2.09	.00	.00
MED982773814	VULCAN ELECTRIC CO	KEZAR FALLS	3.25	.00	.00
MED018999706	WEBBER TANKS INC	BUCKSPORT	8.10	.00	.00
MED981888415	WEIR'S MOTOR SALES INC	ARUNDEL	5.13	.00	.00
MED046221115	18054 PORTLAND TERMINAL	SOUTH PORTLAND	9.97	.00	.00

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MAINE

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO CANNOT BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- LESS THAN 1.1 TONS RCRA HAZARDOUS WASTE, AND
- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MED018979047	BOB CHAMBERS CHEVROLET	AUGUSTA	1.03	.00	.00
MED981069644	CENTRAL MAINE POWER CO	AUGUSTA	.29	.00	.00
MED001097245	DRAGON PRODUCTS COMPANY INC	THOMASTON	.00	.00	.00
MED985731132	GENERAL ELECTRIC COMPANY	BANGOR	.89	.00	.00
MED001110337	GULF OIL LIMITED PARTNERSHIP	SOUTH PORTLAND	.48	.00	.00
MED156038978	HARRY C CROOKER & SONS INC	TOPSHAM	.74	.00	.00
MED001104959	HINCKLEY COMPANY	SOUTHWEST HARBO	.91	.00	.00
MED057975765	INTERSTATE EQUIPMENT CORP	ELIOT	.71	.00	.00
MED982195729	MAINE AIR NATIONAL GUARD	SOUTH PORTLAND	.63	.00	.00
MED071735096	MAINE POLY INC	GREENE	.29	.00	.00
ME2210022453	MG OLIVER OTIS HOWARD USARC	AUBURN	.63	.00	.00
MED019052919	MORONG FALMOUTH	FALMOUTH	.66	.00	.00
MED981889165	OMS#3 MAINE ARMY NATIONAL GUARD	BANGOR	.94	.00	.00
MED981889173	ORGANIZATIONAL MAINTENANCE SHOP #1	PORTLAND	1.08	.00	.00
MED049288160	PRIDE MANUFACTURING CO	BURNHAM	.51	.00	.00
MED980667810	SAFETY-KLEEN CORP	LEEDS	.00	.00	.00
MED985467901	TRANSCO DISTRIBUTORS	AUGUSTA	.95	.00	.00
MED980670640	UNICO	SANFORD	.56	.00	.00
MED982763419	UNITED TECHNOLOGY CENTER	BANGOR	.68	.00	.00
ME5211890012	USPFO FOR MAINE	AUGUSTA	.19	.00	.00
MED000243055	WESTPOINT STEVENS INC	BIDDEFORD	.05	.00	.00
MED982753394	WISCASSET FORD INC	WISCASSET	1.09	.00	.00

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MARYLAND

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MDD003101847	A-1 PLATING CO	BALTIMORE	48.18	.00	.00
MDD003090198	AAI CORP	HUNT VALLEY	16.09	.00	.00
MDD022393771	ABBEY DRUM CO	BALTIMORE	67.99	.00	.00
MDD003067832	AIR PRODUCTS & CHEMICALS INC	ELKTON	107.85	.00	.00
MDD048581763	ALLIED SIGNAL INC	TOWSON	11.74	735.00	.00
MDD069396711	ALLIED SIGNAL INC	BALTIMORE	279.10	.00	.00
MDD981043383	ALLIEDSIGNAL AEROSPACE	COLUMBIA	3.72	570.00	.00
MDD990812869	ALLTRISTA METAL SERVICES CO	BALTIMORE	77.12	.00	.00
MDD003062213	ALMAG PLATING CORP	BALTIMORE	26.51	.00	.00
MD0000192971	ALPHA RIDGE LANDFILL	MARRIOTTSVILLE	13.55	.00	.00
MDD054907027	AMERADA HESS BALTIMORE TERMINAL	BALTIMORE	69.59	.00	.00
MDD981045321	AMERICAN TANK TRANSPORT INC	ELKRIDGE	3,007.04	.00	.00
MDD003093119	AMG RESOURCES CORP	BALTIMORE	2,571.63	.00	.00
MD0570024000	ANDREWS AFB	ANDREWS AFB	77.45	.00	.00
MDD001715705	ARMCO STAINLESS & ALLOY	BALTIMORE	328.30	.00	.00
MDD054909072	ATLANTIC ALLIANCE CORP	BALTIMORE	28.34	.00	.00
MDD095415840	ATLANTIC WOOD INDUSTRIES	FRUITLAND	15.40	.00	.00
MDD985384775	ATOTECH USA INC	BALTIMORE	366.77	.00	.00
MDD049918659	BALTIMORE GALVANIZING CO INC	BALTIMORE	154.89	.00	.00
MDD000619395	BALTIMORE GAS & ELECTRIC CO	BALTIMORE	385.09	.00	.00
MDD985406297	BALTIMORE GAS & ELECTRIC CO	GLEN BURNIE	16.36	.00	.00
MDD022402994	BARRE NATIONAL INC	WOODLAWN	27.12	355.00	.00
MDD053941878	BAUSCH & LOMB INC	OAKLAND	123.15	.00	.00
MDD003093499	BAYER CORP	BALTIMORE	35.30	.00	.00
MDD056506389	BEAZER EAST INC	SALISBURY	22.10	.00	.00
MDD985419258	BENMATT INDUSTRIES	FEDERALSBURG	13.31	.00	.00
MDD982566218	BERETTA USA CORP	ACCOKEEK	34.03	.00	.00
MDD053945432	BETHLEHEM STEEL SPARROWS POINT DIVS	SPARROWS POINT	356,560.23	.00	.00
MDD046283495	BETHSHIP DIVISION BETHLEHEM STEEL C	SPARROWS POINT	672.79	.00	.00
MDD981737521	BGK TRUCKERS INN INC	JESSUP	176.21	.00	.00
MDD003065877	BLACK & DECKER INC	HAMPSTEAD	45.99	.00	.00
MDD048573158	BP OIL COMPNAY	BALTIMORE	148.43	.00	.00
MDD000797365	BROWNING FERRIS INC	GLEN BURNIE	3,454.94	.00	.00
MDD095430948	BRUNING PAINT CO	BALTIMORE	805.37	.00	.00
MDD003073905	CADMUS JOURNAL SERVICES	EASTON	15.35	.00	.00
MDD982579518	CAMBRIDGE BIOTECH CORP	ROCKVILLE	35.02	1,681.00	.00
MDD981739840	CAPITAL ELECTRO CIRCUTIS INC	GAITHERSBURG	75.31	.00	.00
MDD003073962	CELLO CORP	HAVRE DE GRACE	42.93	.00	.00
MDD050783398	CHESAPEAKE BIOLOGICAL LABS INC	BALTIMORE	29.93	55.00	.00
MDD069380657	CHESAPEAKE FINISHED METALS INC	BALTIMORE	199.61	.00	.00
MDD990686156	CHEVRON BALTIMORE TERMINAL	BALTIMORE	154.73	.00	.00
MDD985372143	CITRUS & ALLIED ESSENCES	BELCAMP	795.34	.00	.00
MDD980555189	CLEAN HARBORS OF BALTIMORE	BALTIMORE	4,730.10	594,042.00	.00
MDD010094621	COLONIAL PIPELINE CO	WOODBINE	314.45	.00	.00
MDD000731141	COLONIAL PIPELINE CO ABERDEEN JCT	FOREST HILL	90.69	.00	.00
MDD038942884	CONSOLIDATED PHARMACEUTICAL GROUP	BALTIMORE	21.56	.00	.00
MDD000620989	CROWN CENTRAL PETROLEUM CORP	BALTIMORE	17.32	.00	.00
MDD044975670	CROWN CORK & SEAL CO INC	FURITLAND	81.09	.00	.00
MDD003075942	CYTEC INDUSTRIES INC	HAVRE DE GRACE	358.39	.00	.00
MDD003255163	DURON INC	BELTSVILLE	84.10	400.00	.00
MDD092391945	E M D S INC	GAITHERSBURG	58.28	.00	.00
MDD990759375	EASTALCO ALUMINUM CO	FREDERICK	1,260.41	30.00	.00
MDD982575284	EDGEMERE	EDGEMERE	3,761.47	.00	.00
MDD147252290	ELECTRO CIRCUTIS	BALTIMORE	70.39	.00	.00
MDD071217095	ELECTROMET CORP	HAGERSTOWN	22.68	.00	.00

Note: Please refer to the introduction for an explanation of this list.

MARYLAND

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MDD003084464	ELF ATOCHEM NORTH AMERICA INC	BALTIMORE	2,227.75	.00	.00
MDD980553820	FAIRCHILD SPACE & DEFENSE CORP	GERMANTOWN	13.99	.00	.00
MD8750619621	FDA M0D1	BELTSVILLE	5.38	757.00	.00
MDD985368869	FELLOWES WORCESTER DEVISION	BELCAMP	32.60	.00	.00
MDD003071875	FMC CORP	BALTIMORE	10,428.09	.00	.00
MD8211620267	FORT DETRICK	FREDERICK	12.89	101.00	.00
MD3750832062	FREDERICK CANCER RESEARCH AND DEVEL	FREDERICK	60.89	30.87	.00
MDD049606106	GIANT FOOD INC	LANDOVER	16.67	.00	.00
MDD003091972	GM TRUCK & BUS GROUP	BALTIMORE	620.21	.00	.00
MDD001710227	GRACE DAVISION	BALTIMORE	18.45	.00	.00
MDD985423748	GRAPHIC TECHNOLOGY INC	BALTIMORE	18.42	.00	.00
MDD985384767	HATCHS AUTO BODY	SEABROOK	13.42	.00	.00
MDR000001370	HOWARD CO GATEWAY BUILDING	COLUMBIA	15.80	.00	.00
MDD077410538	INEMEC CO	BALTIMORE	109.95	.00	.00
MDD985422575	INLAND LEIDY INC	BALTIMORE	20.12	.00	.00
MDD089945950	INTERNATIONAL PAPER	ODENTON	86.00	.00	.00
MDD003072063	J M HUBER CORP	HAVRE DE GRACE	18.71	.00	.00
MDD980196695	JOHNS HOPKINS HSOPITAL	BALTIMORE	23.85	.00	.00
MDD001910777	JOHNS HOPKINS UNIVERSITY	BALTIMORE	21.89	2,043.37	.00
MDD040549461	JOHNS HOPKINS UNIVERSITY	LAUREL	13.22	667.00	.00
MDD980550735	JOHNS HOPKINS UNIVERSITY SCHOOL OF	BALTIMORE	70.25	4,295.25	.00
MDD030344253	JOSEPH E SEAGRAM & SONS INC	RELAY	30.59	.00	.00
MDD003090503	KAYDON RING & SEAL INC	BALTIMORE	120.08	.00	.00
MDD980554653	LAIDLAW ENVIRONMENTAL SERVICES	LAUREL	31.93	977.10	.00
MDD982675738	LAIDLAW ENVIRONMENTAL SERVICES	MILLERSVILLE	13.76	.00	.00
MDD985388438	LAIDLAW ENVIRONMENTAL SERVICES	FREDERICK	55.01	.00	.00
MDD003063278	LENMAR INC	BALTIMORE	536.92	.00	.00
MDD985382001	LIFE TECHNOLOGIES INC	FREDERICK	7.47	241.00	.00
MDD003419090	LOCKHEED MARTIN	BALTIMORE	428.92	.00	.00
MDD059161653	LOCKHEED MARTIN	GLEN BURNIE	14.25	.00	.00
MDD108983834	MALCO PLASTICS	OWINGS MILLS	19.15	.00	.00
MDD069386480	MARTIN MARIETTA LABS	BLATIMORE	87.29	20,565.00	.00
MDD000731356	MARYLAND ENVIRONMENTAL SERVICE	BALTIMORE	2,255.61	.00	.00
MDD030346688	MARYLAND MEDICAL MET PATH	BALTIMORE	12.67	25,333.04	.00
MDD030324073	MARYLAND PORT ADMIN	BALTIMORE	3,435.28	.00	.00
MDD985369750	MCCORMICK & CO INC	HUNT VALLEY	31.76	.00	.00
MDD981044100	MCCORMICK AND CO INC	HUNT VALLEY	39.62	.00	.00
MDD990812364	MCCORQUODALE COLOR CARD	WHITEFORD	25.73	.00	.00
MDR000001057	MED NET INC	BALTIMORE	209.50	.00	.00
MDD003102753	METAL FINISHING INC	HAGERSTOWN	61.20	.00	.00
MDD985386143	MID ATLANTIC FINSIHING INC	CAPITOL HEIGHTS	15.33	.00	.00
MDD062011796	MINERAL PIGMENTS	BELTSVILLE	45.54	.00	.00
MD9800013865	NASA GODDARD SPACE FLIGHT CENTER	GREENBELT	18.17	1,448.00	.00
MDD985386416	NATIONAL INST OF ALCOHOL	ROCKVILLE	1.27	95.48	.00
MD6150004095	NATIONAL INSTITUTES OF HEALTH	BETHESDA	167.27	2,273.57	.00
MD4170024687	NATIONAL NAVAL MEDICAL CENTER	BETHESDA	11.51	113.00	.00
MD2970590004	NATIONAL SECURITY AGENCY	FT GEORGE G MEA	260.62	.00	.00
MD5470090015	NAVAL AIR STATION	SOLOMON'S	34.06	.00	.00
MD7170024536	NAVAL AIR STATION PATUXENT RIVER	PATUXENT RIVER	133.81	.00	.00
MD4170024109	NAVAL SURFACE WARFARE CENTER	INDIAN HEAD	553.48	5.00	.00
MD6170024685	NAVAL SURFACE WARFAREA CENTER	ANNAPOLIS	16.34	17,352.00	.00
MDD000737049	NIH/NIA/GERONTOLOGY RESEARCH CENTER	BALTIMORE	5.39	156.11	.00
MDD003082997	NOXELL CORP	HUNT VALLEY	109.38	3.00	.00
MDD980919070	NOXELL CORP	COCKEYSVILLE	17.47	.00	.00
MDD981940737	OGDEN BIOSERVICES	ROCKVILLE	.53	52.70	.00

Note: Please refer to the introduction for an explanation of this list.

MARYLAND

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MDD981111206	PAM ENGINEERING INC	FREDERICK	61.98	.00	.00
MDD052340973	PATAPSCO WASTEWATER TREATMENT PLANT	BALTIMORE	223.21	.00	.00
MDD003070349	PHILIPS TECHNOLOGIES AIRPAX	CAMBRIDGE	78.78	.00	.00
MDD980918288	PPG INDUSTRIES INC	BALTIMORE	15.67	.00	.00
MDD030320709	QUEBECOR PRINTING MEMPHIS	GLEN BURNIE	118.92	.00	.00
MDD099402844	QUEST INTERNATIONAL	OWINGS MILLS	40.14	.00	.00
MDD985368968	RED STAR YEAST	BALTIMORE	23.13	.00	.00
MDD069377042	REICHHOLD CHEMICALS INC	BALTIMORE	836.52	.00	.00
MDD003063476	RHONE-POULENC	BALTIMORE	53.65	.00	.00
MDD069390839	RUST OLEUM CORP	WILLIAMSPORT	526.68	.00	.00
MDD980706097	SCHLUMBERGER MALCO INC	OWINGS MILLS	92.47	.00	.00
MDD003093507	SCM GLIDCO ORGANICS CORP	BALTIMORE	103.03	.00	.00
MDD095353348	SECURITY FENCE SUPPLY	BLADENSBURG	2,097.76	.00	.00
MDD000215160	SHERWIN WILLIAMS CO	BALTIMORE	2,345.69	.00	.00
MDD003075207	SIGNODE EASTERN OPERATIONS	BALTIMORE	78.87	.00	.00
MDD003060860	SOUTHERN GALVANIZING CO	BALTIMORE	107.35	.00	.00
MDD985369305	SPECTRA INC	CLARKSBURG	590.28	.00	.00
MDD069371847	ST SERVICES	BALTIMORE	19.83	.00	.00
MDD058594920	STONE INDUSTRIAL	COLLEGE PARK	1,066.66	.00	.00
MDD043382191	STRATUS PETROLUEM CORP	BALTIMORE	152.15	.00	.00
MDD003073095	SWEETHEART CUP CO INC	OWNINGS MILLS	63.02	.00	.00
MDD003084514	TATE ACCESS FLOORS INC	JESSUP	314.00	.00	.00
MDD063212377	TERUMO MEDICAL CORP	ELKTON	29.24	.00	.00
MDD056497589	THE FILM & CONVERTING GROUP	SALISBURY	64.98	.00	.00
MDD003067121	THIOKOL CORP	ELKTON	290.53	15.00	.00
MDD003077278	THOMAS MFG CORP	PARKTON	18.82	.00	.00
MD3210021355	U S ARMY GARRISON ABERDEEN PROVING	APG	576.91	3.70	.00
MDD005971650	UNITED STATES CAN CO	SPARROWS POINT	1,675.09	.00	.00
MDD980829873	UNIVERSITY OF MD AT COLLEGE PARK	COLLEGE PARK	78.80	3,295.00	.00
MDD021461876	UNIVERSITY OF MD BALTO EHS	BALTIMORE	20.71	5.00	.00
MD9210020567	US DEPT OF ARMY FT MEADE	FORT MEADE	45.39	6.00	.00
MD0170090021	US NAVAL ACADEMY	ANNAPOLIS	21.28	.00	.00
MD4690307844	USCG YARD SAFETY OFFICE	BALTIMORE	91.13	170.00	.00
MD5123510732	USDA ARS BELTS AGRI RESEARCH CTR	BELTSVILLE	9.83	1,876.00	.00
MDD120508940	USDA ARS BELTSVILLE AGRICULTURAL	BELTSVILLE	15.14	1,280.00	.00
MD5131531811	USDC NIST	GAITHERSBURG	16.19	146.00	.00
MDD990686222	VISTA CHEMICAL COMPANY	BALTIMORE	31,063.01	.00	.00
MDD980694012	W L GORE & ASSOCIATEDS INC	ELKTON	281.55	.00	.00
MDD982704256	W L GORE & ASSOCIATES	ELKTON	16.80	.00	.00
MDD074933961	W R GRACE & CO	COLUMBIA	96.39	1,855.00	.00
MDD022536478	WARD MACHINERY CO	COCKEYSVILLE	50.56	.00	.00
MDD985420108	WASHINGTON GAS CHILLUM	CHILLUM	36.29	.00	.00
MDD046041885	WATKINS JOHNSON CO	GAITHERSBURG	25.28	.00	.00
MDD003069721	WESTERN PUBLISHING CO INC	CAMBRIDGE	14.97	.00	.00
MDD980553994	WESTINGHOUSE ADVANCED TECH CENTER	LINTHICUM	7.18	242.00	.00
MDD000619718	WESTINGHOUSE BWI SITE	LINTHICUM	102.07	212.00	.00
MDD000218669	WESTVACO CORP	LUKE	21.71	.00	.00
MDD022688329	3M COMMERCIAL GRAPHICS DIVISION	WESTMINSTER	21.68	.00	.00

Note: Please refer to the introduction for an explanation of this list.

MARYLAND

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MDD005569454	ALLIANT TECHSYSTEMS	ANNAPOLIS	1.38	.00	.00
MDD000621144	BALTIMORE GAS & ELECTRIC CO	BALTIMORE	1.46	.00	.00
MDD000621243	BALTIMORE GAS & ELECTRIC CO	LUSBY	12.77	.00	.00
MDD101462752	BALTIMORE GAS & ELECTRIC CO	BALTIMORE	9.72	.00	.00
MDD980555486	BALTIMORE GAS & ELECTRIC CO	BALTIMORE	1.29	.00	.00
MDD980832067	BALTIMORE GAS & ELECTRIC CO	BALTIMORE	3.00	.00	.00
MDD985423789	BARRE NATIONAL INC	BALTIMORE	7.15	.00	.00
MDD981737695	BY CHEM CORP	WILLIAMSPORT	3.14	.00	.00
MDD982678997	COLOR PRELUDE INC	7600 ENERGY PAR	12.54	.00	.00
MDD985384791	CRAFTSMAN PRESS	BLADENSBURG	9.95	.00	.00
MDD003074234	CROWN CORK & SEAL CO INC	BALTIMORE	2.77	.00	.00
MDD980691455	CSX TRANSPORTATION	CUMBERLAND	1.64	.00	.00
MDD003067394	DAVIS & HAMPHILL INC	ELKRIDGE	9.07	.00	.00
MDD044147098	DRESSER INDUSTIRES	SALISBURY	9.56	.00	.00
MDD003243532	EG & G PRESSURE SCIENCE	BELTSVILLE	10.56	.00	.00
MDD008424434	EXXON CO USA	BALTIMORE	5.91	.00	.00
MD8750614804	FDA CVM	BELTSVILLE	1.20	.00	.00
MD4470000924	FOOD AND DRUG ADMIN	BALTIMORE	2.53	20.40	.00
MDD041354309	FRANCIS O DAY CO INC	ROCKVILLE	7.37	.00	.00
MD0000106310	HOWARD CO CARRS MILL LANDFILL	WOODBINE	7.65	.00	.00
MDD985412253	INDEPENDENT CAN COMPANY	BELCAMP	12.81	.00	.00
MDD053937421	K & L MICROWAVE INC	SALISBURY	12.07	.00	.00
MDD003065463	LEAVER BROTHERS CO	BALTIMORE	8.11	.00	.00
MDD980690838	LONG LIFE TREATED WOOD INC	HELERON	3.57	.00	.00
MDD074927740	LOYOLA COLLEGE	BALTIMORE	3.97	9.34	.00
MDD083501023	MARYLAND AIR NATIONAL GUARD	BALTIMORE	6.85	.00	.00
MDD985373075	MONTELL USA INC	EKLTON	6.62	.00	.00
MD5170024686	NAVAL SURFACE WARFARE CENTER	BETHESDA	4.30	.00	.00
MD4170090001	NAVEODTECHDIV	INDIAN HEAD	12.22	.00	.00
MD0000374785	NEW CHESAPEAKE CADILLAC JAGUAR	COCKEYSVILLE	2.96	.00	.00
MD7750014667	NIH ANIMAL CENTER	POOLESVILLE	.20	2.43	.00
MD0000027326	NIH NIAAA	KENSINGTON	.29	2.65	.00
MDD091818930	NIRO INC	COLUMBIA	11.75	.00	.00
MDD003065117	OLSON WIRE PRODUCTS CO INC	BALTIMORE	3.97	.00	.00
MDD131481038	PATS INC	COLUMBIA	2.97	.00	.00
MDD003064375	PERDUE INCORP	SALISBURY	4.17	.00	.00
MD0000136648	PHARMAKINETICS LABORATORIES INC	BALTIMORE	8.86	.00	.00
MDD000804963	PIER SOL INC	BALTIMORE	5.40	.00	.00
MDD000731596	POTOMAC ELECTRIC POWER CO	DICKERSON	8.63	.00	.00
MDD053936464	POTOMAC ELECTRIC POWER CO	NEWBURG	9.70	.00	.00
MDD064846959	PROTO CIRCUITS	ROCKVILLE	9.23	.00	.00
MDD003093515	SCM CHEMICALS	BALTIMORE	2.19	.00	.00
MDD044148856	SHELL OIL CO	BALTIMORE	12.45	.00	.00
MD6470090006	SMITHSONIAN INSTITUTE	SUITLAND	4.02	.00	.00
MDD000647636	STATE HWY ADMIN	BROOKLANDVILLE	3.62	.00	.00
MDD048567523	TEXACO/STAR ENTERPRISE SALES	BALTIMORE	5.96	.00	.00
MDD044142123	THE ISPA CO	BALTIMORE	12.58	.00	.00
MDD050793926	TOWSON STATE UNIVERSITY	TOWSON	8.21	.00	.00
MDD985368612	TRANSCONTINENTAL GAS	ELLICOTT CITY	11.01	.00	.00
MD8213822762	US ARMY RESEARCH LAB	ADELPHI	5.01	2.00	.00
MD0000634717	US EPA REGION III RMR SITE	ELKTON	1.56	.00	.00
MD8210020758	USAG FORT RITCHIE	FORT RITCHIE	3.17	.00	.00
MDD004383402	WESTINGHOUSE ELECTRIC CORP	ANNAPOLIS	5.83	.00	.00

Note: Please refer to the introduction for an explanation of this list.

MARYLAND

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO CANNOT BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- LESS THAN 1.1 TONS RCRA HAZARDOUS WASTE, AND
- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MDD980829345	BALTIMORE GAS & ELECTRIC CO	BALTIMORE	1.08	.00	.00
MDD981107972	CARROLL CO MAINT CTR	WESTMINSTER	.72	.00	.00
MDD981945579	MONTGOMERY CO TRANSFER STATION	DERWOOD	.00	.00	.00
MDD000737106	SAFETY KLEEN CORP	GLEN BURNIE	.30	.00	.00
MDD000737395	SAFETY KLEEN CORP	SILVER SPRING	.00	.00	.00
MDD981034291	SAFETY KLEEN CORP	BALTIMORE	.81	.00	.00
MDD985370048	SOUTHERN MD ELECTRIC COOP INC	HUGHESVILLE	.45	.00	.00
MDD083509836	TRI STATE ENVELOPE CORP	BELTSVILLE	.00	.00	.00
MDD990759631	WESTINGHOUSE ELECTRIC CORP	HUNT VALLEY	.39	.00	.00
MDD042183566	WESTINGHOUSE ELECTRIC CORP MITS	SYKESVILLE	.74	.00	.00

Note: Please refer to the introduction for an explanation of this list.

MASSACHUSETTS

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MAD001005370	A T & T NETWORK SYSTEMS	N. ANDOVER	268.06	268.00	.00
MAD053459673	A.W. CHESTERTOWN	GROVELAND	16.41	.00	.00
MAD047058565	ACCURATE METAL FINISHING INC.	RANDOLPH	19.08	.00	.00
MAD985268721	ACME PRINTING CO.	WILMINGTON	40.65	.00	.00
MAD001046408	ACTON METAL PROCESSING CORPORATION	WALTHAM	65.84	.00	.00
MAD001025170	ACUSHNET CO. TITELIST & FOOT-JOY WR	ACUSHNET	22.27	.00	.00
MAD062319777	AEROVOX INC.	NEW BEDFORD	96.18	.00	.00
MAD000842377	AGFA DIVISION, BAYER CORP.	WILMINGTON	289.70	.00	.00
MAD001014174	AGFA DIVISION, BAYER CORP.	WILMINGTON	124.66	.00	.00
MAD001061001	ALBEROX CORPORATION	NEW BEDFORD	20.27	103.00	.00
MAD002423267	ALLEGRO MICROSYSTEMS, INC,.	WORCESTER	61.46	.00	.00
MAD985276518	ALPHA ANALYTICAL LABORATORY	WESTBORO	20.92	1,708.17	.00
MAD001030311	ALPHA INDUSTRIES, INC.	WOBURN	16.81	55.00	.00
MAD981067234	ALTERNATE CIRCUIT TECHNOLOGY	HAVERHILL	2,850.59	.00	.00
MAD990886301	ALTRON INCORPORATED	WILLMINGTON	1,530.95	.00	.00
MAR000006528	AMERICAN GRAVURE ENGRAVING	HOLYOKE	24.97	.00	.00
MAD980522817	AMERICAN INSULATED WIRE, INC.	SO. ATTLEBORO	97.28	.00	.00
MAD981213556	AMERICAN LIGHTING FIXTURES	TAUNTON	34.03	.00	.00
MAD001127224	AMERICAN OPTICAL CORPORATION	SOUTHBRIDGE	166.88	.00	.00
MAD001005990	AMERICRAFT CARTON INC.	LOWELL	15.00	.00	.00
MAD980730980	AMICON, INC.	DANVERS	42.72	.00	.00
MAD000649640	ANALOG DEVICES SEMICONDUCTOR	WILMINGTON	188.86	.00	.00
MAD980732614	ANIKA RESEARCH, INC.	WOBURN	88.59	.00	.00
MAD057988123	ANITEC PRINTING PLATES	HOLYOKE	13.76	.00	.00
MAD083391839	ANITEC PRINTING PLATES	HOLYOKE	85.33	.00	.00
MA0210092730	ARNG TRAINING SITE	CAMP EDWARDS	14.53	.00	.00
MAD981207566	ASHLAND CHEMICAL, CO.	TEWSBURY	75.28	.00	.00
MA5000000091	AULSON CO., INC.	MIDDLETON	45.00	.00	.00
MAD059706937	AXTON CROSS CO., INC.	HOLLISTON	35.42	3,675.00	.00
MA5000000323	B F GOODRICH	LEOMINISTER	204.52	.00	.00
MAD075348912	BALL-FOSTER GLASS CONTAINER, CO.	MILFORD	173.32	.00	.00
MAD980914519	BARD VASCULAR SYSTEMS DIVISION	BILLERICA	24.74	110.00	.00
MAD055322861	BARRY CONTROLS	BRIGHTON	19.66	.00	.00
MAD985312404	BASF CORP.	HOLYOKE	16.76	.00	.00
MAD071723621	BETH ISRAEL HOSPITAL	BOSTON	60.92	9.00	.00
MAD039324009	BIRD INCORPORATED	NORWOOD	38.03	.00	.00
MAD981062995	BLH ELECTRONICS, INC.	CANTON	22.05	.00	.00
MAD088977186	BORDEN & REMINGTON CORPORATION	FALL RIVER	20.73	808.53	.00
MAD001039767	BOSTIK INC.	MIDDLETON	1,105.91	.00	.00
MAD076575513	BOSTON EDISON COMPANY	DORCHESTER	436.99	.00	.00
MAD006955850	BP OIL COMPANY	REVERE	20.64	.00	.00
MAD982543357	BRADFORD INDUSTRIES, INC.	LOWELL	60.51	.00	.00
MAD042129064	BRAININ ADVANCE INDUSTRIES	ATTLEBORO	43.22	.00	.00
MAD055742761	BROOKFIELD WIRE CO., INC	BROOKLINE	111.26	.00	.00
MAD022960413	BRUSH WELLMAN, INC.	NEWBURYPORT	43.07	.00	.00
MAD076590652	BULL ELECTRONICS	BRIGHTON	487.18	.00	.00
MAD985290964	C.G.I. CIRCUITS, INC.	TAUNTON	43.02	.00	.00
MAD001008093	C.L. HAUTHAWAY & SONS	LYNN	162.65	.00	.00
MAD001034016	CAMBRIDGE PLATING COMPANY	BELMONT	72.62	.00	.00
MAD053451019	CAMGER CHEMICAL SYSTEMS, INC.	NORFOLK	14.88	.00	.00
MAD049441512	CAPITOL CIRCUIT CORPORATION	ALLSTON	2,675.48	.00	.00
MAD048975742	CHAMBERLAIN MFG. CORP.	NEW BEDFORD	53.50	.00	.00
MAD980912323	CHEMDESIGN CORPORATION	FITCHBURG	3,323.63	6.00	.00
MAD041172719	CHEMET CORPORATION	ATTLEBORO	40.08	.00	.00
MAD991289505	CHILDREN'S HOSPITAL CORP.	BOSTON	18.20	.00	.00

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MASSACHUSETTS

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MAD001419514	CHOMERICS, INC.	WOBURN	3,090.72	40.00	.00
MAD000844126	CIBA CORNING DIAGNOSTICS CORP.	EAST WALPOLE	38.39	115.00	.00
MAD985314293	CIRCUIT BOARD EXPRESS	WARDHILL	18.96	.00	.00
MAD000844100	CITGO PETROLEUM CORP.	EAST BRAINTREE	2,308.57	.00	.00
MAD981215353	CLEAN HARBORS ENVIRONMENTAL SERVICE	BRAINTREE	32.89	46,720.18	.00
MAD053452637	CLEAN HARBORS OF BRAINTREE, INC	BRAINTREE	260.58	.00	.00
MAD980523203	CLEAN HARBORS OF NATICK, INC	NATICK	21.56	2,040.07	.00
MAD049424237	COASTAL METAL FINISHING	MERRIMAC	40.28	.00	.00
MAD065160137	COASTAL OIL NEW ENGLAND, INC.	REVERE	27.60	.00	.00
MAD001115609	COLUMBIA MANUFACTURING	WESTFIELD	21.68	.00	.00
MAD069350478	COPLEY PHARMACEUTICAL INC.	CANTON	41.95	28.00	.00
MAD047982152	COYNE TEXTILES SERVICES	NEW BEDFORD	1,079.87	.00	.00
MAD981063001	CPC INCORPORATED	RANDOLPH	122.98	.00	.00
MAD980671747	CRAIG SYSTEMS CORP.	AMESBURY	19.35	.00	.00
MAD082303777	CYN OIL CORPORATION	STOUGHTON	629.78	.00	.00
MAD076580745	DANA FARBER CANCER INSTITUTE	BOSTON	25.26	125.00	.00
MAD981061419	DANAHER TOOL	SPRINGFIELD	41.08	.00	.00
MAD001024306	DANIELS PRINTING COMPANY	EVERETT	40.48	.00	.00
MAD981210222	DATA INSTRUMENTS, INC.	ACTON	36.33	.00	.00
MAD073801631	DAV-TECH PLATING, INC.	MARLBORO	5,541.11	.00	.00
MAD071723563	DEACONESS HOSPITAL	BOSTON	22.29	430.00	.00
MA5000001859	DENNECREPE CORPORATION	FRAMINGHAM	125.20	.00	.00
MAD001016302	DENNISON MFG. CO.	FRAMINGHAM	2,774.56	.00	.00
MA7210025154	DEPARTMENT OF THE ARMY DEVENS RESER	DEVENS	832.48	.00	.00
MAD000829986	DIGITAL EQUIPMENT CORP.	HUDSON	36.86	.00	.00
MAD001047620	DUNCAN GALVANIZING INC.	EVERETT	358.64	.00	.00
MAD985285758	DUPONT MERCK PHARMACEUTICAL CO.	NORTH BILLERICA	37.22	179.00	.00
MAD030826143	DUPONT NEN PRODUCTS	NORTH BILLERICA	3.09	131.00	.00
MAD981062904	DURACELL, INC.	NEEHAM	36.99	.00	.00
MAD000790675	E.I. DUPONT DENEMOURS CO.	WILMINGTON	26.29	.00	.00
MAD001113059	EASTERN ETCHING MFG	CHICPEE	489.13	.00	.00
MAD980525505	EASTERN MANUFACTURING CORP.	AMESBURY	4,651.97	.00	.00
MAD001017862	EASTERN REPRODUCTION CORP.	WALTHAM	99.04	.00	.00
MAD106768344	EATON CORPORATION	BEVERLY	15.21	.00	.00
MAD001138726	ECC CORPORATION	HOLDEN	244.51	.00	.00
MAD985277219	EISAI RESEARCH INSTITUTE OF BOSTON,	ANDOVER	21.69	20.00	.00
MA5000000125	ELECTROSWITCH	ROCKLAND	132.97	.00	.00
MA5000001198	ELITE CHEMICAL	SPRINGFIELD	17.10	.00	.00
MAD001419274	EPEC, INC.	NEW BEDFORD	141.29	.00	.00
MAD985280825	ESP LOCK PRODUCTS, INC.	LEOMINSTER	160.92	.00	.00
MAD000842427	EXXON CO. USA, EVERETT TERMINAL	EVERETT	798.07	.00	.00
MAD985289032	EXXON COMPANY-31167	MASHPEE	20.70	.00	.00
MAD001036276	F.M. CALLAHAN & SON, INC.	MALDEN	36.83	121.00	.00
MAD079506085	FEDERL METAL FINISHING, INC.	CHARLESTOWN	9,232.20	.00	.00
MAD990893034	FLEXCON COMPANY, INC.;	SPENCER	83.37	.00	.00
MAD001136035	FLEXCON INDUSTRIAL PARK	SPENCER	383.72	.00	.00
MAD981074875	FOILMARK MANUFACTURING CORP.	NEWBURYPORT	42.18	.00	.00
MAR000006221	FORMER FILTEK PROPERTY	BEVERLY	53.76	.00	.00
MAD084814136	FRANKLIN ENVIRONMENTAL SERVICES	WRENTHAM	26.08	.00	.00
MAD985294222	FT ROSE SITE	LANESBORO	64.17	.00	.00
MAD001128115	FURON	WORCESTER	487.43	.00	.00
MAD155318066	GAC PRINTED CIRCUITS	LOWELL	43.19	.00	.00
MAD065781197	GALILEO ELECTRO OPTICS CORP.	STURBRIDGE	60.42	.00	.00
MAD001027325	GARE INCORPORATED	HAVERHILL	19.56	.00	.00
MAD019371079	GENERAL CHEMICAL CORPORATION	FRAMINGHAM	818.77	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MAD002084093	GENERAL ELECTRIC	PITTSFIELD	938.76	.00	.00
MAD001408491	GENERAL ELECTRIC AIRCRAFT ENGINES	LYNN	3,392.85	.00	.00
MAD001408517	GENERAL ELECTRIC AIRCRAFT ENGINES	LYNN	1,232.10	.00	.00
MAD001439546	GENERAL ELECTRIC CO.	FITCHBURG	19.79	.00	.00
MAD063894786	GENERAL METAL FINISHING CO., INC.	ATTLEBORO	125.84	.00	.00
MAD982196172	GENETICS INSTITUTE	ANDOVER	38.87	21.00	.00
MAD980673065	GENETICS INSTITUTE, INC.	CAMBRIDGE	8.79	111.00	.00
MAD981207822	GENZYME CORP.	CAMBRIDGE	230.56	.00	.00
MAD121617534	GI PLASTEK	NEWBURYPORT	19.90	.00	.00
MAD066605809	GILLETTE MANUFACTURING (USA), INC.	BOSTON	4,471.89	10.00	.00
MAD094277571	GLOBAL PETROLEUM CORP.	REVERE	187.30	.00	.00
MAD001033190	GLOBE MANUFACTURING CO.	FALL RIVER	33.01	.00	.00
MAD980909956	GLOBE NEWSPAPER COMPANY	NORTH BILLERICA	24.72	.00	.00
MAD001408483	GLYPTAL, INC	CHELSEA	59.72	.00	.00
MAD002297968	GOULD ELECTRONICS INC.	NEWBURYPORT	21.65	.00	.00
MAD985268556	GTE GOVERNMENT SYSTEMS CORP.	TAUNTON	13.44	.00	.00
MAD991302712	H. C. STARCK, INC.	NEWTON	93.14	.00	.00
MAD981889678	H&R 1871 INC.	GARDNER	53.77	.00	.00
MAD046613279	HANDY & HARMAN ATTLEBORO REFINING D	ATTLEBORO	96.85	.00	.00
MAD048974349	HANDY AND HARMAN ELECTRONIC MATERIA	NORTH ATTLEBORO	692.28	.00	.00
MAD001963263	HARVARD UNIVERSITY-CAMBRIDGE CAMPUS	CMBRIDGE	55.34	.00	.00
MAD000846287	HARVARD UNIVERSITY-LONGWOOD CAMPUS	BOSTON	30.50	134.00	.00
MAD001117597	HAZEN PAPER CO.	HOLYOKE	132.08	.00	.00
MAD001113463	HEATBATH CORPORATION	INDIAN ORCHARD	18.95	.00	.00
MAD001028646	HEWLETT-PACKARD COMPANY	WALTHAM	30.74	.00	.00
MAD086534864	HEWLETT-PACKARD COMPANY	ANDOVER	13.58	.00	.00
MAD980672422	HI-TECH PLATING/THE N.E. TINNING CO	EVERETT	215.94	.00	.00
MA5000001792	HYBRIDON INC.	MILFORD	39.91	.00	.00
MAR000005884	HYDRIDON INC.	WORCESTER	19.27	.00	.00
MAD001065069	I T W DEVCON	DANVERS	42.09	.00	.00
MAD056019979	IDEAL TAPE CO.	LOWELL	340.08	.00	.00
MAD981204316	IMI INC.	HAVERHILL	16.37	.00	.00
MAD985294305	IMMULOGIC PHARMACEUTICAL CORP.	WALTHAM	51.45	.00	.00
MAD001133073	INDEPENDENT PLATING, CO.	WORCESTER	95.27	.00	.00
MAD040094724	INDUSTRIAL BLAST COIL CORP.	SOUTH EASTON	21.60	.00	.00
MAD001116359	INDUSTRIAL ETCHING, INC.	E. LONGMEADOW	92.84	.00	.00
MAD000842468	INDUSTRIAL HEAT TREATING	N. QUINCY	55.53	.00	.00
MAD981215411	INNOVATIVE MEMBRANE SYSTEMS INC.	NORWOOD	92.77	.00	.00
MAD001046325	IONICS, INCORPORATED	WATERTOWN, MA	134.03	.00	.00
MAD985290675	ITW ABHENSIVE SYSTEMS	DANVERS	30.24	.00	.00
MAD001019470	IVEX CORPORATION	NEWTON	29.27	.00	.00
MAD001040195	JAP ENAMELAC CORPORATION	CHELMSFORD	15.82	.00	.00
MAD985280858	JOHNSON MATTHEY	WARD HILL	1.68	51.00	.00
MAD985288414	KAO INFOSYSTEMS CO.	PLYMOUTH	69.03	.00	.00
MAD059716597	KIDDIE-FENWAL, INC.	ASHLAND	40.14	.00	.00
MAD094277266	KOCH MEMBRANE SYSTEMS, INC.	WILMINGTON	26.87	.00	.00
MAD094266459	KOMTEK	WORCESTER	83.21	.00	.00
MAD001125681	L S STARRETT COMPANY	ATHOL	135.95	.00	.00
MAD001055805	LAIDLAW CHEMICAL SERVICES, INC.	NORTH ANDOVER	20.25	.00	.00
MAD000604447	LAIDLAW ENVIRONMENTAL SERVICES	LAWRENCE	410.42	500.00	.00
MAD985266782	LAWREENCE MARTIN LAB.-MGH EAST	CHARLESTOWN	27.68	1,319.40	.00
MAD980668230	LEACH & GARNER COMPANY, GENERAL FIN	NORTH ATTLEBORO	20.05	40.00	.00
MAD980522577	LEWCOTT CORPORATION	MILLBURY	18.98	.00	.00
MAD001440155	LILLY INDUSTRIES (USA) INC.	TEMPLETON	133.47	31,997.89	.00
MAD048266324	LINDBERG CORP.	BOSTON	104.68	.00	.00

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MAD051782753	LINDBERG CORPORATION	NORWOOD	479.41	.00	.00
MAD001015650	LORAL INFRARED & IMAGING SYSTEMS, I	LEXINGTON	65.57	.00	.00
MAD982711871	LUDLOW TECHNICAL PRODUCTS	CHICOPEE	18.47	.00	.00
MAD001424985	M I T LINCOLN LABORATORY	LEXINGTON	27.21	524.00	.00
MAD001003334	M.W.CARR CO., INC.	SOMERVILLE	18.45	.00	.00
MAD980672398	M/A-COM, INC.	LOWELL	54.37	120.00	.00
MAD000189068	M/A-COM, INC.	BURLINGTON	23.78	10.00	.00
MAD985307560	M/A/-COM, INC.	LOWELL	4,862.02	16.00	.00
MAD981071707	MA NATIONAL GUARD OMS 15 & CMS	FORT DEVENS / A	16.14	.00	.00
MAD058898776	MADICO, INC	WOBURN	174.60	.00	.00
MAD058889031	MAJILITE MANUFACTURING,INC .	LOWELL	106.08	.00	.00
MAD001030576	MALDEN MILLS INDUSTRIES, INC.	LAWRENCE	70.63	.00	.00
MAD985294347	MARTIN MARIETTA CORP.	PITTSFIELD	28.62	.00	.00
MAD001060698	MARTIN MARIETTA CORPORATION	BURLINGTON	20.07	.00	.00
MAD982710618	MASS. CENTER DISEASE CONTROL-LAB. I	JAMACIA PLAIN	37.79	145.00	.00
MA5000001040	MASS. HIGHWAY DEPT./CENTRAL ARTERY/	BOSTON	25.48	.00	.00
MAD001425594	MASS. INSTITUTE OF TECHNOLOGY	CAMBRIDGE	252.03	681.00	.00
MA5000001404	MASSACHUSETTS COLLEGE OF ART	BOSTON	23.62	.00	.00
MAD073130411	MASSACHUSETTS GENERAL HOSPITAL	BOSTON	182.30	6,925.30	.00
MAD985307826	MASSPOWER	INDIAN ORCHARD	25.10	.00	.00
MAD000001776	MATERIALS UNLIMITED	TEMPLETON	28.29	.00	.00
MAD066610585	MATHESON	GLOUCESTER	34.79	.00	.00
MAD121626287	MICRON SEPARATION, INC.	WESTBOROUGH RD.	38.69	.00	.00
MAD001414879	MICROSEMI CORPORATION	WATERTOWN	104.24	.00	.00
MAD047648829	MICROWAVE PRINTED CIRCUITRY	LOWELL	27.29	.00	.00
MAD001050152	MILLIPORE CORP.	BEDFORD	73.41	.00	.00
MAD000842740	MILTON BRADLEY	EAST LONGMEADOW	4.42	440.01	.00
MAD000846147	MOBIL OIL	SPRINGFIELD	41.32	.00	.00
MAD985296151	MOBIL OIL CORP SSJFA	TEWKSBURY	16.68	.00	.00
MAD985293844	MOLTEN METAL TECHNOLOGY, INC.	FALL RIVER	70.12	.00	.00
MAD001114818	MONSANTO CHEMICAL COMPANY	SPRINGFIELD	4,620.40	.00	.00
MAD990894172	MONSANTO CO.	EVERETT	112.90	.00	.00
MAD001022375	MORTON INTERNATIONAL	BEVERLY	856.38	.00	.00
MAD087452611	MORTON INTERNATIONAL CHICOPEE FACIL	CHICOPEE	115.34	.00	.00
MAD980523344	MULTI-LAB., INC.	LAWERENCE	607.25	.00	.00
MAD001066059	MYSTIC PLATING CO.	MEDFORD	7,493.71	.00	.00
MAD001122381	NATIONAL METAL FINISHING CORP.	SPRINGFIELD	27,979.40	.00	.00
MA2170022022	NAVAL AIR STATION	SOUTH WEYMOUTH	13.93	.00	.00
MAD079532263	NEW ENGLAND MEDICAL CENTER	BOSTON	18.80	962.00	.00
MAD001132331	NEW ENGLAND PLATING CO., INC.	WORCESTER	166.68	.00	.00
MAD980731681	NEW ENGLAND POWER-BUCKLAND STATION	BUCKLAND	15.00	.00	.00
MAD001126861	NEW METHOD PLATING CO. INC.	WORCESTER	37.75	.00	.00
MAD001125640	NICHOLAS & STONE CO.	GARDNER	25.09	.00	.00
MAD001423631	NORTHEASTERN UNIVERSITY	BOSTON	11.83	215.00	.00
MAD001829662	NORTHROP GRUMMAN CORP.	NORWOOD	8.54	110.00	.00
MAD000192559	NOVACOR CHEMICALS INC.	LEOMINSTER	24.63	.00	.00
MAD981887268	NOVACOR CHEMICALS, INC.	INDIAN ORCHARD	1,380.40	.00	.00
MAD981065451	OLIN AEGIS	NEW BEDFORD	36.45	.00	.00
MAD001403104	OLIN CORP.	WILMINGTON	29.80	.00	.00
MAD985290865	OMNIGLOW CORPORATION	W. SPRINGFIELD	155.42	.00	.00
MAD080031180	OSRAM SYLVANIA INC.	DANVERS	298.56	.00	.00
MAD051778934	PARLEX CORPORATION	METHUEN	412.43	.00	.00
MAD083379420	PCI GROUP / J.C. RHODES	NEW BEDFORD	37.84	.00	.00
MAD043413400	PER-MARK PRINTED CIRCUITS, INC.	NORWWOD	18.67	.00	.00
MAD981066731	PERSEPTIVE BIOSYSTEMS, INC.	BEDFORD	45.61	.00	.00

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MAD985287440	PERSEPTIVE BIOSYSTEMS, INC.	CAMBRIDGE	144.98	.00	.00
MAD982198434	PHAR-ECO LABORATORIES INC.	NORTH ANDOVER	169.26	.00	.00
MA5000001578	PHARM-ECO LABORATORIES INC.	LEXINGTON	27.78	145.00	.00
MAD981069701	PHARMASOL CORPORATION	S. EASTON	41.52	.00	.00
MAD980912992	PHOTOFABRICATION ENGINEERING, INC.	MILFORD	27.49	.00	.00
MAD981074156	PLATING FOR ELECTRONICS	WALTHAM	63.85	.00	.00
MAD001021245	PLATING TECHNOLOGY INC.	NEW BEDFORD	82.61	.00	.00
MAD001402320	POLAROID CORP	WALTHAM	32,505.92	.00	.00
MAD000846451	POLAROID CORP.	CAMBRIDGE	145.38	.00	.00
MAD000846469	POLAROID CORPORATION	CAMBRIDGE	19.21	.00	.00
MAD000846493	POLAROID CORPORATION	ASSONET	1,220.11	458.72	.00
MAD043409879	POLAROID CORPORATION	WALTHAM	97.83	.00	.00
MAD058060476	POLAROID CORPORATION	NEW BEDFORD	634.42	.00	.00
MAD062163191	POLAROID CORPORATION	NORWOOD	113,020.05	.00	.00
MAD981896129	POLY ORGANIX, INC.	NEWBURYPORT	3,564.34	6,578.00	.00
MAD065785776	POLYCLAD LAMINATES, INC.	MILLBURY	27.20	.00	.00
MAD002081651	POLYFIBRON TECHNOLOGIES, INC	ADAMS	41.84	.00	.00
MAD054430095	POLYMETAL FINISHING INC.	SPRINGFIELD	39.20	.00	.00
MAD001012244	PRINTED CIRCUIT CORPORATION	WOBURN	85.05	.00	.00
MAD985294602	PROFESSIONAL CONTRACT STER.	TAUNTON	48.17	.00	.00
MAD982194482	PROTO TECHNOLOGY CORP.	CLINTON	61.38	.00	.00
MAR000006726	QUANTUM CORP.	SHREWBURY	115,449.65	.00	.00
MAD000636373	RAYTHEON COMMPANY	WALTHAM	29.67	.00	.00
MAD001055235	RAYTHEON COMPANY	ANDOVER	518.90	110.00	.00
MAD001411016	RAYTHEON COMPANY	QUICY	15.25	.00	.00
MAD001411081	RAYTHEON COMPANY	LOWELL	182.57	281.00	.00
MAD001410539	RAYTHEON COMPANY - RES	SUDBURY	27.39	24.80	.00
MAD980913172	RAYTHEON COMPANY ADVANCED DEVICE CT	ANDOVER	57.77	.00	.00
MAD001339159	RAYTHEON COMPANY ELEC. SYSTMS. LABS	LEXINGTON	27.49	22.00	.00
MAD001923408	RAYTHEON COMPANY, ELECTRONIC SYSTEM	WALTHAM	147.21	20.00	.00
MAD990685554	RAYTHEON ELECTRONIC SERVICES	WAYLAND	63.14	75.00	.00
MAD001011071	REED & BARTON CORP.	TAUNTON	37.65	.00	.00
MAD001065937	REVERE COPPER PRODUCTS, INC.	NEW BEDFORD	145.99	.00	.00
MAD001064963	REVERE GRAPHICS WORLDWIDE	PLYMOUTH	58.77	.00	.00
MAD001434299	REXAM DSI	WEST SPRINGFIEL	45.95	.00	.00
MAD985293802	REXAM GRAPHICS	SOUTH HADLEY	1,065.63	.00	.00
MAD001035971	ROCHE BROS. BARREL & DRUM CO.	LOWELL	89.14	.00	.00
MAD981070410	ROHM TECH INC.	MALDEN	74.37	.00	.00
MAD985307610	ROHM TECH, INC.	FITCHBURG	18.93	.00	.00
MAD080812431	ROSEMAR SILVER	NORTH DIGHTON	67.92	.00	.00
MAD009870643	ROY BROS., INC.	BILLERICA	41.98	.00	.00
MAD981062797	RULE CUTTING TOOL, INC.	SOUTH DEERFIELD	61.93	.00	.00
MAD001015429	RUSSELECTRIC	HINGHAM	31.86	.00	.00
MAD982755639	SAFETY-KLEEN CORP	CANTON	38.16	.00	.00
MAD001126234	SAINT-GOBAIN REALTY TRUST NORTON CO	WORCESTER	64.46	.00	.00
MAD981067515	SAMUEL CABOT INC.	NEWBURYPORT	32.67	.00	.00
MAD001116938	SAVAGE ARMS, INC.	WESTFIELD	64.58	.00	.00
MAD980730857	SCHOTT FIBER OPTICS, INC.	SOUTHBRIDGE	42.42	.00	.00
MAD047063896	SEMICON COMPONENTS	BURLINGTON	24.45	.00	.00
MAD066586884	SENIOR FLEXONICS-METAL BELLOW DIV.	SHARON	13.26	.00	.00
MAD001005289	SERVOLIFT/EASTERN CORP.	BOSTON	36.41	.00	.00
MAD981069008	SHAWMUT MILLS	WEST BRIDGEWATE	60.17	.00	.00
MAD000844498	SHIPLEY COMPANY LLC	MARLBOROUGH	576.15	.00	.00
MAD000844282	SIMPLEX TIME RECORDER CO.	GARDNER	42.27	.00	.00
MAD001114206	SMITH & WESSON	SPRINGFIELD	112,213.67	.00	.00

Note: Please refer to the introduction for an explanation of this list.

MASSACHUSETTS

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MAD001113331	SPAULDING SPORTS WPORLDWIDE	CHICOPEE	66.73	.00	.00
MAD080036163	SPRINGBORN LABORATORIES, INC.	WAREHAM	26.02	191.00	.00
MAD000844977	STAHL USA	PEABODY	173.69	.00	.00
MAD048662944	STANDARD PLATING, INC.	WEST SPRINGFILD	66.86	.00	.00
MAD002578227	STANLEY CREATIVE RIVET	TAUNTON	16.23	.00	.00
MAD981062284	SUPERCON, INC.	SHREWSBURY	417.56	.00	.00
MAD001041383	SURFACE COATINGS, INC.	WILMINGTON	136.04	.00	.00
MAD001842764	SURPENANT CABLE CORP.	CLINTON	111.15	.00	.00
MAD001202340	SWANK INCORPORATED	ATTLEBORO	23.26	.00	.00
MAD980525638	SWISSTRONICS, INC.	WATERTOWN	37.03	.00	.00
MAD041710609	TECH-ETCH, INC.	PLYMOUTH	259.09	.00	.00
MAD001067941	TELEDYNE RODNEY METALS	NEW BEDFORD	121.14	.00	.00
MAD985268119	TEWKSBURY INDUSTRIES, INC.	TEWKSBURY	54.08	.00	.00
MAD007325814	TEXAS INSTRUMENTS INC.	ATTLEBORO	974.07	.00	.00
MAD000639054	TEXTRON SPECIALTY MATERIALS	LOWELL	29.82	.00	.00
MAD097437982	TEXTRON SPECIALTY MATERIALS	LOWELL	38.35	.00	.00
MAD001013994	THE FOXBORO COMPANY	FOXBORO	4,529.92	.00	.00
MAD053483467	THE GILLETTE COMPANY	ANDOVER	33.27	.00	.00
MAD000133496	TITEFLEX CORPORATION	SPRINGFIELD	28.98	.00	.00
MAD985276914	TOWN AND COUNTRY MANUFACTURINR	CHELSEA	80.47	.00	.00
MAD985294057	TRI-STAR TECHNOLOGIES CO., INC.	METHUEN	694.30	.00	.00
MAD000829994	TUBED PRODUCTS INC.	EASTHAMPTON	20.02	.00	.00
MAD099198178	TUFTS UNIVERITY MEDICAL SCHOOL	BOSTON	13.79	230.00	.00
MA9750615388	U.S. FOOD AND DRUG ADMINISTRATION	WINCHESTER	1.58	467.72	.00
MAD043066323	UNITED CIRCUITS, INC.	DRACUT	68.92	.00	.00
MAD075347500	UNIVER. OF MASS. MEDICAL CENTER	WORCESTER	5.73	11,466.00	.00
MAD000844670	UNIVERSITY OF MASS. / AMHERST	AMHERST	32.42	131.00	.00
MAD991302365	UNIVERSITY OF MASS. BOSTON	BOSTON	10.91	958.29	.00
MA8570024424	US AIR FORCE HANSCOM AIR FORCE BASE	HANSCOM AFB	39.26	.00	.00
MAD087139945	USCI DIVISION, C.R. BARD, INC.	BILLERICA	12.58	.00	253.54
MAD980731269	V.H. BLACKINTON & CO., INC.	ATTLEBORO FALLS	20.19	.00	.00
MAD980672216	VALLEY PLATING INC.	SPRINGFIELD	118.74	.00	.00
MAD985290154	VAN LEER METALLIZED PRODUCTS	FRANKLIN	47.28	.00	.00
MAD001764794	VAN WATERS AND ROGERS, INC.	SALEM	369.32	.00	.00
MAD021008206	VENTURE TAPE CORP.	ROCKLAND	64.24	.00	.00
MAD985290980	WAKEFIELD ENGINEERING	FALL RIVER	488.02	.00	.00
MAD001197755	WALTON & LONBSBURY, INC	ATTLEBORO	14.60	.00	.00
MAD000844597	WATERS CORP.	TAUNTON	750.68	.00	.00
MAD001047968	WATERS CORPORATION	MILFORD	26.72	15.00	.00
MA0570024026	WEST AIR RESERVE BASE	CHICOPEE	14.74	.00	.00
MAD001119502	WESTFIELD COATINGS CORP.	WESTFIELD	146.30	.00	.00
MAD062173497	WESTFORD ANODIZING CORPORATION	WESTFORD	43.69	.00	.00
MAD000844522	WESTVACO, ENVELOPE DIVISION	SPRINGFIELD	42.07	.00	.00
MAD001128032	WYMAN-GORDON COMPANY	NORTH GRAFTON	95,953.46	.00	.00
MAD052924495	ZECCO, INC.	NORTHBORO	1,002.86	.00	.00
MAD048269062	ZENECA RESINS	WILMINGTON	137.98	5.00	.00
MAD051505477	ZENECA SPECIALTIES	DIGHTON	151.07	10.00	.00
MAD981894389	0005-1904 SUNOCO SERVICE STATION	N. ABINGTON	34.17	.00	.00
MA2570024487	102 FW/EM	OTIS ANG BASE	758.20	.00	.00

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MASSACHUSETTS

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MAD985276344	ACUSHNET CO. TITLEIST AND FOOT-JOY	DARTMOUTH	4.90	.00	.00
MAD985276948	ACUSHNET CO., TITLEIST AND FOOT-JOY	NEW BEDFORD	10.87	.00	.00
MA8690330719	AIR STATION CAPE COD	OTIS, ANGB	10.34	10.00	.00
MAR000006080	AMERICAN ANNUITY GROUP, INC.	NORTH ADAMS	12.93	.00	.00
MAD053449393	AMETEK AEROSPACE PRODUCTS, INC.	WILMINGTON	6.62	.00	.00
MAD980916548	ANALOG DEVICES ASSEMBLED PRODUCTS D	WESTWOOD	5.30	.00	.00
MAD982545923	ARBORWAY METAL FINISHING, INC.	DORCHESTER	8.89	.00	.00
MAD001068154	ARMSTRONG WORLD INDUSTRIES, INC.	BRAINTREE	9.69	.00	.00
MAD980524300	ASTRA USA, INC.	WESTBOROUGH	12.60	.00	.00
MAD069920080	AUROLITE CORP.	WORCESTER	8.39	.00	.00
MAD001013226	BAIRD CORPORATION	BEDFORD	7.25	.00	.00
MAD001199256	BALFOUR COMPANY	ATTLEBORO	3.78	.00	.00
MAD055744908	BAY STATE STERLING	WESTBORO	5.79	.00	.00
MAD981201783	BELOIT FIBER SYSTEMS DIVISION	DALTON	6.61	.00	.00
MAD001051283	BEMIS COMPANY, INC.	PEPPERELI	9.36	.00	.00
MAD001007905	BIRD MACHINE CO., INC	SOUTH WALPOLE	2.38	.00	.00
MAD990886673	BORDEN CHEMICAL COMPANY	LEOMINSTER,	1.77	.00	.00
MAD051787323	BOSTON & MAINE CORP.	N. BILLERICA	1.58	.00	.00
MAD097454599	BOSTON EDISON COMPANY, PNPS	PLYMOUTH,	6.64	.00	.00
MAD000845412	BOSTON EDISON MATERIAL MANAGEMENT C	WATERTOWN	13.16	.00	.00
MAD985314319	BOSTON SCIENTIFIC CORP	WATERTOWN	12.48	.00	.00
MAD065160756	BOSTON UNIVERSITY MEDICAL CENTER	BOSTON	7.68	.00	.00
MAD053469466	C.F.C. INCORPORATED	WALTHAM	5.86	.00	.00
MAD019170521	CABOT CORPORATION	BILLERICA	10.18	5.00	.00
MAD985280809	CABOT SAFETY CORPORATION	SOUTHBRIDGE	7.09	.00	.00
MAD001027861	CALIFORNIA PRODUCTS CORP.	CAMBRIDGE	5.23	.00	.00
MAD001128198	CHASE	WESTBORO	5.24	.00	.00
MAD000844118	CIBA CORNING DIAGNOSTICS	MEDFIELD	11.92	10.00	.00
MAD985274901	CLEAN HARBORS ENVIORNMENTAL SERVICE	BEDFORD	3.36	.00	.00
MA2690307879	COAST GUARD SUPPORT CENTER	BOSTON	10.60	.00	.00
MAD000791038	COMMONWEALTH SPRAGUE CAPACITOR	NORTH ADAMS	9.32	.00	.00
MAD001028760	COMMUNICATION & POWER IND., INC.	BEVERLY	12.97	.00	.00
MAD087443537	CONRAIL W. SPRINGFIELD ENGINE TERMN	SPRINGFIELD	2.02	.00	.00
MAD049432008	CROWN CORK & SEAL CO.	LAWERENCE	4.57	.00	.00
MAP000032470	DEBLOIS OIL COMPANY	ATTLEBORO	2.19	.00	.00
MAD066596933	DELTA ELECTRONICS MFG. CO., INCORPO	BEVERLY	3.82	.00	.00
MAD050587641	DIELECTRIC POLYMERS, INC.	HOLYOKE	12.06	.00	.00
MAR000006098	DYNAMIC CHROMIUM IND. INC.	LAWRENCE	12.36	.00	.00
MAD981203656	DYNAMICS RESEARCH CORP.	ANDOVER	2.25	.00	.00
MAD001014182	DYNAMICS RESEARCH CORPORATION	WILMINGTON	10.79	.00	.00
MAD000843920	EMERSON & CUMING, INC.	CANTON	3.41	.00	.00
MAD019367176	ENVIRONMENTAL ISSUES MGR.-SIMOND IN	FITCHBURG	1.97	.00	.00
MAD985289024	EXXON CO.	MARLBORO	1.10	.00	.00
MAD985289099	EXXON CO.	MILLIS	3.90	.00	.00
MAR000005793	EXXON CO. USA #30930	WALTHAM	7.60	.00	.00
MAD985289362	EXXON CO.-35692	WAYLAND	3.10	.00	.00
MAD985289354	EXXON CO.-35730	WALTHAM	1.20	.00	.00
MAD985288638	EXXON CO.-35814	BILLERICA	2.30	.00	.00
MAD985289008	EXXON COMPANT-35578	LYNNFIELD	1.70	.00	.00
MAD985297167	EXXON COMPANY-33121	WALTHAM	1.30	.00	.00
MAD985289016	EXXON COMPANY-35030	MARLBOROUGH	1.30	.00	.00
MAD985288745	EXXON COMPANY-35048	CHELSEA	2.80	.00	.00
MAD985288695	EXXON COMPANY-35520	BRIGHTON	1.20	.00	.00
MAD985289289	EXXON COMPANY-35573	SOUTHBORO	12.70	.00	.00
MAD985297209	FISHER PIERCE	WEYMOUTH	12.81	.00	.00

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MASSACHUSETTS

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- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MAD001118413	FOUNTAIN PLATING COMPANY, INC.	WEST SPRINGFIEL	2.92	.00	.00
MAD001017599	GENCORP INC. LAWRENCE	LAWRENCE	1.23	.00	.00
MAD060094760	GENERAL ELECTRIC	MEDFORD	6.06	.00	.00
MAD000791814	GENERAL ELECTRIC AIRCRAFT ENGINES	MEDFORD	4.76	.00	.00
MAD985275569	GENERAL METAL FINISHING CO., INC.	ATTLEBORO	7.32	.00	.00
MAD001029768	GENRAD CORPORATION	CONCORD	1.67	.00	.00
MAD052929635	GENTEX OPTICS	DUDLEY	11.93	.00	.00
MAD001032358	GLOBE NEWSPAPER COMPANY	BOSTON	6.62	.00	.00
MAD982191264	GREYHOUND LINES, INC.	BOSTON	12.79	.00	.00
MAD000846337	GULF OIL LIMITED PARTNERSHIP	CHELSEA	5.00	.00	.00
MAD001115526	HAMPDEN PAPERS INC	HOLYOKE	8.49	.00	.00
MAD069354868	HOPKINTON LIQUIFIED NATURAL GAS COR	HOPKINTON	7.77	.00	.00
MAD001023613	HUB FOLDING BOX CO., INC.	MANSFIELD	12.68	.00	.00
MAD001117720	HUNT ROONEY CO.	ORANGE	9.31	.00	.00
MA5000000059	IMMUNOGEN, INC.	CAMBRIDGE	1.66	.00	.00
MAD985294487	INTERNATIONAL EQUIPMENT CO.	NEEDHAM HEIGHTS	2.25	.00	.00
MAD001029099	INTERNATIONAL PAPER	FRAMINGHAM	8.93	.00	.00
MAD001410240	ITEK OPTICAL SYSTEMS	LEXINGTON	6.91	.00	.00
MAD001926401	LFE CORP.	CLINTON	1.32	.00	.00
MAD001013515	LIGHT METAL PLATERS INC.	WALTHAM	12.14	.00	.00
MAD062172929	LIGHTOLIER	WILMINGTON	3.02	.00	.00
MAD001899020	LIGHTOLIER FALL RIVER	FALL RIVER	8.50	.00	.00
MAR000005603	MA. PORT AUTHORITY LOGAN 2000 CONST	EAST BOSTON	11.95	.00	.00
MAD985294263	MARTIN MARIETTA CORP.	PITTSFIELD	7.65	.00	.00
MAD985294958	MARTIN MARIETTA CORP.	DALTON	4.54	.00	.00
MAD985290873	MARTIN MARIETTA CORPORATION	WILMINGTON	2.15	.00	.00
MAD004863502	MASS. ELECTRIC CO.-N.S. DISTRICT HE	MALDEN	3.76	.00	.00
MAD001041789	MCCORD WINN TEXTRON	WINCHESTER	3.34	.00	.00
MAD980670822	MEDICAL AREA TOTAL ENERGY PLANT	BOSTON	11.32	.00	.00
MAD000846162	MILESTONE, INC.	SPRINGFIELD	2.99	.00	.00
MAD057988883	MILTON BRADLEY	EAST LONGMEADOW	5.37	.00	.00
MAD985296458	MOBIL OIL CORP., SS728	WHITMAN	1.15	.00	.00
MAD985296854	MOBIL OIL CORP, SSJFD	HINGHAM	1.61	.00	.00
MAD001129618	MORGAN CONSTRUCTION CO.	WORCESTER	8.36	.00	.00
MAD099199051	MORTON INTERNATIONAL	DANVERS	11.54	.00	.00
MA5000000836	MORTON INTERNATIONAL, INC	N. ANDOVER	2.76	.00	.00
MAD981214620	MORTON INTL. ADVANCED MATERIALS	WOBURN	2.46	.00	.00
MAD981888902	MUPAC P.C. B.	BROCKTON	10.68	.00	.00
MAD000790709	NASHUA CORPORATION	CHELMSFORD	4.29	.00	.00
MAD001131952	NATIONAL PERFORATING CORPORATION	CLINTON	4.03	.00	.00
MAD055179634	NEW ENGLAND POWER COMPANY	SOMERSET	7.85	.00	.00
MAD000649707	NORTHROP GRUMMAN CORPORATION	NORWOOD	5.48	.00	.00
MAD046131678	NYPRO, INC.	CLINTON	5.50	.00	.00
MAD985294255	PARKER METAL CORPORATION	WORCESTER	12.86	.00	.00
MA5000002469	PERSEPTIVE BIOSYSTEMS, INC.	FRAMINGHAM	10.25	.00	.00
MAD066609520	PHILLIPS LIGHTING CORPORATION	LYNN	1.29	.00	.00
MAD086538394	RAYTHEON COMPANY	BEDFORD	8.39	.00	.00
MAD053471223	RAYTHEON COMPANY, ELECTRONIC SYSTEM	NORWOOD	1.16	.00	.00
MAD985266493	RAYTHEON ELECTRONIC SERVICES	MARLBORO	10.21	.00	.00
MAD019291525	RAYTHEON SERVICE CO.	BURLINGTON	3.68	.00	.00
MAD981204464	REPLIGEN CORP.	CAMBRIDGE	6.79	.00	.00
MAD985293778	REXAM GRAPHICS	SOUTH HADLEY	12.58	.00	.00
MAD002068831	ROYAL PLATING POLISHING	PITTSFIELD	6.56	.00	.00
MAD096287354	SAFETY-KLEEN CORP	WEST BROOKFIELD	9.36	.00	.00
MAD985301191	SEARS UNIT #2343 & 7363	LANESBOROUGH	9.86	.00	.00

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MASSACHUSETTS

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- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MAD981204779	SEPRACOR,INC	MARLBOROUGH	4.98	.00	.00
MAD985300995	SFEF CORP.	PEABODY	5.27	.00	.00
MAD000769638	SHELL OIL COMPANY	FALL RIVER	3.16	.00	.00
MAD982201329	SPRAGUE NORTH ADAMS, INC	NORTH ADAMS	3.40	.00	.00
MAD001129519	STANLEY TOOLS	WORCESTER	5.56	.00	.00
MAR000006148	SUPERMARKET INFORMATION SYSTEM:	WESTBORO	9.73	.00	.00
MA5000001982	SUPERMARKET INFORMATION SYSTEMS, IN	SHREWSBURY	5.49	.00	.00
MAD066996323	TECHALLOY COMPANY, INC.	NORTHAMPTON	12.07	.00	.00
MAD000844688	TENNESSEE GAS PIPELINE	HOPKINGTON	2.36	.00	.00
MAD019146802	TENNESSEE GAS PIPELINE	AQAWAM	5.94	.00	.00
MAD982546541	TEXACO SERVICE STATION	DEDHAM	3.99	.00	.00
MAD985280262	TEXACO SERVICE STATION	WORCESTER	2.24	.00	.00
MAD001863943	TEXTRON SYSTEMS DIVISION	WILMINGTON	9.49	1.00	.00
MAD985290287	THE BUTCHER COMPANY	MARLBOROUGH	3.60	.00	.00
MAD197330798	TRM COPY CTR.	WALPOLE	7.05	.00	.00
MA1210020631	U.S. ARMY SOLDIER SYSTEMS COMMAND	NATICK	12.81	18.96	.00
MAD982198350	UNITED PARCEL SERVICE, INC.	CHELMSFORD	8.34	.00	.00
MAD112844212	UNIVERSAL FOREST PRODUCT, INC.	BELCHERTOWN	3.80	.00	.00
MAD985279173	VARIAN REMEDIATION PROJECT	BEVERLY	3.70	.00	.00
MAD001381912	VERNON PLASTICS COMPANY	HAVERHILL	11.40	.00	.00
MAD043412147	VISTA CHEMICAL CO.-MANSFIELD PLANT	MANSFIELD	9.08	.00	.00
MAD985290998	WAKEFIELD ENGINEERING	WAKEFIELD	10.02	.00	.00
MAD059017855	WARREN PUMPS INC.	WARREN	8.38	.00	.00
MAD000650051	WINDFIELD ALLOY INC.	LAWERENCE	3.72	.00	.00
MAD001438084	WRIGHT LINE, INC.	WORCESTER	8.06	.00	.00
MAD001128016	WYMAN-GRAFTON CO.	WORCESTER	1.20	.00	.00
MAD000847608	0005-2746	CANTON	1.43	.00	.00
MAD982199424	0005-3264 SUNOCO PERM CLOSED 6/95	LEXINGTON	5.84	.00	.00
MAD000636688	0006-0806 SUNOCO SERVICE STATION	MANSFIELD	2.15	.00	.00

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MASSACHUSETTS

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GENERATORS WHO CANNOT BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- LESS THAN 1.1 TONS RCRA HAZARDOUS WASTE, AND
- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MAD088984380	AGFA DIVISION, BAYER CORP.	NORTH READING	.50	.00	.00
MAD000846501	ASE AMNERICAS, INC.	BILLERICA	.94	.00	.00
MAD001006311	BIRD JOHNSON CO.	WALPOLE	.68	.00	.00
MAD000636258	BORDEN PROPONITE	NORTH ANDOVER	.99	.00	.00
MAD096290044	CHELSEA TERMINAL LIMITED PARTNERSHI	CHELSEA	.82	.00	.00
MAD001028745	CORNELL - DUBILIER ELECTRONICS, INC	NEW BEDFORD	.25	.00	.00
MAD062179890	ENVIRONMENTAL COMPLIANCE CORP.	STOUGHTON	.33	.00	.00
MAD985287259	EXXON COMPANY-32353	IPSWICH	1.00	.00	.00
MAD047075734	GEOCHEM, INC., D/B/A JET-LINE ENV.	LOWELL	.00	.00	.00
MAD019237668	NEW ENGLAND POWER SERVICE CO. GARAG	WESTBOROUGH	.41	.00	.00
MAD000846006	SAFETY-KLEEN CORP	BRIDGEWATER	.00	.00	.00
MAD060095569	SAFETY-KLEEN CORP.	SALISBURY	.00	.00	.00
MAD088978143	SAFETY-KLEEN MARLBORO	MARLBOROUGH	.00	.00	.00

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MICHIGAN

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MID985589076	A & K FINISHING, INC.	KENTWOOD	13.28	.00	.00
MID005373782	A.G. SIMPSON (MICHIGAN) INC.	STERLING HEIGHT	90.52	.00	.00
MID980792212	AAR ADVANCED STRUCTURES	LIVONIA	23.88	.00	.00
MID006019251	AAR CADILLAC MANUFACTURING	CADILLAC	565.62	.00	.00
MIR000001479	ACE-TEX ENTERPRISES	DETROIT	76.63	.00	.00
MIT270012818	ACORN WINDOW SYSTEMS, INC.	QUINCY	16.47	.00	.00
MID038708665	ACT LABORATORIES INC	HILLSDALE	39.44	.00	.00
MID049239171	ADAC PLASTICS INCORPORATED	MUSKEGON	48.17	.00	.00
MID072598725	ADVANCE PLATING & FINISHING	GRAND RAPIDS	78.39	.00	.00
MID131420176	ADVANCED FRICTION MATERIALS CO.	STERLING HEIGHT	81.80	.00	.00
MID985645456	AEROQUIP CORP., COUPLING PRODUCTS	JACKSON	20.92	.00	.00
MID005356498	AEROQUIP CORP/AEROSPACE, HOSE DIV.	JACKSON	28.75	.00	.00
MID048231732	AFCO INDUSTRIES INCORPORATED	HOLLAND	48.87	.00	.00
MID080358351	AGREVO USA COMPANY	NORTH MUSKEGON	124.75	22,085.00	.00
MID083942714	AJAX METAL PROCESSING INCORPORATED	WARREN	80.35	.00	.00
MID005320031	AJAX METAL PROCESSING, PLATING DIV	DETROIT	1,007.87	.00	.00
MID000265207	AKZO NOBEL COATINGS INC.	PONTIAC	533.01	.00	.00
MID981189020	ALBAR INDUSTRIES INCORPORATED	LAPEER	43.71	.00	.00
MID006016190	ALLEGAN METAL FINISHING COMPANY	ALLEGAN	100.17	.00	.00
MID085890846	ALLIED FINISHING INCORPORATED	KENTWOOD	251.19	.00	.00
MID005107222	ALLIEDSIGNAL AUTOMOTIVE ST. JO. PLA	ST. JOSEPH	54.06	.00	.00
MID103481396	ALLWASTE CONTAINER SERVICES	DETROIT	27.52	.00	.00
MID054753322	ALRECO METALS INCORPORATED	BENTON HARBOR	83.27	.00	.00
MID086744802	AMERICAN AXLE AND MANUFACTURING, IN	DETROIT	31.55	.00	.00
MID981197254	AMERICAN BUMPER & MANUFACTURING CO	IONIA	789,722.40	.00	.00
MID985664770	AMERICAN INTERNATIONAL AIRWAYS, INC	OSCODA	26.73	.00	.00
MI0000263871	AMERICAN INTERNATIONAL AIRWAYS, INC	YPSILANTI	29.00	.00	.00
MID049266521	AMERICAN JETWAY CORPORATION	WAYNE	95.75	.00	.00
MID061862926	AMERICAN TAPE COMPANY	MARYSVILLE	166.23	.00	.00
MID052034402	AMERICHEM CORPORATION	MASON	38.61	.00	.00
MID099658288	AMOCO PETROLEUM PRODUCTS	NAPOLEON	31.95	.00	.00
MID062226998	AMR COMBS-GRAND RAPIDS INC	GRAND RAPIDS	35.30	.00	.00
MID006026793	AMWAY CORPORATION	ADA	394.75	.00	.00
MID002931228	ANDERSON DEVELOPMENT COMPANY	ADRIAN	2,629.10	776.00	.00
MID052035425	APOLLO PLATING INCORPORATED	ROSEVILLE	172,038.60	.00	.00
MID005413653	ARTHUR B. MYR INDUSTRIES, INC.	BELLEVILLE	77.25	.00	.00
MID985597368	ASH STEVENS INC/RIVERVIEW PILOT PL	RIVERVIEW	25.60	.00	.00
MID980683726	ASHLAND CHEMICAL	LANSING	73.11	.00	.00
MID010872059	ASHLAND PETROLEUM CO., DETROIT TERM	TAYLOR	42.20	.00	.00
MID051759082	ASP & MFG. CO., INC.	GRAND HAVEN	33.22	.00	.00
MID046075107	ATLAS OIL TERMINAL	TAYLOR	104.44	.00	.00
MID093824415	ATMOSPHERE ANNEALING, INC.	LANSING	635.72	.00	.00
MID000718726	AUGUSTA DEVELOPMENT CORP.	MILAN	12,652.99	.00	.00
MID981953912	AUTOALLIANCE INTERNATIONAL INC.	FLAT ROCK	532.61	.00	.00
MID985657030	AUTOCAM CORPORATION	KENTWOOD	144.33	.00	.00
MID985595404	AUTOMOTIVE PROD USA INCORPORATED	AUBURN HILLS	15.00	.00	.00
MID985572742	AUTOMOTIVE PRODUCTS (USA) INC	STERLING HEIGHT	523.49	.00	.00
MID982642183	AUTOSTYLE PLASTICS INCORPORATED	GRAND RAPIDS	65.84	.00	.00
MID006565816	AUTOSTYLE PLASTICS, INCORPORATED	GRAND RAPIDS	56.32	.00	.00
MID092175066	BAILEY MANUFACTURING CORPORATION	HILLSDALE	64.42	.00	.00
MID980504708	BANGOR INDUSTRIES, INC.	BANGOR	186.74	17,930.00	.00
MID001868595	BASF CORPORATION	GRAND RAPIDS	1,063.16	.00	.00
MID064197742	BASF CORPORATION	WYANDOTTE	1,634.64	65.00	.00
MID980896518	BASF CORPORATION	SOUTHFIELD	505.07	5.00	.00
MID981194269	BASF CORPORATION	LIVONIA	43.08	.00	.00

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MICHIGAN

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MI0000938704	BASF CORPORATION-POINTE HENNEPIN SI	GROSSE ILE	340.87	.00	.00
MID007138746	BASF CORPORATION, BOURKE AVE PLANT	DETROIT	3,470.79	.00	.00
MID001868538	BASF CORPORATION, MILFORD AVE PLANT	DETROIT	1,712.57	.00	.00
MID985637412	BAY CITY PLATERS	BAY CITY	21,394.51	.00	.00
MID099123291	BECKER MANUFACTURING-ROSEVILLE	ROSEVILLE	18.39	.00	.00
MID985619055	BEHR INDUSTRIES CORPORATION	COMSTOCK PARK	41.87	.00	.00
MID097804025	BEKAERT CORPORATION	MUSKEGON	58.50	.00	.00
MID006411409	BENCHMARK COATERS	OTSEGO	21.04	.00	.00
MID043772490	BENTELER INDUSTRIES, INC.	GALESBURG	183.25	.00	.00
MID007250079	BFGOODRICH AVIONICS SYSTEMS, INC.	GRAND RAPIDS	18.32	.00	.00
MID081213027	BIOLAB INC	ADRIAN	34.43	.00	.00
MID005050281	BLISSFIELD MANUFACTURING CO.	BLISSFIELD	14.30	.00	.00
MID084300490	BORGWARNER AUTOMOTIVE	STERLING HEIGHT	18.35	.00	.00
MID041812777	BORROUGHS CORPORATION	KALAMAZOO	103.47	.00	.00
MI0001007806	BRENNERS SERVICE	COMSTOCK PARK	90.04	.00	.00
MID005480900	BRONSON PLATING COMPANY	BRONSON	67.20	.00	.00
MID006407175	BRUNSWICK BOWLING	MUSKEGON	43.87	.00	.00
MID005334495	BUDD COMPANY	DETROIT	1,315.92	.00	.00
MID072575731	BURDICK & JACKSON, INC.	MUSKEGON	430.84	.00	.00
MID006004451	CADILLAC PLATING CORPORATION	WARREN	119.25	.00	.00
MID985566496	CALUMET ELECTRONICS CORP	CALUMET	224.65	.00	.00
MID054697230	CAMBRIDGE INDUSTRIES	LAPEER	35.51	.00	.00
MID006022586	CANNON-MUSKEGON CORPORATION	MUSKEGON	53.47	.00	.00
MID981953946	CASS RIVER COATINGS INCORPORATED	VASSAR	38.56	.00	.00
MID065869810	CELLO-FOIL PRODUCTS, INCORPORATED	BATTLE CREEK	39.24	.00	.00
MID981959398	CHEM-TREND INCORPORATED	HOWELL	125.45	3,275.00	.00
MID985618586	CHEM_STRIP, INC.	DETROIT	14.12	.00	.00
MID042430751	CHEMCENTRAL/DETROIT	ROMULUS	99.27	.00	.00
MID017108192	CHEMCENTRAL/GRAND RAPIDS	WYOMING	16.72	.00	.00
MID985568021	CHEMICAL ANALYTICS, INCORPORATED	ROMULUS	19.98	107.05	.00
MID050604768	CHROME CRAFT CORPORATION	HIGHLAND PARK	152.50	.00	.00
MID099113169	CHRYSLER CORP., JEEP & TRUCK ENGR.	DETROIT	30.98	.00	.00
MID985569987	CHRYSLER CORP., JEFFERSON NO. ASSY	DETROIT	783.36	.00	.00
MID005357942	CHRYSLER CORP., MARYSVILLE NDC	MARYSVILLE	163.06	.00	.00
MID072782683	CHRYSLER CORP., STERLING STAMPING	STERLING HEIGHT	21.12	.00	.00
MID005358064	CHRYSLER CORP., TRENTON ENGINE PL	TRENTON	53.69	.00	.00
MID980700868	CHRYSLER CORP., WARREN STAMPING PL	WARREN	21.05	.00	.00
MID000718791	CHRYSLER CORP-CHELSEA PROVING GRND	CHELSEA	15.38	1,880.00	.00
MID985572890	CHRYSLER CORP/CHRYSLER TECHNOLOGY	AUBURN HILLS	124.50	.00	.00
MID000810648	CHRYSLER CORPORATION	HIGHLAND PARK	31.66	42.30	.00
MID005358007	CHRYSLER CORPORATION	WARREN	747.99	.00	.00
MID005357934	CHRYSLER CORPORATION-MCGRAW GLASS	DETROIT	62.30	.00	.00
MID980896690	CHRYSLER MOTORS, STERLING HTS ASSY	STERLING HEIGHT	391.57	.00	.00
MID054683479	CITY ENVIRONMENTAL, INC.	DETROIT	3,549.00	.00	.00
MID980991566	CITY ENVIRONMENTAL, INC.	DETROIT	14.33	.00	.00
MIR000004622	CITY OF FLINT WINDIATE PARK	FLINT	30.49	.00	.00
MID006005482	CLAWSON TANK COMPANY	CLARKSTON	42.54	.00	.00
MID982627630	CME CORP.	MT. PLEASANT	23.89	.00	.00
MID060174380	CODING PRODUCTS INCORPORATED	KALKASKA	89.03	.00	.00
MID072782857	COMMONWEALTH INDUSTRIES	DETROIT	459.99	.00	.00
MID985654581	COMPONENT SERVICES, INC.	LUDINGTON	16.15	.00	.00
MID085899706	CONSUMER POWER COMPANY	LUDINGTON	204.12	.00	.00
MID006021661	CONTROLLED PLATING TECH. INC.	GRAND RAPIDS	229.60	.00	.00
MID000809277	COOPER IND. KIRSCH DIVISION	STURGIS	254.94	.00	.00
MID005069430	COOPER IND. KIRSCH DIVISION	STURGIS	87.00	.00	.00

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MID086176658	COPPER RANGE COMPANY	WHITE PINE	193.36	.00	.00
MIT270012131	CROWN GROUP ECORSE PLT	ECORSE	255.26	.00	.00
MID000810630	CROWN PAPER CO., DBA CROWN VANTAGE	PARCHMENT	31.18	.00	.00
MID982624017	CSX TRANSPORTATION	BENTON HARBOR	210.81	.00	.00
MID982628463	CSX TRANSPORTATION	SAGINAW	138.53	.00	.00
MID098673486	CURTIS METAL FINISHING COMPANY	STERLING HEIGHT	287.18	.00	.00
MID985567114	CYANO CORPORATION OF MICHIGAN INC.	DETROIT	185.55	.00	.00
MID005360680	CYTEC INDUSTRIES	KALAMAZOO	821.42	.00	.00
MID985569128	DAPCO INDUSTRIES	DEXTER	32.83	.00	.00
MID005379813	DEARBORN FRAME PLANT/FORD MOTOR CO	DEARBORN	74.86	.00	.00
MID981955222	DECO-TRIM INCORPORATED	NEW HUDSON	87.47	.00	.00
MID053339370	DEFIANCE VAUNGARDE	OWOSSO	26.72	.00	.00
MID005356621	DELPHI CHASSIS SYSTEMS	LIVONIA	568.25	.00	.00
MID005356845	DELPHI CHASSIS SYSTEMS	SAGINAW	13.45	.00	.00
MID017079625	DELPHI ENERGY & ENGINE MGMT. SYSTEM	WYOMING	398.44	.00	.00
MID076331271	DELPHI INTERIOR & LIGHTING SYSTEMS	LIVONIA	13.84	.00	.00
MID981001506	DEPOR INDUSTRIES INCORPORATED	FERNDALE	21.30	.00	.00
MID000809889	DETREX CORPORATION	REDFORD	275.69	.00	.00
MID091605972	DETREX CORPORATION	DETROIT	735.19	.00	.00
MID005356803	DETROIT DIESEL CORPORATION	DETROIT	38.15	.00	.00
MID000722157	DETROIT EDISON COMPANY	DETROIT	48.44	.00	.00
MID092175074	DETROIT EDISON COMPANY	MONROE	16.59	.00	.00
MID017079393	DEWITT BARRELS INCORPORATED	GRAND RAPIDS	261.55	.00	.00
MI9570090002	DFSP ESCANABA	ESCANABA	60.60	.00	.00
MID005344973	DIAMOND CHROME PLATING INC.	HOWELL	41.90	.00	.00
MID982631335	DIESEL TECHNOLOGY COMPANY	KENTWOOD	22.64	.00	.00
MIR000001933	DOMESTIC UNIFORM RENTAL CO	DETROIT	17.41	.00	.00
MID006011936	DONNELLY CORPORATION	HOLLAND	15.83	.00	.00
MID038616959	DONNELLY CORPORATION	HOLLAND	16.65	.00	.00
MID981952765	DONNELLY CORPORATION	HOLLAND	34.43	.00	.00
MID981958176	DONNELLY CORPORATION	HOLLAND	69.68	.00	.00
MID982424798	DONNELLY CORPORATION	HOLLAND	44.64	.00	.00
MIR000001149	DONNELLY CORPORATION	NEWAYGO	65.50	.00	.00
MID056998339	DOTT MANUFACTURING COMPANY	DECKERVILLE	24.13	.00	.00
MID002971539	DOU-TANG PRODUCTS	PAW PAW	19.18	.00	.00
MID981092190	DOUBLE EAGLE STEEL COATING COMPANY	DEARBORN	11,536.46	.00	.00
MID000724724	DOW CHEMICAL CO-MIDLAND PLANT SITE	MIDLAND	9,637,184.77	338,663.00	.00
MID006016919	DOW CHEMICAL COMPANY, THE	LUDINGTON	196.91	8,200.00	.00
MID981953953	DOW CORNING AEM	ABURN	53.05	.00	.00
MID000809632	DOW CORNING CORP. MIDLAND PLANT	MIDLAND	449,014.87	106,200.00	.00
MID049262702	DOW CORNING CORPORATION	HEMLOCK	96.55	.00	.00
MID005353487	DOW CORNING, CORPORATE CENTER	MIDLAND	55.96	.00	.00
MID095938254	DRAKE MECHANICAL PLATING INC.	HOMER	104.75	.00	.00
MID092947928	DRUG & LABORATORY DISPOSAL INC.	PLAINWELL	533.02	5,272.00	.00
MID006556351	DURA CONVERTIBLE SYSTEMS DIVISION	ADRIAN	109.21	.00	.00
MIT270019698	DYNA PLATE INCORPORATED	WYOMING	146.90	.00	.00
MID074259565	DYNECOL INCORPORATED	DETROIT	1,872.34	.00	.00
MID099124349	E.I. DUPONT DE NEMOURS & COMPANY	TROY	597.38	.00	.00
MID005512066	E.I. DUPONT, FLINT PLANT	FLINT	2,807.82	.00	.00
MID005358825	E.I. DUPONT, MOUNT CLEMENS	MOUNT CLEMENS	13,088.58	.00	.00
MID000809640	EI DUPONT DE NEMOURS. MONTAGUE WORK	MONTAGUE	92.53	.00	.00
MID980990113	ELECTRO CHEMICAL FINISHING COMPANY	WYOMING	35,407.88	.00	.00
MID042444687	ELECTRO PLATING SERVICE	MADISON HEIGHTS	9,130.36	18,204,924.47	.00
MID005068143	ELECTRO-VOICE INCORPORATED	BUCHANAN	2,527.21	.00	.00
MID005363114	ELF ATOCHEM NORTH AMERICA, INC.	RIVERVIEW	2,494.23	.00	.00

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MID004916730	ELM PLATING	JACKSON	325.50	.00	.00
MID981088289	ENAMELCOTE INCORPORATED	WARREN	29.35	.00	.00
MID000261180	ENSCO ENPAK FIELD SERVICE	EAST LANSING	1.32	2,634.00	.00
MID000261198	ENSCO FIELD SERVICES	LANSING	7.78	15,563.00	.00
MID056717747	ENTHONE-OMI INC.	WARREN	436.39	125.85	.00
MID006410708	ENVIRONMENTAL COATINGS INC.	CALEDONIA	158.35	.00	.00
MID057002602	ENVIRONMENTAL WASTE CONTROL INC.	INKSTER	1,941.70	.00	.00
MID006545511	ESCO COMPANY, LIMITED PARTNERSHIP	MUSKEGON	1,966.63	.00	.00
MID068091693	ESSEX SPECIALTY PRODUCTS INC	HILLSDALE	121.33	.00	.00
MID005354766	EVART PRODUCTS TEXTRON, INC.	EVART	155.71	.00	.00
MID982637175	EXCEL CIRCUITS COMPANY INC.	ORION	97.98	.00	.00
MID982069700	EXTRUDED ALUMINUM CORPORATION	BELDING	103.90	.00	.00
MID005381439	EXTRUDED METALS	BELDING	152.79	.00	.00
MID043768555	FARWELL PLANT, RENOSOL CORPORATION	FARWELL	57.00	.00	.00
MID042158329	FAYETTE TUBULAR PROD., READING DIV	READING	24.16	.00	.00
MID044970754	FEDERAL SCREW WORKS, PLANTS 3 & 4	ROMULUS	558.23	.00	.00
MID005358783	FEDERAL-MOGUL CORPORATION	ST. JOHNS	2,051.31	.00	.00
MID006021414	FEDERAL-MOGUL CORPORATION	GREENVILLE	830.37	.00	.00
MID079850699	FINISHING SERVICES INCORPORATED	YPSILANTI	235.86	.00	.00
MID057042434	FKI AUTOMOTIVE	KENTWOOD	554.94	.00	.00
MID000721720	FORD ELECTRONICS TECHNICAL CENTER	DEARBORN	57.22	20.00	.00
MIR000002816	FORD MOTOR CO DYNAMOMETER BLDG	DEARBORN	15.24	.00	.00
MID088756069	FORD MOTOR CO. PARTS REDISTRIBUTION	ROMULUS	317.02	.00	.00
MID072784036	FORD MOTOR CO. TOOL & DIE PLANT	DEARBORN	31.58	.00	.00
MID065597809	FORD MOTOR CO., DEARBORN ENGINE PLA	DEARBORN	148.54	.00	.00
MID072784150	FORD MOTOR CO., LIVONIA TRANSMISSIO	LIVONIA	15.26	.00	.00
MID000809228	FORD MOTOR CO., MICHIGAN TRUCK PL	WAYNE	1,924.59	.00	.00
MID091955476	FORD MOTOR CO., MILAN PLASTICS PL	MILAN	246.25	.00	.00
MID005379888	FORD MOTOR CO., RAWSONVILLE PLANT	YPSILANTI	390.20	.00	.00
MID044253029	FORD MOTOR CO., SHELDON ROAD PLANT	PLYMOUTH	162.51	5.00	.00
MID000809756	FORD MOTOR CO., TRANS & ROUGE SVCS.	DEARBORN	13.26	.00	.00
MID005379847	FORD MOTOR CO., YPSILANTI PLANT	YPSILANTI	41.64	.00	.00
MID076380658	FORD MOTOR CO-R & E CTR.	DEARBORN	602.55	.00	.00
MID000809764	FORD MOTOR COMPANY	DEARBORN	725.13	.00	.00
MIT270010085	FORD MOTOR COMPANY, PILOT PLANT	ALLEN PARK	69.40	.00	.00
MID009305665	FORD MOTOR COMPANY, SALINE PLANT	SALINE	310.05	.00	.00
MID044255420	FORD MOTOR COMPANY, STERLING PLANT	STERLING HEIGHT	28.43	.00	.00
MID005379854	FORD MOTOR COMPANY, UTICA PLANT	SHELBY TWSP.	1,015.06	.00	.00
MID005379706	FORD MOTOR COMPANY, WAYNE ASSY PL	WAYNE	28,344.80	.00	.00
MID005379714	FORD MOTOR COMPANY, WIXOM ASSY PL	WIXOM	3,000.19	.00	.00
MID097813513	FRIGIDAIRE COMPANY, REFRIGERATOR PR	GREENVILLE	26.50	.00	.00
MID080361124	FUEL SYSTEMS TEXTRON	ZEELAND	22.60	.00	.00
MID005338801	GAGE PRODUCTS COMPANY	FERNDALE	10,119.41	.00	.00
MID005341813	GELMAN SCIENCES	ANN ARBOR	15.24	.00	.00
MID053669040	GENCORP, INCORPORATED	IONIA	50.59	.00	.00
MIT270013113	GENERAL FORMULATIONS INCORPORATED	SPARTA	42.90	.00	.00
MID980568836	GENERAL MOTORS CORPORATION	PONTIAC	1,605.71	.00	.00
MID005375837	GENERAL PLATING INC., PLANT #2	OAK PARK	43,476.77	.00	.00
MID981529290	GENESEE POLYMERS CORPORATION	BURTON	63.92	.00	.00
MI0985660042	GIDDINGS & LEWIS CASTING TECHNOLOGY	MENOMINEE	25.44	.00	.00
MID006020408	GM MFD GRAND RAPIDS METAL PLANT	GRAND RAPIDS	1,063.00	.00	.00
MID041793340	GM POWERTRAIN GROUP	SAGINAW	41.34	.00	.00
MID005356860	GM WORLD WIDE FACILITIES GROUP	FLINT	239.92	.00	.00
MID005356688	GM, POWERTRAIN GROUP, BAY CITY PLAN	BAY CITY	25.93	.00	.00
MID082220757	GMC MILFORD PROVING GROUND	MILFORD	234.62	.00	.00

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MICHIGAN

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MID003912920	GMC SERVICE PARTS OPERATIONS	WATERFORD	41.33	.00	.00
MID050615996	GMC TECHNICAL CENTER	WARREN	826.47	.00	.00
MID005356902	GMC TRUCK & BUS PONTIAC EAST ASSY	PONTIAC	987.70	.00	.00
MID005356878	GMC-DELPHI SAGINAW STEERING SYSTEMS	SAGINAW	3,852.45	.00	.00
MID980795488	GMC, CADIL. DETROIT/HAMTRAMCK ASSY	DETROIT	1,397.29	.00	.00
MID005356647	GMC, DELPHI ENERGY & ENGINE MANAGEM	FLINT	92.02	.00	.00
MID005356654	GMC, DELPHI ENERGY & ENGINE MANAGEM	FLINT	44.80	.00	.00
MID980568570	GMC, DELPHI ENERGY & ENGINE MANAGEM	FLINT	455.67	.00	.00
MID980568620	GMC, DELPHI ENERGY & ENGINE MANAGEM	FLINT	115.48	.00	.00
MID980568745	GMC, DELPHI ENERGY & ENGINE MANAGEM	FLINT	35.34	.00	.00
MID005356951	GMC, FLINT VAN SLYKE COMPLEX	FLINT	3,521.05	.00	.00
MID005356928	GMC, LANSING BODY PLANT	LANSING	967.46	.00	.00
MID005356894	GMC, LANSING PLANT #1	LANSING	255.10	.00	.00
MID980700827	GMC, LANSING PLANTS 2 & 3	LANSING	29.47	.00	.00
MID005356712	GMC, NAO FLINT OPERATIONS	FLINT	646.17	.00	.00
MID001876663	GMC, NAO-KALAMAZOO PLANT	KALAMAZOO	27.11	.00	.00
MID000718544	GMC, ORION ASSEMBLY	LAKE ORION	1,200.10	.00	.00
MID005356811	GMC, POWER TRAIN WARREN	WARREN	57.27	.00	.00
MID003906773	GMC, SERVICE PARTS OPERATIONS	SWARTZ CREEK	98.78	4,660.00	.00
MID985636620	GRACO INC. - PLYMOUTH	PLYMOUTH	41.19	.00	.00
MIT270012198	GRAND HAVEN BRASS FOUNDRY	GRAND HAVEN	1,300.72	.00	.00
MID270012669	GRAND RAPIDS DIE CASTING CORP.	GRAND RAPIDS	1,073.73	.00	.00
MID087478574	GREAT LAKES ENVIRONMENTAL SERVICES,	WARREN	31.26	.00	.00
MID985621051	GREEN BAY PAINT SLUDGE SITE	MENOMINEE	5,349.00	.00	.00
MID000809780	GRUMMAN OLSON	STURGIS	89.84	.00	.00
MID048784896	GUARDIAN INDUSTRIES	CARLETON	150.82	.00	.00
MID006017438	GUARDSMAN PRODUCTS INCORPORATED	GRAND RAPIDS	1,467.42	.00	.00
MID982650780	GUARDSMAN PRODUCTS INCORPORATED	FREMONT	249.39	.00	.00
MID985612936	H & H TUBE & MFG. CO.	VANDERBILT	141.00	.00	.00
MID065850620	H.B. FULLER COMPANY	GRAND RAPIDS	201.07	.00	.00
MID097239669	H.S. PROCESSING L.P.	ERIE	4,057.63	.00	.00
MID006025324	HASTINGS MANUFACTURING COMPANY	HASTINGS	389.94	.00	.00
MID072595457	HAWORTH INCORPORATED	HOLLAND	323.31	.00	.00
MID980792279	HAYES WHEELS INTERNATIONAL	HOWELL	70.87	.00	.00
MID005357355	HAYES WHEELS INTERNATIONAL INC.	ROMULUS	188.12	.00	.00
MID095395216	HEMLOCK SEMICONDUCTOR CORPORATION	HEMLOCK	14.88	.00	.00
MID005362223	HENKEL CORPORATION, PARKER AMCHEM	WARREN	245.31	.00	.00
MID006012801	HERMAN MILLER INCORPORATED	ZEELAND	28.07	.00	.00
MID062226774	HITACHI MAGNETICS CORPORATION	EDMORE	63.59	.00	.00
MID038777694	HORIZON TECHNOLOGY GROUP	ROMULUS	34.03	.00	.00
MID080345614	HOWMET CORPORATION	WHITEHALL	408.27	.00	.00
MID985566223	HUNTSMAN CORP.	MARYSVILLE	94.64	.00	.00
MID985566652	IGK INDUSTRIES	ANN ARBOR	64.23	.00	.00
MID985568641	II STANLEY COMPANY INCORPORATED	BATTLE CREEK	1,134.16	.00	.00
MIR000006627	IMMUNO-US INC	ROCHESTER	45.08	.00	.00
MID982632028	IMPERIAL ADHESIVES, INC.	KALAMAZOO	13.61	.00	.00
MID981091408	INDUSTRIAL COATING INCORPORATED	BRIDGEPORT	18.92	.00	.00
MID006025845	INTEGRATED METAL TECHNOLOGY INC.	SPRING LAKE	126.69	.00	.00
MID055850127	INTERNATIONAL BUMPER INC	GRAND RAPIDS	381.63	.00	.00
MID005385406	INTERNATIONAL HARDCOAT	DETROIT	20.96	.00	.00
MID981099435	J & M PLATING COMPANY, INC.	ALBION	77.72	.00	.00
MID985652643	JABIL CIRCUIT	AUBURN HILLS	22.85	.00	.00
MID003938156	JAMES RIVER PAPER COMPANY, INC.	KALAMAZOO	57.71	.00	.00
MIR000003996	JAMES RIVER PAPER COMPANY, INC.	KALAMAZOO	14.80	.00	.00
MID005343801	JET DIE/BARNES GROUP INC	LANSING	62.39	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MID058816927	JOHNSON CONTROLS BATTERY GROUP, INC	OWOSSO	2,791.18	.00	.00
MID005511852	K.C. JONES PLATING COMPANY	HAZEL PARK	879.72	.00	.00
MID101645174	KALAMAZOO METAL FINISHERS INC.	KALAMAZOO	126.91	.00	.00
MID173674698	KALAMAZOO STRIPPING AND DERUSTING	KALAMAZOO	112.51	.00	.00
MID005338504	KARMAZIN PRODUCTS CORPORATION	WYANDOTTE	15.65	.00	.00
MID008966608	KASLE STEEL CORPORATION	DEARBORN	20.50	.00	.00
MID982205395	KAY AUTOMOTIVE GRAPHICS	LAKE ORION	49.07	.00	.00
MID006015598	KEELER BRASS CO/FURNITURE HARDWARE	GRAND RAPIDS	332.58	.00	.00
MIO000361212	KELSEY HAYES CO	FOWLERVILLE	32.87	.00	.00
MID053334439	KELSEY-HAYES COMPANY	BRIGHTON	258.32	.00	.00
MID178080156	KELSEY-HAYES FENTON	FENTON	166.47	.00	.00
MID980683775	KENTWOOD SITE/STEELCASE INC.	KENTWOOD	2,000.68	.00	.00
MID061872917	KERR CORPORATION	ROMULUS	13.49	.00	.00
MID051762029	KISH, S.P. INDUSTRIES, INC.	CHARLOTTE	14.63	.00	.00
MID006024699	KNAPE & VOGT MANUFACTURING COMPANY	GRAND RAPIDS	77.14	.00	.00
MID981954845	KNOLL GROUP, MUSKEGON	MUSKEGON	100.20	.00	.00
MID083684902	KOCH REFINING COMPANY	FERRYSBURG	41.28	.00	.00
MID980614739	KOCH REFINING COMPANY	NILES	16.72	.00	.00
MID985569318	KOYO CORPORATION	BATTLE CREEK	21.89	.00	.00
MID055850366	KRAFT FOODS, CARTON & CONTAINER	BATTLE CREEK	121.96	.00	.00
MID043681840	KYSOR/CADILLAC	CADILLAC	38.69	.00	.00
MID006014070	LA-Z-BOY CONTRACT FURNITURE GROUP	GRAND RAPIDS	33.65	.00	.00
MID981090509	LACKS - AIRLANE	KENTWOOD	320.58	.00	.00
MID980998546	LACKS - RALEIGH	KENTWOOD	43.91	.00	.00
MID080359433	LACKS - SARANAC	SARANAC	21.81	.00	.00
MID985568286	LACKS - 52ND	KENTWOOD	316.57	.00	.00
MID982602849	LAKE SHORE INC.	IRON RIVER	21.55	.00	.00
MID027637693	LAKESHORE ELECTRO-PLATE	BENTON HARBOR	11,041.62	.00	.00
MIR000001537	LAKESHORE ELECTRO-PLATE	STEVENSVILLE	6,317.91	.00	.00
MID053335782	LANSING PLATING COMPANY	LANSING	87.10	.00	.00
MID005227228	LEAR MENDON CORPORATION	MENDON	463.23	.00	.00
MIT270010325	LECO CORPORATION	ST. JOSEPH	13,743.21	.00	.00
MID000776096	LEON PLASTICS INCORPORATED	GRAND RAPIDS	22.20	.00	.00
MIT270012222	LESLIE METAL ARTS COMPANY PLANT 2	GRAND RAPIDS	102.60	.00	.00
MID980996086	LIBBEY-OWENS-FORD	CLINTON	70.65	.00	.00
MID061865754	LIBRA INDUSTRIES, INC. OF MICHIGAN	JACKSON	320.74	.00	.00
MID084299387	LIBRALTER PLASTICS, INC.	WALLED LAKE	60.72	.00	.00
MID005336961	LONGWORTH PLATING SERVICE	CHELSEA	100.78	.00	.00
MID006031785	LORIN INDUSTRIES	MUSKEGON	135.96	.00	.00
MID006031561	LOWELL ENGINEERING CORPORATION	ALTO	132.03	.00	.00
MID005515705	LTV STEEL-TUBULAR PRODUCTS CO.	FERNDALE	146.00	.00	.00
MID005338371	MACDERMID INCORPORATED	FERNDALE	575.56	.00	.00
MID055850200	MACDONALD INDUSTRIAL PLASTICS	GRAND RAPIDS	411.27	.00	.00
MID005392170	MAGLINE INCORPORATED	STANDISH	59.03	.00	.00
MID054699830	MAGNETEK-OWOSSO	OWOSSO	18.36	.00	.00
MID980821391	MAGNI INDUSTRIES, INC.	DETROIT	48.77	.00	.00
MID047189097	MALLOY LITHOGRAPHING INCORPORATED	ANN ARBOR	38.28	.00	.00
MID005506357	MARATHON OIL COMPANY	DETROIT	1,507.75	.00	.00
MID000724823	MARATHON OIL COMPANY-FLINT	MT. MORRIS	133.76	.00	.00
MID000724815	MARATHON OIL COMPANY-JACKSON	JACKSON	221.78	.00	.00
MID092954098	MARATHON OIL COMPANY-MUSKEGON	N. MUSKEGON	330.26	.00	.00
MID000724807	MARATHON OIL COMPANY-NILES (S)	NILES	306.60	.00	.00
MID982604001	MARCH COATINGS, INC	BRINGTON	58.85	.00	.00
MID005371661	MARSH PLATING CORPORATION	YPSILANTI	320.20	.00	.00
MID005390836	MARSHALL BRASS COMPANY	MARSHALL	27.09	.00	.00

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MID085031599	MASCOTECH BRAUN COMPANY	DETROIT	5,099.72	.00	.00
MID084300987	MASCOTECH FORMING TECHNOLOGIES	FRASER	1,279.16	.00	.00
MID006028542	MASTER FINISH COMPANY	GRAND RAPIDS	102.10	.00	.00
MID981796303	MATERIALS & TECHNOLOGY LABORATORY	LANSING	55.86	.00	.00
MID006569081	MAYCO PLASTICS INCORPORATED	STERLING HEIGHT	34.18	.00	.00
MID069820181	MCGEAN-ROHCO INCORPORATED	LIVONIA	42.79	.00	.00
MID017422304	MCLOUTH STEEL, TRENTON PLANT	TRENTON	18,460.50	.00	.00
MID006015960	MEAD JOHNSON & CO., ZEELAND PLANT	ZEALAND	27.29	.00	.00
MID985579218	MECHANICS UNIFORM RENTAL CO.	DETROIT	177.05	.00	.00
MID985662295	MELCO ENGRAVING, INC.	ROCHESTER HILLS	19.94	.00	.00
MID981954241	MERIDIAN INCORPORATED	SPRING LAKE	589.28	.00	.00
MID005034749	MERILLAT INDUSTRIES INCORPORATED	ADRIAN	51.87	.00	.00
MID005356886	METAL FABRICATING DIVISION OF	PONTIAC	56.57	.00	.00
MID046708137	METALLOY CORP HUDSON MACHINE DIVIS	HUDSON	56.25	.00	.00
MID004950549	METALWORKS INCORPORATED	LUDINGTON	115.02	.00	.00
MID981089022	METOKOTE CORPORATION PLANT 8	GRAND BLANC	26.48	.00	.00
MID985660034	MICH CON MUSKEGON	MUSKEGON	133.25	.00	.00
MIR000003897	MICH CON WOOLFOLK STATION	BIG RAPIDS	102.93	.00	.00
MID985576495	MICH. AUTOMOTIVE COMPRESSOR, INC.	PARMA	176.32	.00	.00
MID000724831	MICHIGAN DISPOSAL WASTE TREATMENT P	BELLEVILLE	43,259.00	.00	.00
MIT270010465	MICHIGAN PROVING GROUNDS	ROMEO	36.35	.00	.00
MID060975844	MICHIGAN RECOVERY SYSTEMS INC.	ROMULUS	14,118.72	.00	.00
MID985569516	MICHIGAN STATE UNIVERSITY	EAST LANSING	221.61	.00	.00
MIT270010598	MICHIGAN UNIVERSITY OF THE	ANN ARBOR	36.40	175.00	.00
MID981089220	MICHNER PLATING CO/METAL TREAT DIV	JACKSON	82.25	.00	.00
MID005499116	MICHNER PLATING COMPANY	JACKSON	336.57	.00	.00
MID054686100	MICROPHOTO INC.	DETROIT	85.62	.00	.00
MID006020457	MIDWEST PLATING COMPANY INC.	GRAND RAPIDS	39.00	.00	.00
MID006025811	MILLER-SMITH MANUFACTURING COMPANY	SPRING LAKE	51.40	.00	.00
MID005503263	MODERN HARD CHROME	WARREN	201.82	.00	.00
MID985616689	MOLD-TECH MI	FRASER	20.30	.00	.00
MID009708678	MONSANTO COMPANY	TRENTON	63.43	250.00	.00
MID074246919	MONSANTO COMPANY	TRENTON	364.81	40.00	.00
MID005380134	MOTOR WHEEL CORPORATION	LANSING	63.04	.00	.00
MID005357504	MUELLER BRASS COMPANY	PORT HURON	455.18	.00	.00
MID005357520	MUELLER IMPACTS COMPANY	MARYSVILLE	68.67	.00	.00
MID981196512	MURRAY RECON INCORPORATED	ROMULUS	22.02	.00	.00
MID982626665	NABCO, INCORPORATED	MARION	122.71	.00	.00
MID005068507	NATIONAL COPPER PRODUCTS INC.	DOWAGIAC	42.74	.00	.00
MID068806520	NATIONAL METAL PROCESSING, INC.	DETROIT	522.42	.00	.00
MID064191216	NATIONAL RESEARCH COMPANY	FRASER	111.44	.00	.00
MIT270010549	NATIONAL STANDARD NILES LAKE ST PL	NILES	326.63	.00	.00
MID004320479	NATIONAL STEEL CORP, GT LAKES DIV	ECORSE	994.49	.00	.00
MID038606372	NERO PLASTICS INC	OWOSSO	21.64	.00	.00
MID005167242	NILES CHEMICAL PAINT CO., INC.	NILES	115.11	.00	.00
MID038624508	NIPPONDENSO MANUFACTURING, USA	BATTLE CREEK	698.72	.00	.00
MID087054078	NORTH STAR STEEL COMPANY	MONROE	11,107.07	.00	.00
MID065453169	NORTHERN COATINGS & CHEMICAL CO.	MENOMINEE	35.35	.00	.00
MID046535555	NORTHSTAR PRINT GROUP	NORWAY	34.07	.00	.00
MID980993869	NORTHWEST AIRLINES, INC.	DETROIT	14.44	.00	.00
MID021087275	NORTRU INC TRANSFER FACILITY	DETROIT	239.17	.00	.00
MID981090012	NORTRU INCORPORATED	DETROIT	136.92	.00	.00
MID985619824	NORTRU RESOURCES GROUP OF NORTRU, I	DETROIT	444.70	.00	.00
MID082859315	NTA ENGINEERING SYSTEMS	NILES	728.87	.00	.00
MID072793128	NUTRASWEET COMPANY, THE	HARBOR BEACH	87.24	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MID006014906	OCCIDENTAL CHEMICAL CORPORATION	MONTAGUE	422.94	.00	.00
MID109191114	OIS OPTICAL IMAGING SYSTEMS INC.	TROY	26.93	.00	.00
MID079275160	OMC RECREATIONAL BOAT GROUP LP-MI	CADILLAC	57.44	.00	.00
MID985567015	OMC RECREATIONAL BOAT GROUP LP-MI	CADILLAC	44.32	.00	.00
MID985566629	PAINT SERVICES GROUP OF NORTRU INC	DETROIT	10,141.67	.00	.00
MID005380126	PARKE-DAVIS DIVISION/WARNER-LAMBERT	ROCHESTER	21.37	5,237.00	.00
MID006013643	PARKE-DAVIS, DIV OF WARNER-LAMBERT	HOLLAND	165,020.71	1,620.00	.00
MIT270013709	PARKE-DAVIS, DIV OF WARNER-LAMBERT	ANN ARBOR	40.05	17.00	.00
MID005515853	PARKER HANNIFIN CORPORATION	KALAMAZOO	247.65	.00	.00
MID041793589	PARLIN INDUSTRIES INCORPORATED	FERNDALE	2,179.35	.00	.00
MID058801044	PATERSON HEAT TREAT INCORPORATED	CENTER LINE	113.92	.00	.00
MID981000060	PATRIOT SENSORS AND CONTROLS	PECK	27.41	.00	.00
MID005460902	PAW PAW PLATING INCORPORATED	PAW PAW	45.98	.00	.00
MID059899864	PEAKER SERVICES INCORPORATED	BRIGHTON	19.25	.00	.00
MID981195696	PENINSULAR PLATING	GRAND RAPIDS	487.78	.00	.00
MID041413154	PEPIN IRECO	ISHPEMING	176.60	.00	.00
MID980615298	PETRO-CHEM PROC. GRP., NORTRU INC	DETROIT	76,576.25	.00	.00
MID981192776	PLASTECH ENGINEERED PRODUCTS, INC.	ST. CLAIR SHORE	17.08	.00	.00
MID006409387	PLASTIC PLATE I	GRAND RAPIDS	236.71	.00	.00
MID980998538	PLASTIC PLATE II	KENTWOOD	29.25	.00	.00
MID061876363	PLATING SPECIALTIES INCORPORATED	MADISON HEIGHTS	23.91	13.00	.00
MID004916417	PPG CHEMFIL CORPORATION	TROY	133.96	.00	.00
MID048788749	PPG INDUSTRIES INCORPORATED	ADRIAN	50.59	.00	.00
MID980990642	PPG INDUSTRIES INCORPORATED	STERLING HEIGHT	23.65	.00	.00
MID980995096	PPG INDUSTRIES INCORPORATED	FLINT	174.29	.00	.00
MID981950173	PPG INDUSTRIES INCORPORATED	FLAT ROCK	18.00	.00	.00
MID054672803	PRECISION COATINGS INCORPORATED	WALLED LAKE	159.00	.00	.00
MID006018485	PRECISION PRODUCTS GROUP	MUSKEGON	14.66	.00	.00
MID981532310	PRINTCO INC.	GREENVILLE	24.32	.00	.00
MID047153077	PRODUCTION PLATED PLASTICS, INC.	RICHLAND	61.52	.00	.00
MID985621804	PVS TECHNOLOGIES, INC.	DETROIT	656.12	.00	.00
MID006530273	PVS-NOLWOOD CHEMICALS, INC.	DETROIT	85.10	.00	.00
MID005364187	QUAKER CHEMICAL CORP	DETROIT	105.53	.00	.00
MID985656685	QUALA SYSTEMS, INC.	KALAMAZOO	23.06	.00	.00
MID068814482	QUANEX CORPORATION, MACSTEEL DIV	JACKSON	2,608.53	.00	.00
MID082767591	QUANEX CORPORATION, MI SEAMLESS	SOUTH LYON	655,967.65	.00	.00
MID980793350	QUANTA CORPORATION	WYANDOTTE	440.02	.00	.00
MID044434595	QUANTUM COMPOSITES INCORPORATED	MIDLAND	24.59	.00	.00
MID985567759	R & J INDUSTRIES	JACKSON	51.08	.00	.00
MID006023204	RAPISTAN DEMAG CORPORATION	GRAND RAPIDS	501.77	.00	.00
MID094808110	RED SPOT WESTLAND, INC	WESTLAND	333.51	.00	.00
MID047179437	REILLY PLATING COMPANY	MELVINDALE	905.47	.00	.00
MID005320197	RING SCREW WORKS	MADISON HEIGHTS	324.95	.00	.00
MID101577955	RING SCREW WORKS	CENTERLINE	103.07	.00	.00
MID985599448	ROGERS CARTAGE CO	GOBRALTAR	17.29	.00	.00
MI0000927483	ROGERS CARTAGE CO	GIBRALTAR	16.27	.00	.00
MID057700023	ROMEO R.I.M. INCORPORATED	ROMEO	41.19	.00	.00
MID068801588	ROSEDALE PRODUCTS	ANN ARBOR	34.86	.00	.00
MID087738431	ROUGE STEEL COMPANY	DEARBORN	137.29	.00	.00
MID985663251	SAFETY-KLEEN CORP	ROMULUS	243.36	.00	.00
MID981000359	SAFETY-KLEEN CORP.	MASON	13.93	.00	.00
MID981000607	SAFETY-KLEEN CORP.	SAGINAW	15.60	.00	.00
MID000724591	SAMUEL WHITTAR INCORPORATED	DETROIT	2,821.60	.00	.00
MID981091218	SANDVIK STEEL COMPANY	BENTON HARBOR	27.65	.00	.00
MID980615132	SARNS 3M HEALTH CARE	ANN ARBOR	14.16	.00	.00

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- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MID078398658	SATURN CORPORATION	MADISON HEIGHTS	88.90	.00	.00
MID005515614	SEALED POWER TECHNOLOGIES, L.P.	ST. JOHNS	655.60	.00	.00
MID043682327	SEALED POWER TECHNOLOGIES, L.P.	MUSKEGON	881.65	.00	.00
MID980499735	SEALED POWER TECHNOLOGIES, L.P.	MUSKEGON	51.60	.00	.00
MID020093142	SEIBERT OXIDERMO INCORPORATED	ROMULUS	208.91	.00	.00
MID099113128	SELFRIDGE AIR NATIONAL GUARD	SELFRIDGE ANG B	31.43	.00	.00
MID054676580	SELFRIDGE PLATING	HARRISON TWP.	164.28	.00	.00
MIO001000439	SEMPCO INC	WEST BRANCH	61.85	.00	.00
MID985664895	SERMACOAT INC	BRIGHTON	14.45	.00	.00
MID980684187	SH CAPITOL PARTNERS INC DBA CIRCUIT	LIVONIA	134.26	.00	.00
MID060978038	SHERWIN WILLIAMS CO.	TROY	18.67	.00	.00
MID005035464	SIMPSON IND., LITCHFIELD OPS	LITCHFIELD	24.25	.00	.00
MID006016596	SMITHS IND/AEROSPACE & DEFENSE SYS	GRAND RAPIDS	28.64	.00	.00
MID980684088	SOLVENT DISTILLERS GRP./NORTRU, INC	DETROIT	6,040.40	.00	.00
MID981784663	SOUTHERN GRAPHIC SYSTEMS	BATTLE CREEK	34.18	.00	.00
MID118728666	SPECTRA PRODUCTS CORPORATION	GRAND HAVEN	110.08	.00	.00
MID981000482	SPECTRUM INDUSTRIES INC.	GRAND RAPIDS	25.65	.00	.00
MID006020929	SPRAYON PRODUCTS	HOLLAND	25.17	.00	.00
MID099662439	ST. JOSEPH MERCY HOSPITAL	ANN ARBOR	137.72	1.00	.00
MID000776070	STANLEY DOOR SYSTEMS	TROY	231.34	.00	.00
MID099124299	STANLEY TOOLS, FOWLERVILLE	FLOWLERVILLE	67.70	.00	.00
MID006016547	STEELCASE INC, GRAND RAPIDS SITE	GRAND RAPIDS	5,560.18	.00	.00
MID982074452	STEELCASE WOOD FURNITURE	KENTWOOD	230.15	.00	.00
MID005342134	STREBOR INC., KALAMAZOO PLANT	KALAMAZOO	15.71	31,415.60	.00
MIR000006353	STUCKEYS COLDWATER	COLDWATER	13.31	.00	.00
MID122401318	STYLECRAFT PRODUCTS, INC.	DETROIT	22.88	.00	.00
MID016744971	SUMITEC INCORPORATED	BENTON HARBOR	77.13	.00	.00
MI0000239996	SUMMIT POLYMERS INC	VICKSBURG	52.73	.00	.00
MID059697201	SUMMIT POLYMERS INCORPORATED	KALAMAZOO	32.54	.00	.00
MID072585839	SUN CHEMICAL/GEN. PRINTING INK DIV.	PORTAGE	37.60	.00	.00
MIR000004127	SUPERIOR METAL FINISHING	DETROIT	16.80	.00	.00
MID039994561	TANK MANAGEMENT, INC	LIVONIA	119.86	.00	.00
MID102350311	TECH NICKEL INCORPORATED	BUCHANAN	21.29	.00	.00
MID985582618	TECHNICAL AUTO PARTS INC.	BATTLE CREEK	105.65	.00	.00
MID006407597	TELEDYNE CONTINENTAL MOTORS	MUSKEGON	20.55	.00	.00
MID006015911	TENNECO PACKAGING INC.	FILER CITY	33.77	.00	.00
MID013039748	TESA TAPE INCORPORATED, SPARTA	SPARTA	32.73	.00	.00
MID109179754	THE CROWN GROUP, LIVONIA MI. PLANT	LIVONIA	26.35	.00	.00
MID980617435	THE DOW CHEMICAL COMPANY	MIDLAND	17,790.24	.00	.00
MID980994271	THE DOW CHEMICAL COMPANY	FREELAND	3,814.50	.00	.00
MID000820381	THE UPJOHN COMPANY	KALAMAZOO	38,313.73	30,828.00	.00
MID000821512	THE UPJOHN COMPANY	KALAMAZOO	30.72	.00	.00
MID000821520	THE UPJOHN COMPANY	KALAMAZOO	96.32	9,396.12	.00
MID980897185	THERMOFIL, INCORPORATED	BRIGHTON	106.88	.00	.00
MID982644957	THOMSON SAGINAW BALL SCREW COMPANY	SAGINAW	45.53	.00	.00
MID065877102	TIARA YACHTS, INC.	HOLLAND	30.95	.00	.00
MID083290551	TILDEN MINING COMPANY L.C.	ISHPEMING	20.70	.00	.00
MID005358130	TOTAL PETROLEUM INC. ALMA REFINERY	ALMA	937,950.13	.00	.00
MID985566611	TRIALON CORPORATION	SAGINAW	61.03	.00	.00
MID982627556	TTX COMPANY/DRACO DIVISION	WATERFORD	153.60	.00	.00
MID041511478	TYLER REFRIGERATION CORP.	NILES	177.44	.00	.00
MIR000001735	U OF M CHEMISTRY BLDG.	ANN ARBOR	25.48	60.00	.00
MIR000001784	U OF M MEDICAL SCIENCE RESEARCH B1	ANN ARBOR	29.29	129.00	.00
MIR000001792	U OF M NORTH CAMPUS TRANSFER FACILI	ANN ARBOR	15.74	160.00	.00
MIO571924760	U.S. AIR FORCE K.I. SAWYER AFB	GWINN	59.48	101.00	.00

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- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MID020844148	U-HAUL #102	INKSTER	15.26	.00	.00
MID006021679	UNC JOHNSON TECHNOLOGY	MUSKEGON	894.50	.00	.00
MID990859456	UNIPRO UNLIMITED	VANDERBILT	63.89	.00	.00
MID005323910	UNITED PAINT AND CHEMICAL CORP.	SOUTHFIELD	40.84	.00	.00
MID006571087	UNITED STEEL & WIRE	BATTLE CREEK	721.71	.00	.00
MID053320677	UNO-VEN -ROMULUS TERMINAL	ROMULUS	15,846.00	.00	.00
MI5210022781	US ARMY, TANK-AUTOMOTIVE & ARMAMENT	WARREN	89.16	.00	.00
MIR000009134	USDA-FOREST SERVICE	WATERSMEET	87.00	.00	.00
MID054689302	VALASSIS COMMUNICATIONS, INC.	LIVONIA	15.00	.00	.00
MID006023378	VALLEY CITY PLATING	GRAND RAPIDS	56.87	.00	.00
MID041801366	VAN PRODUCTS COMPANY	VANDERBILT	77.35	.00	.00
MID095410049	VICKERS INC. JACKSON PLANT	JACKSON	78.68	.00	.00
MID005346754	VICO PRODUCTS COMPANY	PLYMOUTH	30.85	.00	.00
MID006407142	VIKING CORPORATION	HASTINGS	33.51	.00	.00
MIO000991752	VIKING ENERGY OF MCBAIN	MCBAIN	31.23	.00	.00
MID005377213	VINEWOOD CORPORATION	DURAND	573.12	.00	.00
MID985578988	VOIGT & SCHWEITZER GALVANIZERS INC.	REDFORD	50.00	.00	.00
MID075400671	WACKER SILICONES CORPORATION	ADRIAN	112.11	.00	.00
MID008901373	WALKER WIRE (ISPAT) INC.	FERNDALE	249.61	.00	.00
MIR000008235	WAYNE CO BRIDGE 0295/BEECH DALY	DEARBORN HGTS.	23.15	.00	.00
MIR000008243	WAYNE CO BRIDGE 0320/UPPR ROUGE	DETROIT	23.58	.00	.00
MIR000008250	WAYNE COUNTY BRIDGE 0414	CANTON TWP.	17.60	.00	.00
MIT270011265	WAYNE STATE UNIVERSITY/EH&S OFFICE	DETROIT	47.01	.00	.00
MID981957830	WEBCRAFT GAMES INCORPORATED	YPSILANTI	41.12	.00	.00
MID005381967	WELLS ALUMINUM CORP/KALAMAZOO DIV.	KALAMAZOO	262.34	.00	.00
MID000810390	WHIRLPOOL CORP., BENTON HARBOR DIV	BENTON HARBOR	881.99	.00	.00
MID016993834	WHITE TOWER INDUSTRIAL LAUNDRY &CLE	DETROIT	170.59	.00	.00
MID006401970	WILLIAMS INTERNATIONAL	COMMERCE TOWNSH	21.66	.00	.00
MID005356969	WOLVERINE COIL COATING INC.	LINCOLN PARK	205.82	.00	.00
MID005354386	WOLVERINE GASKET	INKSTER	22.15	.00	.00
MID000810408	WOODLAND MEADOWS LANDFILL NORTH	CANTON TWP	945.96	.00	.00
MID080361454	WYCKOFF CHEMICAL COMPANY	SOUTH HAVEN	3,430.76	.00	.00
MID985569946	YAMAHA MUSICAL PRODUCTS	GRAND RAPIDS	105.93	.00	.00
MID083684290	ZEELAND CHEMICALS INCORPORATED	ZEELAND	2,746.99	.00	.00
MID980614267	3M DETROIT, ABRASIVE SYSTEMS DIV.	DETROIT	158.10	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MID061568176	ALCHEM ALUMINUM INCORPORATED	COLDWATER	9.11	.00	.00
MID021033378	ALKEN-ZIEGLER	KALKASKA	1.73	.00	.00
MID048222608	ALLIEDSIGNAL AEROSP., GUIDANCE SYS	BOYNE CITY	6.43	.00	.00
MID020105565	AMERICAN AXLE & MANUFACTURING INC.	DETROIT	6.20	.00	.00
MID061876090	AMERICAN INTERNATIONAL AIRWAYS, INC	YPSILANTI	4.07	.00	.00
MID044436541	APX INTERNATIONAL	LINCOLN PARK	7.26	.00	.00
MID985575836	APX INTERNATIONAL	MADISON HEIGHTS	12.49	.00	.00
MID044973642	ARMORCLAD INCORPORATED	FARMINGTON HILL	8.10	.00	.00
MID005353651	AUTOMOTIVE FINISHES INCORPORATED	DEARBORN	11.57	.00	.00
MID052025566	AUTOMOTIVE PLASTIC TECHNOLOGIES	STERLING HEIGHT	7.49	.00	.00
MID005322094	B & B PAINT CORPORATION	FLINT	10.17	.00	.00
MID048223986	BASF CORPORATION	HOLLAND	4.66	.00	.00
MID270013642	BASF CORPORATION	HAMTRAMACK	2.80	.00	.00
MID985574102	BECKER MANUFACTURING INCORPORATED	AUBURN HILLS	8.65	.00	.00
MID119271351	BECKER MANUFACTURING-URETHANE DIVIS	STERLING HEIGHT	3.48	.00	.00
MIO000233429	BUCKEYE PIPE LINE CO., L.P.	TRENTON	3.96	.00	.00
MIR000008995	BUCKEYE PIPE LINE CO., L.P.	MELVINDALE	5.25	.00	.00
MIR000008987	BUCKEYE PIPE LINE COMPANY	NOVI	1.46	.00	.00
MIR000008979	BUCKEYE PIPE LINE COMPANY, L.P.	TAYLOR	4.13	.00	.00
MID985574961	CADILLAC LUXURY CAR DIVISION	FLINT	8.20	.00	.00
MID981101264	CADILLAC RUBBER & PLASTICS/CAD DIV	CADILLAC	6.41	.00	.00
MID058799271	CASS RIVER COATINGS INCORPORATED	VASSAR	11.45	.00	.00
MID006402887	CHEM-TREND INCORPORATED	HOWELL	9.42	.00	.00
MID000823021	CHRYSLER CORP., MOUND RD ENGINE PL	DETROIT	4.47	.00	.00
MIR000000810	CHRYSLER PENTASTAR AVIATION	WATERFORD	3.87	.00	.00
MID017184334	CLARK HIGHWAY SERVICES, INC.	LAKE CITY	1.34	.00	.00
MIT270012164	CLARK REFINING AND MARKETING, INC.	MARSHALL	3.37	.00	.00
MID000809822	CONRAIL DETROIT LIVERNOIS YARD	DETROIT	4.20	.00	.00
MID052044963	CONSUMERS POWER COMPANY	JACKSON	8.37	.00	.00
MID097804330	CONSUMERS POWER COMPANY	MUSKEGON	6.06	.00	.00
MID982418691	CONSUMERS PWR CO/OVERISEL COMPRESR	HAMILTON	1.36	.00	.00
MIT270012149	CROWN GROUP DETROIT, MI PLANT	DETROIT	12.34	.00	.00
MID000810622	CROWN PAPER CO., DBA CROWN VANTAGE	PARCHMENT	11.14	.00	.00
MID981798820	CSMS AND MAINTENANCE ARMORY	LANSING	1.98	.00	.00
MIR000006460	CSX TRANSPORTATION	BALDWIN	2.90	.00	.00
MIP200001470	CSZ TRANSPORTATION	PORT HURON	1.63	.00	.00
MID985572759	CURTLIN MANUFACTURING INCORPORATED	OSSEO	13.05	.00	.00
MID985641448	CUSTOM HEAT TREAT, INC.	KINGSFORD	3.15	.00	.00
MIP200001471	DAIRY MART STORE NO. 9601	GRAND RAPIDS	4.00	.00	.00
MID010881332	DELTA RESINS & REFRACTORIES	DETROIT	10.34	.00	.00
MID005357967	DETROIT AXLE PLANT	DETROIT	3.81	.00	.00
MID000721548	DETROIT EDISON COMPANY	ST. CLAIR	11.90	.00	.00
MID000721571	DETROIT EDISON COMPANY	TRENTON	9.55	.00	.00
MID000809608	DETROIT EDISON COMPANY	DETROIT	9.58	.00	.00
MID087056685	DETROIT EDISON COMPANY	FRENCHTOWN TWP.	7.74	.00	.00
MID000721670	DIVERSEY CORPORATION	WYANDOTTE	4.99	.00	.00
MI0001025477	DIVERSIFIED CHEMICAL TECHNOLOGIES,	DETROIT	8.48	.00	.00
MID985662717	DONNELLY CORPORATION	HOLLAND	2.80	.00	.00
MID000809798	EAGLE-PICHER HT DIV/RUBBER PLANT	HILLSDALE	7.55	.00	.00
MID054169958	EAGLE-PICHER, HT DIV/JONESVILLE PL	JONESVILLE	11.47	.00	.00
MIR000006031	EXCELDA MANUFACTURING	BRIGHTON	9.18	.00	.00
MID017267410	FISHER STEEL & SUPPLY COMPANY	MUSKEGON	3.90	.00	.00
MID982624025	FLINT TOOL & DIE	FLINT	6.55	.00	.00
MID982421224	FOMOCO CCO ITC BLDG. D	DEARBORN	1.64	.00	.00
MID005379797	FORD MOTOR CO., DEARBORN STAMPING	DEARBORN	9.08	.00	.00

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MID076342708	FORD MOTOR CO, MT CLEMENS PLASTICS	MT. CLEMENS	4.96	.00	.00
MID985617588	FORD MOTOR COMPANY, A.T.N.P.C.	LIVONIA	6.97	.00	.00
MID005057005	FORD MOTOR COMPANY, MONROE PLANT	MONROE	11.70	.00	.00
MID061874723	FORD MOTOR COMPANY, VAN DYKE PLANT	STERLING HEIGHT	8.04	.00	.00
MIT270011307	FORD MOTOR DEARBORN GLASS PLANT	DEARBORN	4.86	.00	.00
MIR000008318	FORMER BLUE'S MARATHON	BENTON HARBOR	5.88	.00	.00
MI0001021534	FORMER VARNELL PLATING CO	PRAIRIE RONDE T	4.67	.00	.00
MID006532246	G P PLASTICS INCORPORATED	ROCHESTER HILLS	7.77	.00	.00
MID005109392	GAST MANUFACTURING CORPORATION	BENTON HARBOR	4.13	.00	.00
MID985622653	GLOBE BUSINESS FURNITURE	BIG RAPIDS	13.05	.00	.00
MID005356795	GM-WILLOW RUN ASSEMBLY	YPSILANTI	11.67	.00	.00
MID085468965	GMC SPO LANSING	LANSING	10.07	.00	.00
MID006020416	GMC, DELPHI AUTOMOTIVE SYSTEMS	GRAND RAPIDS	2.01	.00	.00
MID980700843	GMC, LANSING PLANT 5	LANSING	8.68	.00	.00
MID005356696	GMC, POWERTRAIN GRP MALLEABLE IRON	SAGINAW	8.84	.00	.00
MID079300075	GRAND TRUCK WESTERN RR LOCOMOTIVE	BATTLE CREEK	11.79	.00	.00
MID094529286	GRAND TRUCK WESTERN RR PORT HURON	PORT HURON	2.75	.00	.00
MID053323911	GREAT LAKES GAS TRANSMISSION CO.	OTISVILLE	11.99	.00	.00
MI0000128306	H.B. FULLER AUTO PRODUCTS, INC.	WARREN	1.83	.00	.00
MID079290797	HARBISON-WALKER REFRACTORIES CO.	LUDINGTON	1.27	.00	.00
MID006009047	HEADER PRODUCTS INCORPORATED	ROMULUS	5.92	.00	.00
MID005038500	HOLNAM INC DUNDEE PLT	DUNDEE	6.59	.00	.00
MID980567838	HOSKINS MANUFACTURING COMPANY	MIO	1.12	.00	.00
MID005356050	HOWARD PLATING INDUSTRIES, INC.	MADISON HEIGHTS	5.30	.00	.00
MID080345630	HOWMET CORPORATION PLANT 4	WHITEHALL	3.46	.00	.00
MID000722942	HOWMET CORPORATION PLANT 5	WHITEHALL	2.77	.00	.00
MID985567171	HURON MFG. DIVISION, PORT HURON PL	PORT HURON	8.46	.00	.00
MID060174125	HY-LIFT DIVISION	MUSKEGON	3.37	.00	.00
MID020886040	INX INTERNATIONAL INK. CO.	KALAMAZOO	11.88	.00	.00
MID070293139	ITW FOAMSEAL	OXFORD	11.65	.00	.00
MID005320247	J & L SPECIALTY STEEL INCORPORATED	DETROIT	1.99	.00	.00
MID005344544	J.D. PLATING COMPANY INCORPORATED	MADISON HEIGHTS	4.25	.00	.00
MID076394709	JACKSON PRISON COMPLEX	JACKSON	7.54	.00	.00
MID981002926	KAUMAGRAPH FLINT CORP.	MILLINGTON	13.00	.00	.00
MID985580489	KEELER DIECAST	GRAND RAPIDS	2.03	.00	.00
MID005357371	KELSEY-HAYES COMPANY	JACKSON	11.28	.00	.00
MID006017339	KNOLL GROUP, MUSKEGON	MUSKEGON	7.94	.00	.00
MID005366679	KOLENE CORPORATION	DETROIT	4.04	.00	.00
MID044260990	KRAFT FOODS, POST DIVISION	BATTLE CREEK	6.21	13.60	.00
MID006014666	LACKS INDUSTRIES, INC.	GRAND RAPIDS	5.54	.00	.00
MID005379607	LAFARGE CORPORATION	ALPENA	10.09	.00	.00
MID065859191	LEIGH PRODUCTS INC.	COOPERSVILLE	12.47	.00	.00
MID081601122	MACDERMID, INC.	NEW HUDSON	1.64	.00	.00
MID985586726	MASCOTECH SPEC. VEHICLES	DETROIT	2.03	.00	.00
MIR000003657	MDEQ, ENVIRONMENTAL RESPONSE DIV.	JASPER TWNSHP,	3.64	.00	.00
MID005375597	MEANS INDUSTRIES, VASSAR PLANT	VASSAR	1.98	.00	.00
MID005356944	METAL FABRICATING DIV, GMC GRAND BL	GRAND BLANC	7.38	.00	.00
MI0000980797	METRO GARAGE	DETROIT	6.41	.00	.00
MID985610641	MICH CON BUCKLEY	MESICK	3.81	.00	.00
MID985614957	MICH CON WEALTHY	GRAND RAPIDS	8.97	.00	.00
MI0000937094	MICHIGAN GAS STORAGE AKRON CITY GAT	AKRON	6.48	.00	.00
MIT270012008	MICHIGAN PLASTIC PRODUCTS COMPANY	GRAND HAVEN	7.47	.00	.00
MID000724864	MILLER METAL PRODUCTS	GRAND RAPIDS	10.38	.00	.00
MID004921318	MINOWITZ MANUFACTURING COMPANY	ROSEVILLE	2.09	.00	.00
MID006013403	MORSE HEMCO	HOLLAND	6.02	.00	.00

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MID005356910	NAO PROPERTY MANAGEMENT-FIERO FACIL	PONTIAC	1.31	.00	.00
MID005069257	NAT'L STANDARD NILES CITY COMPLEX	NILES	6.00	.00	.00
MID982428328	NATIONAL STEEL CORP.	TRENTON	6.13	.00	.00
MID981197940	NORTHWEST AIRLINES, INC.	DETROIT	2.37	.00	.00
MID185028081	OIS OPTICAL IMAGING SYSTEMS INC.	TROY	5.99	.00	.00
MID980898571	OLIVER PRODUCTS COMPANY	GRAND RAPIDS	5.84	.00	.00
MID049295223	PANDROL JACKSON	LUDINGTON	8.65	.00	.00
MID980587893	POWERTRAIN DIV. GMC	YPSILANTI	7.38	.00	.00
MID084581578	PRINTCO INCORPORATED	NILES	8.05	.00	.00
MID985656677	QUALA SYSTEMS, INC.	MIDLAND	9.07	.00	.00
MID020087128	REICHHOLD CHEMICALS, INC.	FERNDALE	4.20	.00	.00
MID006011472	RELIANCE FINISHING COMPANY	GRAND RAPIDS	11.72	.00	.00
MID981199938	ROAD COMMISSION FOR OAKLAND COUNTY	WATERFORD	8.51	.00	.00
MID000722694	SAFETY KLEEN CORPORATION	ROMULUS	1.26	.00	.00
MID000722686	SAFETY-KLEEN CORPORATION	PONTIAC	5.64	.00	.00
MID981000615	SAFETY-KLEEN CORPORATION	GRAND RAPIDS	12.51	.00	.00
MID044965911	SEARS UNIT #1460	LIVONIA	1.79	.00	.00
MIR000006395	SEARS UNIT #1490	TROY	2.45	.00	.00
MIR000003244	SEARS UNIT #2040	BATTLE CREEK	3.16	.00	.00
MID982629776	SEARS UNIT #8270	STERLING HEIGHT	3.52	.00	.00
MIO000461012	SEARS UNIT #9620	FLINT	5.65	.00	.00
MID005365812	SEIBERT-OXIDERMO, INC.	DETROIT	6.95	.00	.00
MID000609107	SHELL OIL COMPANY	JACKSON	1.67	.00	.00
MID000609115	SHELL OIL COMPANY	ROMULUS	6.05	.00	.00
MID068819648	SHELL OIL COMPANY, DEACON STREET	DETROIT	5.55	.00	.00
MID982204406	SHERWIN WILLIAMS COMPANY	GRANDVILLE	5.27	.00	.00
MID057393159	SODUS HARD CHROME, INC.	SODUS	9.11	.00	.00
MID085889285	SUN CHEMICAL CORP. OF MICHIGAN	MUSKEGON	3.54	.00	.00
MI0001012236	TECH NICKEL INC	BENTON HARBOR	8.52	.00	.00
MID985625516	THOMSON BAY COMPANY	BAY CITY	9.87	.00	.00
MIR000010116	TREMCO AUTOBODY TECHNOLOGIES	BRIGHTON	3.38	.00	.00
MIT270011273	TREMCO AUTOBODY TECHNOLOGIES	BRIGHTON	8.86	.00	.00
MID005367784	TRU-LINE METAL PRODUCTS	LIVONIA	9.03	.00	.00
MID981800949	TRW INFLATABLE RESTRAINTS INC.	ROMEO	4.54	.00	.00
MIR000001776	U OF M CAMPUS SAFETY SERVICES BLDG.	ANN ARBOR	1.36	.00	.00
MID985622224	UNITED PARCEL SERVICE INCORPORATED	WYOMING	6.25	.00	.00
MID004912150	UNIVERSAL SUPERABRASIVES INC.	ROMULUS	6.73	.00	.00
MID980681696	VAN WATERS & ROGERS INCORPORATED	DUTTON	1.76	.00	.00
MID029631686	VESCO OIL CORPORATION	DETROIT	1.50	.00	.00
MID005394465	WALBRO ENGINE MANAGEMENT CORP.	CASS CITY	12.62	.00	.00
MIR000008268	WAYEN COUNTY BRIDGE 0456	GROSSE ILE	8.85	.00	.00
MIR000008276	WAYNE COUNTY BRIDGE 0471	NORTHVILLE TWP	3.00	.00	.00
MIR000008284	WAYNE COUNTY BRIDGE 0476	WAYNE	9.71	.00	.00
MIR000008292	WAYNE COUNTY BRIDGE 2006A	CANTON TWP.	3.00	.00	.00
MID980682827	WESTERN MICHIGAN UNIVERSITY	KALAMAZOO	11.97	.00	.00
MID005318480	YALE-SOUTH HAVEN INCORPORATED	SANDUSKY	10.90	.00	.00
MID980620025	ZIEBART PRODUCTS GROUP	REDFORD	8.04	.00	.00
MID000666701	0008-3642 SUNOCO SERVICE STATION	DETROIT	3.09	.00	.00
MID001698182	0019-9208 RIVER ROUGE TERMINAL	DETROIT	3.94	.00	.00
MID985613785	0354-5662 SUNOCO SERVICE STATION	FLINT	2.40	.00	.00
MID982622268	1TW FOAMSEAL	LAPEER	9.00	.00	.00

Note: Please refer to the introduction for an explanation of this list.

MICHIGAN

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO CANNOT BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- LESS THAN 1.1 TONS RCRA HAZARDOUS WASTE, AND
- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MID981780570	ACE FINISHING INCORPORATED	WARREN	.00	.00	.00
MID057004871	ALGONAC CAST PRODUCTS INCORPORATED	ALGONAC	.00	.00	.00
MID064168461	AMERICAN STEEL CORPORATION	DETROIT	.00	.00	.00
MID985646587	BARNETT CLARK INCORPORATED	SPRING LAKE	.00	.00	.00
MID005339460	CADON PLATING COMPANY	WYANDOTTE	.68	.00	.00
MID005361597	CONTAINER SPECIALTIES INCORPORATED	FLINT	.49	.00	.00
MID006958524	DETROIT H.Q. BUILDING	DETROIT	.00	.00	.00
MID005324546	DIECAST CORPORATION	JACKSON	.00	.00	.00
MID990760282	GMC, DELPHI SAGINAW STEERING SYSTEM	SAGINAW	.18	.00	.00
MID005356704	GMC, NAO-CADILLAC CLARK PLANT	DETROIT	.84	.00	.00
MID072576317	HEKMAN FURNITURE COMPANY	GRAND RAPIDS	.00	.00	.00
MIT270013071	INDUSTRIAL SOLVENTS INCORPORATED	ST. LOUIS	.00	.00	.00
MID048989891	M.P.I. RESEARCH	MATTAWAN	.65	.00	.00
MID005365432	MASLAND ACOUSTIC COMPONENTS	TROY	1.00	.00	.00
MID005339676	MCGRAW-EDISON COMPANY	ALBION	.45	.00	.00
MID053343976	MICHIGAN STATE UNIVERSITY	EAST LANSING	.00	.00	.00
MID041812538	MID STATE PLATING COMPANY	FLINT	.00	.00	.00
MID980791511	NUMATICS INCORPORATED	OWOSSO	.00	.00	.00
MID981531312	PLYMOUTH PLATING WORKS INC.	PLYMOUTH	.66	.00	.00
MIR000001685	QUALITY WOOD TREATING CO INC	LANSING	.75	.00	.00
MID985665876	SQS, INC.	PLYMOUTH	.02	.00	.00
MID981200835	SYSTECH ENV. CORP. - LAFARGE CORP.	ALPENA	.00	.00	.00
MID057697591	TOTAL ROMULUS TERMINAL	ROMULUS	.00	.00	.00
MID985635846	U.P. ENVIRONMENTAL SERVICES, INC.	BARK RIVER	.00	.00	.00
MID098678584	UNISTRUT DIVERSIFIED PRODUCTS	WAYNE	.00	.00	.00
MIT270010234	UNO-VEN COMPANY, BAY CITY TERMINAL	BAY CITY	1.00	.00	.00
MID048090633	WAYNE DISPOSAL SITE #2 LANDFILL	BELLEVILLE	.00	.00	.00

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MINNESOTA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MND980682918	(CSD)/FLEXIBLE PACKAGING DIVISION	NEW HOPE	85.48	.00	.00
MND980613822	UNIV. OF MINNESOTA, ST PAUL CAMPUS	ST PAUL	26.59	.00	.00
MND000819292	ADVANCED FLEX, INC. - PLANT 3	MINNETONKA	96.11	.00	.00
MND985667807	ADVANCED FLEX, INC.- PLANT #2	CHASKA	403.37	.00	.00
MND006259600	AMERICAN NATIONAL CAN COMPANY	ST. LOUIS PARK	76.76	.00	.00
MND079727061	AMERICAN NATIONAL CAN COMPANY	MINNEAPOLIS	203.48	.00	.00
MND006167332	ANDERSEN CORPORATION	BAYPORT	197.25	.00	.00
MN3170022914	ARMAMENT SYS. DIV., UNITED DEFENSE/	FRIDLEY	35.87	.00	.00
MND985699826	ASHLAND PETROLEUM CO.	ST. PAUL PARK	2,955.01	87,700.00	.00
MND001037639	ADVANCE CIRCUITS	ROSEVILLE	2,877.95	.00	.00
MND980680540	ADVANCE CIRCUITS PLANT #3	HOPKINS	419.70	.00	.00
MND058330473	ADVANCED FLEX, INC. - PLANT 1	MINNETONKA	547.12	.00	.00
MND062859038	AFC-DIVISION OF MANUFACTURING	CHATFIELD	30.03	.00	.00
MND076522267	AG-CHEM EQUIPMENT	JACKSON	418.12	.00	.00
MND006175871	ALBERT LEA ELECTROPLATING	ALBERT LEA	79.93	.00	.00
MND081138604	ALLIANT TECHSYSTEMS PROVING GROUND	ELK RIVER	89.20	.00	.00
MND060491040	AMOCO OIL COMPANY	ROSEVILLE	49.87	.00	.00
MND985748763	ANAGRAM INTERNATIONAL INC.	EDEN PRAIRIE	85.37	.00	.00
MND000245068	APPLIED COATING TECHNOLOGY	EDEN PRAIRIE	23.76	.00	.00
MND006254783	APPLIED COATING TECHNOLOGY	MINNEAPOLIS	59.67	.00	.00
MND080248750	APPLIED COATING TECHNOLOGY	MENDOTA HEIGHTS	18.15	.00	.00
MND981190242	APTUS, INC	LAKEVILLE	168.19	.00	.00
MND980826424	ARCTCO, INC.	THIEF RIVER FAL	28.32	.00	.00
MND982645863	ARTISTIC FINISHES INC	ROSEVILLE	25.43	.00	.00
MND980793442	ASHLAND CHEMICAL COMPANY	ST. PAUL	144.25	.00	.00
MND006219919	ASSOCIATED ENGINEERING OF MANKATO	MANKATO	51.61	.00	.00
MND985761113	ATLAS MANUFACTURING	FRIDLEY	43.79	.00	.00
MND980681589	AVTEC FINISHING SYSTEMS	NEW HOPE	785.26	.00	.00
MND000117572	AWARD CRAFT INC.	BLOOMINGTON	229.74	.00	.00
MND980995187	AZTEC ELECTONICS	MINNEAPOLIS	31.56	.00	.00
MND006260053	BARREL FINISH INC	RICHFIELD	97.96	.00	.00
MND982205874	BERGQUIST COMPANY - THERMAL PROD.	CANNON FALLS	54.51	.00	.00
MND990860470	BUCKBEE-MEARS ST. PAUL	ST. PAUL	470.05	.00	.00
MND980700900	BUREAU OF ENGRAVING, INC.	MINNEAPOLIS	1,967.36	.00	.00
MND000819961	BURLINGTON NORTHERN RAILROAD	ST. PAUL	16.25	.00	.00
MND132568015	BURLINGTON NORTHERN SANTE FE RR	MINNEAPOLIS	51.65	.00	.00
MND000608554	CERIDIAN CORP., COMPUTING DEVICES I	BLOOMINGTON	82.24	35.00	.00
MND000808923	CONSOLIDATED CONTAINER CORP.	MINNEAPOLIS	312.15	.00	.00
MND006152334	CANNON EQUIPMENT	CANNON FALLS	89.71	.00	.00
MND006261754	CASS SCREW MACHINE PRODUCTS	BROOKLYN CENTER	16.39	.00	.00
MND985713452	CENTURY CIRCUITS	ST. PAUL	16.87	.00	.00
MND046707444	CERAM TRAZ CORPORATION	OSSEO	101.83	.00	.00
MND985767474	CHALLENGE PRINTING INC.	EDEN PRAIRIE	23.38	.00	.00
MNT280010034	CIRCUIT SCIENCE INC	PLYMOUTH	630.62	.00	.00
MND006172621	CO-OPERATIVE PLATING COMPANY	ST. PAUL	821.82	.00	.00
MND006187595	COLEMAN POWERMATE COMPRESSORS	SPRINGFIELD	17.73	.00	.00
MND985677210	CONTAINER GRAPHICS CORPORATION	WHITE BEAR LAKE	18.69	.00	.00
MND980501167	CRENLO, INC. - PLANT #2	ROCHESTER	213.22	.00	.00
MND050742014	CROWN CORK & SEAL PLANT #23	FARIBAULT	149.80	.00	.00
MND006209860	CRYSTAL CABINET WORKS	PRINCETON	173.36	.00	.00
MND043855527	CTS CORP. - CONNECTOR	NEW HOPE	24.06	.00	.00
MND118765791	CYPRESS SEMICONDUCTOR MN INC.	BLOOMINGTON	67.94	600.00	.00
MND062835376	D.S. MANUFACTURING INC.	PINE ISLAND	34.99	.00	.00
MND006251656	DAVIS-FROST, INC.	MINNEAPOLIS	27.30	.00	.00
MND006149330	DCI, INC.	ST. CLOUD	15.74	.00	.00

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- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MND006256861	DEALERS MANUFACTURING	FRIDLEY	38.05	.00	.00
MND078680790	DESIGN FABRICATED	STILLWATER	88.14	.00	.00
MND022888143	DETERMAN WELDING AND TANK SERVICE	FRIDLEY	488.36	.00	.00
MND985681998	DIVERSIFIED GRAPHICS	MINNEAPOLIS	41.75	.00	.00
MND006249056	DOUGLAS CORPORATION	MINNEAPOLIS	24.69	.00	.00
MND980794705	DOUGLAS CORPORATION	EDEN PRAIRIE	82.61	.00	.00
MND006478523	DOUGLAS CORPORATION, PLATING DIVISI	ST. LOUIS PARK	105.07	.00	.00
MND980994651	DOUGLAS MACHINE LLC	ALEXANDRIA	48.60	.00	.00
MND981190549	DUGAS BOWERS PLATING CO	FRIDLEY	48.03	.00	.00
MND006961239	DULUTH, MISSABE, & IRON RANGE RAILW	PROCTOR	16.30	.00	.00
MND000826339	DUPONT REFINISH	MINNEAPOLIS	26.26	.00	.00
MND980996805	ENVIRO-CHEM, INC.	ROGERS	52.07	.00	.00
MND985767482	ECO FINISHING INC	FRIDLEY	460.45	.00	.00
MND006154918	ELECTRO-PLATING ENG	ST PAUL	156.67	.00	.00
MND982066730	ELECTRONIC INDUSTRIES, INC.	VADNAIS HEIGHTS	29.92	.00	.00
MND078683703	ENGINEERED POLYMERS	MORA	20.15	.00	.00
MND006156590	FEDERAL-HOFFMAN, INC.	ANOKA, MN	1,058.38	.00	.00
MND006223622	FOLDCRAFT COMPANY	KENYON	16.52	.00	.00
MND006147045	FIBERITE, INC.	WINONA	78.35	.00	.00
MND055468169	FLINT INK INCORPORATION	WEST ST. PAUL	18.79	.00	.00
MND006207773	FORD MOTOR CO	ST PAUL	849.14	.00	.00
MND077629467	FRANKLIN HEATING STATION	ROCHESTER	96.53	.00	.00
MND064767858	GLASSTITE, INC.	DUNNELL	53.10	.00	.00
MND980702286	GRACO INC. - RIVERSIDE	MINNEAPOLIS	36.44	.00	.00
MND023060569	GILLETTE COMPANY INC THE	ST. PAUL	88.95	.00	.00
MND982622946	GLOBE BUILDING MATERIALS	ST PAUL	111.04	.00	.00
MND006148092	GOPHER RESOURCE CORPORATION	EAGAN	5,219.22	.00	.00
MND058320011	GUIDANT, CPI	ST. PAUL	28.99	.00	.00
MND000819318	HONEYWELL - MILITARY AVIONICS	MINNEAPOLIS	39.00	.00	.00
MND000819284	HONEYWELL INC. HBC	GOLDEN VALLEY	88.91	.00	.00
MND000294389	HONEYWELL-SOLID STATE ELECTRONICS C	PLYMOUTH	17.06	.00	.00
MND050730175	HARD CHROME INC.	MINNEAPOLIS	443.41	.00	.00
MNR000007260	HARDCOAT, INC.	MINNEAPOLIS	56.25	.00	.00
MND066539743	HOLADAY CIRCUITS INC.	MINNETONKA	319.34	.00	.00
MND006456768	HUTCHINSON TECHNOLOGY INCORPORATED	HUTCHINSON	1,281.14	.00	.00
MND006161756	IBM CORPORATION	ROCHESTER	5,381.51	.00	.00
MND077637650	IMPERIAL, INCORPORATED	ALBERT LEA	17.20	8,172.00	.00
MND985697135	INDEPENDENT TECHNOLOGY SYSTEMS (ITS	BLOOMINGTON	50.23	.00	.00
MND985669126	INTERPLASTIC CORPORATION	VADNAIS HEIGHTS	20.86	.00	.00
MND006258115	JAPS-OLSON COMPANY	MINNEAPOLIS	14.27	.00	.00
MND006159149	JOHN ROBERTS PRINTING CO	MINNEAPOLIS (CO	77.93	.00	.00
MND000608547	JOHNSON MATTHEY SEMICONDUCTOR PACKA	ST. LOUIS PARK	117.49	.00	.00
MND006481287	JOYNER ELECTROPLATING	BROOKLYN PARK	101.55	.00	.00
MND985687565	KURT DIE CAST	FRIDLEY	27.22	.00	.00
MND059680165	KURT MANUFACTURING -MAIN	MINNEAPOLIS	93.57	.00	.00
MND000686071	KOCH REFINERY CO.- HAZ.WASTE FACILI	ROSEMOUNT	565.81	146.00	.00
MND000686121	KOCH SULFURIC ACID UNIT	ROSEMOUNT	15.32	16,027.00	.00
MND985666072	LAKE REGION MFG INC	CHASKA	48.59	.00	.00
MND062838750	LAKESIDE LTD., INC.	NEW HOPE	36.89	.00	.00
MNT280010984	LARSON GLASTRON BOATS, INC.	LITTLE FALLS	13.75	.00	.00
MND008904336	LEEF BROS INC	MINNEAPOLIS	27.66	.00	.00
MND077636397	LITCHFIELD PRECISION COMPONENTS	LITCHFIELD	118.49	.00	.00
MND981536006	LITHO INC	ST PAUL	21.39	.00	.00
MND000823922	LORAL DEFENSE SYSTEMS - EAGAN	ST. PAUL	83.43	.00	.00
MND022826283	LTV STEEL MINING COMPANY	HOYT LAKES	164.79	231.00	.00

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MINNESOTA

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- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MND006148282	LUCAS BODY SYSTEMS - WINONA	WINONA	642.72	.00	.00
MND006158042	LULL INDUSTRIES	EAGAN,	15.85	.00	.00
MND990730673	LUND BOAT CO.	NEW YORK MILLS	28.89	.00	.00
MND083467688	MAYO FOUNDATION	ROCHESTER	87.35	2,695.00	.00
MND982605578	MCLAUGHLIN GORMLEY KING	CHASKA	14.34	.00	.00
MND006164511	MARVIN WINDOWS	WARROAD	359.80	.00	.00
MND006250799	MARWIN PAINTS, INC.	MINNEAPOLIS	122.62	.00	.00
MND980501134	MCLAUGHLIN GORMLEY KING COMPANY	MINNEAPOLIS	50.69	.00	.00
MND054487756	MCNEILUS TRUCK AND MANUFACTURING, I	DODGE CENTER	40.27	.00	.00
MND980995815	MEDALLION KITCHENS OF MINNESOTA, IN	WACONIA	255.39	.00	.00
MND000293365	MEDTRONIC, INC.	FRIDLEY	21.93	.00	.00
MND095296364	MERIT ENTERPRISES, INC.	ISLE	37.06	.00	.00
MND006249668	METAL-MATIC INC	MINNEAPOLIS	15.49	.00	.00
MND985703362	MEYERS PRINTING CO.	BROOKLYN PARK	13.15	18,450.00	.00
MND006219232	MICOM CORPORATION	NEW BRIGHTON	362.80	.00	.00
MND097893085	MIDWEST FURNISHINGS INC.	COON RAPIDS	462.52	.00	.00
MND059028886	MILSOLV MINNESOTA CORPORATION	ROSEVILLE	41.58	.00	.00
MND006478093	MINCO PRODUCTS, INCORPORATED	FRIDLEY	212.45	.00	.00
MND985708437	MINIATURE CIRCUITS INC.	MINNEAPOLIS	21.67	.00	.00
MND981793839	MINNESOTA CORN PROCESSORS	MARSHALL	18.75	.00	.00
MND151774049	MINNESOTA TWIST DRILL	CHISHOLM	15.32	.00	.00
MN0000327155	MN PLANT MGT DOA - CAPITOL COMPLEX	ST. PAUL	9.12	11,757.00	.00
MND980824320	NORTHERN STATES POWER COMPANY	MINNEAPOLIS	35.75	.00	.00
MND006963508	NORTHWEST AIRLINES, INC.	ST. PAUL	440.81	275.01	.00
MND985719475	NEW BRIGHTON WATER TREAMENT PLANT 1	NEW BRIGHTON	173.72	.00	.00
MNT280010257	NICO PRODUCTS INC	MINNEAPOLIS	2,730.48	.00	.00
MND981196215	NOBLE INDUSTRIES LTD.	HIBBING	163.49	.00	.00
MND041775008	NORTH STAR STEEL COMPANY	ST. PAUL	8,458.32	.00	.00
MND062822291	NORTHERN ENGRAVING	SORING GROVE	22.09	.00	.00
MND006248868	NORTHLAND ALUMINUM PRODUCTS, INC	ST LOUIS PARK	30.74	.00	.00
MND006449649	NORTHSHORE MINING COMPANY	SILVER BAY	16.30	.00	.00
MNT280010547	NORTHWEST AUTOMATIC PRODUCTS	MINNEAPOLIS	29.46	.00	.00
MND000826206	NSP - CHESTNUT SERVICE CENTER	MINNEAPOLIS	48.71	.00	.00
MND000824078	NSP WILMARTH STREAM PLANT	MANKATO	122.10	.00	.00
MND981784416	OLSON INDUSTRIES	ST. JAMES	22.00	.00	.00
MND053417515	ONAN CORPORATION	FRIDLEY	147.48	.00	.00
MND985700582	OSMONICS, INC	MINNETONKA	21.03	.00	.00
MND985668227	PRECISION DIVERSIFIED INDUSTRIES, I	PLYMOUTH	106.30	.00	.00
MND086115615	PRINTED CIRCUITS INC.	MINNEAPOLIS	32.73	.00	.00
MND006224612	PENNZOIL PRODUCTS CO.	FRIDLEY	16.82	.00	.00
MND045397965	PIONEER METAL	MINNEAPOLIS	82.80	.00	.00
MND006160014	PLATING INC	ST. PAUL	485.14	.00	.00
MND044792794	POLARIS INDUSTRIES INC	ROSEAU	20.32	.00	.00
MND045976107	PRO-TECH INC	WACONIA	128.44	.00	.00
MND116224288	PROFESSIONAL PLATING INC.	ANOKA	15.05	.00	.00
MND980905301	QUALITY WOOD TREATING CO., INC.	WHITE BEAR LAKE	17.99	.00	.00
MND985667047	QUEBECOR PRINTING - ST. COULD	ST. CLOUD	16.05	.00	.00
MND006147102	QUEBECOR PRINTING - ST. PAUL	ST. PAUL	17.03	.00	.00
MND108667403	RITRAMA DURAMARK	MINNEAPOLIS	30.62	.00	.00
MND985688670	ROCHESTER MEDICAL CORP	STEWARTVILLE	67.69	.00	.00
MND980615496	ROSEMOUNT AEROSPACE INC.	BURNSVILLE	19.68	.00	.00
MND985677889	ROSEMOUNT INC	CHANHASSEN	24.33	.00	.00
MND006253801	SUPERIOR PLATING INC	MINNEAPOLIS	355.22	.00	.00
MND037335072	SANOFI DIAGNOSTICS	CHASKA	20.73	1,378.67	.00
MND071503247	SCHWING AMERICA INC	WHITE BEAR	21.98	.00	.00

Note: Please refer to the introduction for an explanation of this list.

MINNESOTA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MND000293076	SEAGATE TECHNOLOGY	BLOOMINGTON	376.42	.00	.00
MN0000618074	SENGEWALD USA INC	ST. PAUL	19.47	.00	.00
MND006147268	SHELDAHL INC EAST PLANT	NORTHFIELD	2,659.40	.00	.00
MND982424202	SHELDAHL INC WEST FACILITY	NORTHFIELD	111.78	.00	.00
MND985667252	SIERRA CORPORATION	MINNETONKA	49.96	.00	.00
MND982205411	SIGNDESIGN INC.	ST.PAUL	17.33	.00	.00
MND070740055	SILGAN CONTAINER CORP	SAVAGE	73.87	.00	.00
MND980793319	SOO LINE RAILROAD CO SHOREHAM SHOPS	MINNEAPOLIS	37.63	.00	.00
MND087673851	ST. JAMES AUTOMOTIVE	ST. JAMES	15.44	.00	.00
MND061457149	STREATER INC.	ALBERT LEA	196.41	.00	.00
MND006252324	STROUT PLASTICS INCORPORATED	BLOOMINGTON	37.09	.00	.00
MND046707105	SUN CHEMICAL	ST. PAUL	16.44	.00	.00
MND985764273	SWANSON & YOUNGDALE, INC.	MINNEAPOLIS	20.35	.00	.00
MND004320693	THERMO KING CORPORATION	BLOOMINGTON	702.33	.00	.00
MND085114890	TELEX COMMUNICATIONS INC. -LE	LESUEUR	41.14	.00	.00
MND982608366	TEMROC METALS INC.	HAMEL	100.29	.00	.00
MND036232908	THIN FILM TECHNOLOGY	NORTH MANKATO	20.90	.00	.00
MND006161657	TI-KROMATIC PAINTS	ST. PAUL	15.26	.00	.00
MND982639775	TRC CIRCUITS	CRYSTAL	77.03	.00	.00
MND985668201	TRUTH HARDWARE-PAINT PLANT	OWATONNA	52.95	.00	.00
MND000819268	TWIN CITIES ARMY AMMUNITION PLANT	NEW BRIGHTON	74.17	.00	.00
MND006256150	TWIN CITY PLATING	MINNEAPOLIS	31.78	.00	.00
MND981098478	U.S. FILTER RECOVERY SERVICES, INC.	ROSEVILLE	3,021.24	3,850.00	.00
MND000823997	U.S. STEEL - MINNTAC	MOUNTAIN IRON	33.94	.00	.00
MND079731519	UNISYS CORPORATION	ROSEVILLE	116.71	.00	.00
MNT280010414	UNIV. OF MINNESOTA-MINNEAPOLIS CAMP	MINNEAPOLIS	109.32	.00	.00
MND982427452	UBER TANNING	OWATTONA	71.75	.00	.00
MND053422762	UNIVERSAL CIRCUITS INC	PLYMOUTH	202.26	.00	.00
MND981089832	UNIVERSAL CIRCUITS INC.	MAPLE GROVE	177.06	.00	.00
MND006255764	UNIVERSAL PLATING INC.	MINNEAPOLIS	35.47	.00	.00
MND049527575	UNO-VEN ST. PAUL TERMINAL	ST. PAUL	130.50	.00	.00
MN7213820908	US ARMY - TCAAP	ARDEN HILLS	2,352.10	7,750.26	.00
MND050736453	VALSPAR CORPORATION	MINNEAPOLIS	33.42	.00	.00
MNO360090195	VETERANS AFFAIRS MEDICAL CENTER	MINNEAPOLIS	41.72	.00	.00
MND980704399	VIKING DRILL AND TOOL INC.	ST. PAUL	17.92	21,120.72	.00
MND116220898	VISION-EASE POLYCARBONATE	BROOKLYN CENTER	15.53	.00	.00
MND980996433	VTC INC	BLOOMINGTON	50.92	.00	.00
MND053429353	W.S.A. INC. DBA VIRACON	OWATONNA	317.54	.00	.00
MND981089790	WEST PUBLISHING COMPANY	EAGAN	70.17	.00	.00
MND981196231	WALDOCH COLLISION	FOREST LAKE	23.00	.00	.00
MND006147052	WALDORF CORPORATION	ST. PAUL	210.46	.00	.00
MND006206718	WALTER G. ANDERSON INC.	HAMEL	19.83	.00	.00
MND006167720	WATER GREMLIN CO.INC	WHITE BEAR LAKE	48.48	.00	.00
MND006481402	WATT/PETERSON INCORPORATED	PLYMOUTH	20.84	.00	.00
MND985694736	WIPAIRE, INC.	SO. ST.PAUL	198.69	.00	.00
MND006251839	WOLKERSTORFER COMPANY INC.	NEW BRIGHTON	2,689.83	.00	.00
MND006213664	WORUM CHEMICAL COMPANY	ST. PAUL	19.25	.00	.00
MND006962849	ZIEGLER INC	BLOOMINGTON	18.26	.00	.00
MND980898019	3M - BUILDING 544	VADNAIS HEIGHTS	22.03	.00	.00
MND056073299	3M ALEXANDRIA	ALEXANDRIA	35.26	.00	.00
MND006172902	3M AV PRODUCTS/TAPE MFG DIV (MNL138	HUTCHINSON	3,732.48	.00	.00
MND048160964	3M BUILDING 53	ST. PAUL	27.93	.00	.00
MND006172969	3M COMPANY	COTTAGE GROVE	5,276.56	.00	.00
MNT280010778	3M DISTRIBUTION CENTER	ST. PAUL	29.85	.00	.00
MND006173025	3M FAIRMONT	FAIRMONT	37.60	.00	.00

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MINNESOTA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MND000824029	3M MAIN PLANT	ST PAUL	915.25	.00	.00
MND079723979	3M NEW ULM ELECTRICAL PRODUCTS DIV.	NEW ULM	59.79	.00	.00
MNT280010786	3M WOODBURY - BUILDING 518	WOODBURY	14.93	.00	.00
MND000685610	3M WOODBURY - BUILDING 553	WOODBURY	12.94	2,100.00	.00
MND006173082	3M, 3M CENTER	ST. PAUL	1,172.86	27,872.00	.00

Note: Please refer to the introduction for an explanation of this list.

MINNESOTA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MND001970334	ALLIANT TECHSYSTEMS HOPKINS PLANT	HOPKINS	2.90	.00	.00
MND006478010	AMBASSADOR PRESS, INC.	GOLDEN VALLEY	10.96	.00	.00
MND059034694	AMERICAN NATIONAL CAN CO.	ST. PAUL	10.24	.00	.00
MND985760115	ARCA MINNESOTA, INC.	MINNEAPOLIS	5.15	.00	.00
MND982627226	ASSET RECOVERY CORPORATION	ST. PAUL	9.53	.00	.00
MND076505262	BOISE CASCADE INTNL.	INTERNATIONAL F	10.25	.00	.00
MND042302331	BONDHUS CORPORATION	MONTICELLO	7.11	.00	.00
MND985692490	CERTIFIED PAINTING, INC.	ROSEVILLE	7.06	.00	.00
MND985743681	CHEMCENTRAL	LAKEVILLE	8.06	.00	.00
MND023101363	CORCHRAN INCORPORATED	WASECA	11.72	.00	.00
MND982618365	CORPORATE GRAPHICS	NORTH MANKATO	10.63	.00	.00
MND000295865	DONALDSON COMPANY, INC	BLOOMINGTON	10.20	.00	.00
MNO000383364	ELECTROCHEMICALS, INC.	MAPLE PLAIN	9.65	.00	.00
MND006253223	GRACO INC. - MAIN PLANT	MINNEAPOLIS	8.02	.00	.00
MND982426488	H.B. FULLER COMPANY	VADNAIS HEIGHTS	10.93	.00	.00
MND980617252	HENNEPIN TECHNICAL COLLEGE	BROOKLYN PARK	6.52	.00	.00
MND091728683	HIBBING TACONITE COMPANY	HIBBING	13.15	.00	.00
MND982070732	HONEYWELL INC. COMMERCIAL FLIGHT SY	COON RAPIDS	7.30	.00	.00
MND000826313	IMI CORNELIUS INC	ANOKA	11.10	.00	.00
MND985684620	IMPRESSIONS INCORPORATED	ST. PAUL	11.36	.00	.00
MND000272039	KURT MANUFACTURING	MINNEAPOLIS	7.76	.00	.00
MND985667666	KURT MANUFACTURING	COON RAPIDS	9.26	.00	.00
MND042296665	LAKE REGION MFG. INC.	CHASKA	11.61	.00	.00
MND006253843	MCQUAY INTERNATIONAL	FRIDLEY	8.23	.00	.00
MND982643298	MICRO PARTS INC.	EAGAN	6.18	.00	.00
MND006199954	MINAR FORD INC	NEW BRIGHTON	3.31	.00	.00
MND006477244	MINNESOTA RUBBER COMPANY	MINNEAPOLIS	9.97	.00	.00
MND000773341	MN AIR NATIONAL GUARD	DULUTH	7.28	.00	.00
MND985697598	NAHAN PRINTING INC	ST. CLOUD	8.95	.00	.00
MND079724050	NATIONAL COMPUTER SYSTEMS	OWATONNA	10.69	.00	.00
MND980990154	NEWPORT TERMINAL CORPORATION	NEWPORT	4.85	.00	.00
MND049537780	NORTHERN STATES POWER COMPANY	WELCH	4.14	.00	.00
MND985667674	NORTHERN STATES POWER COMPANY	MAPLE GROVE	5.84	.00	.00
MND096490537	PHYSICAL ELECTRONICS, INC.	EDEN PRAIRIE	11.59	.00	.00
MND006261267	PRECISION PLATING INC	MINNEAPOLIS	1.65	.00	.00
MN0000903468	RECYCLIGHTS, INC.	BLOOMINGTON	9.42	.00	.00
MND985680255	REPROGAL COATINGS INC.	DODGE CENTER	3.90	.00	.00
MND985677954	SCHNEIDER (USA)	PLYMOUTH	9.14	.00	.00
MND077638401	SHERWIN-WILLIAMS COMPANY	EDINA	6.78	.00	.00
MND059679506	SILGAN CONTAINERS CORP., ST. PAUL P	ST. PAUL	9.86	.00	.00
MND006153415	SMYTH HM CO INC	ST. PAUL	11.16	.00	.00
MND006247126	TENNANT COMPANY PLANT I	GOLDEN VALLEY	10.15	.00	.00
MND006179543	TUOHY FURNITURE	CHATFIELD	12.18	.00	.00
MND006224950	WESTLING MANUFACTURING COMPANY	PRINCETON	9.13	.00	.00
MND000685768	WILLIAMS PIPELINE CO. - ROSEVILLE	ROSEVILLE	1.51	.00	.00
MND000685628	3M WOODBURY - BUILDING 582	WOODBURY	10.90	.00	.00

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MINNESOTA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO CANNOT BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- LESS THAN 1.1 TONS RCRA HAZARDOUS WASTE, AND
- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MND980795546	UNIV OF MINNESOTA, ROSEMOUNT RES. C	ROSEMOUNT	.00	.00	.00
MN0000981415	UNIV OF MINNESOTA,IWMF	MINNEAPOLIS	.00	.00	.00
MND000686691	AMOCO OIL COMPANY (SPRING VALLEY)	SPRING VALLEY	.44	.00	.00
MND980824890	ARMAMENT SYSTEMS DIVISION (FORMERLY	FRIDLEY	.00	.00	.00
MND148430671	ENERGY SOLUTIONS	MENDOTA HEIGHTS	.00	.00	.00
MND022898118	GOPHER MOTOR REBUILDING, INC.	MINNEAPOLIS	.00	.00	.00
MND000824052	MINNESOTA POWER - DULUTH	DULUTH	.00	.00	.00
MND981097884	SAFETY-KLEEN CORP	EAGAN	.27	.00	.00
MND981953045	SAFETY-KLEEN CORP	BLAINE	.00	.00	.00
MND980615736	VAN WATERS AND ROGERS, INC.	ST. PAUL	.00	.00	.00
MND082371899	WILLIAMS PIPELINE - ROSEMOUNT	APPLE VALLEY	.80	.00	.00
MND000685776	WILLIAMS PIPELINE CORPORATION	EYOTA	.27	.00	.00
MND000685784	WILLIAMS PIPELINE CORPORATION	MANKATO	.00	.00	.00

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MISSISSIPPI

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

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- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MSD985979996	A & B CORES, INC.	RALEIGH	85.84	.00	.00
MSD069530970	ACF SHIPPERS CAR LINE	BUDE	78.18	.00	.00
MSD041165747	AKZO COATINGS, INC.	CLINTON	346.23	.00	.00
MSD073514267	ALL STEEL, INC.	VERONA	42.49	.00	.00
MSD097904932	ALUMAX EXTRUSIONS, INC.	HERNANDO	102.42	.00	.00
MSD079461406	AMERADA HESS CORP.(PURVIS REFINERY)	PURVIS	21.40	.00	.00
MSD981931090	AMERICAN NATIONAL CAN COMPANY	OLIVE BRANCH	18.30	.00	.00
MSD001661719	ARIZONA CHEMICAL COMPANY	GULFPORT	2,292.86	.00	.00
MSD084662832	ARIZONA CHEMICAL COMPANY	PICAYUNE	58.70	.00	.00
MSD041222415	AUTOMATIC PLATING, INC.	TAYLORSVILLE	65.20	.00	.00
MSD010406809	AUTOMATIC PROCESSING, INC.	MOSS POINT	505.27	.00	.00
MSD052062353	AVONDALE INDUSTRIES, INC.	GULFPORT	24.10	.00	.00
MSD052512027	AZTEC INDUSTRIES, INC.	RICHLAND	516.32	.00	.00
MSD004000782	BABCOCK AND WILCOX COMPANY	WEST POINT	474.01	.00	.00
MSD007016843	BALDWIN PIANO & ORGAN COMPANY	GREENWOOD	21.56	.00	.00
MSD000272336	BELOIT MANHATTAN	COLUMBUS	24.29	.00	.00
MSR000001834	BENCHCRAFT RIPLEY UPHOLSTRY	RIPLEY	14.44	.00	.00
MSD008158685	BIRMINGHAM STEEL CORPORATION	JACCKSON	5,460.51	.00	.00
MSD033469867	BRUNSWICK MARINE	WEST POINT	25.58	.00	.00
MSD981749401	CAMP SHELBY TRAINING SITE	CAMP SHELBY	14.67	.00	.00
MSD980601686	CATERPILLAR REMANUFACTURED PRODUCTS	CORINTH	12,695.90	.00	.00
MSD057226961	CAVENHAM FOREST INDUSTRIES, INC.	GULFPORT	286.66	.00	.00
MSD985966514	CENTRAL GALVANIZING, INC.	KOSCIUSKO	670.79	.00	.00
MSD980839229	CHALLENGER ELECTRIC EQUIPMENT COMPA	JACKSON	16.30	.00	.00
MSD054179403	CHEVRON	PASCAGOULA	19,135.55	.00	.00
MSD006294771	CHROMCRAFT FURNITURE	SENATOBIA	460.76	.00	.00
MSR000000307	COLONIAL PIPELINE COLLINS DELIVERY	COLLINS	21.08	.00	.00
MS7570024060	COLUMBUS AIR FORCE BASE	COLUMBUS AFB	82.39	5.00	.00
MSD099640930	COOPER POWER SYSTEMS	LUMBERTON	14.60	.00	.00
MSD981759236	CROFT METALS, INC.	MAGNOLIA	18.23	.00	.00
MSD981921729	CROWN CORK & SEAL	BATESVILLE	17.01	.00	.00
MSD982165367	DANA CORP./PLUMLEY RUBBER DIV.-CREN	CRENSHAW	25.25	.00	.00
MSD040663510	DELCO REMY AMERICA, INC.	MERIDIAN	29.03	.00	.00
MSD065462517	DELPHI PACKARD ELECTRIC	CLINTON	33.50	.00	.00
MSD985978501	DELTA WIRE CORP.	CLARKSDALE	7,997.17	.00	.00
MSD096046792	E.I. DUPONT DE NEMOURS & CO.	PASS CHRISTIAN	909,266.91	.00	.00
MSD980709646	EKA NOBEL, INC.	COLUMBUS	272.36	.00	.00
MSD054531215	EMHART IND., INC./TRUE TEMPER SPORT	AMORY	160.75	.00	.00
MSD981931157	ENTERPRISE PRODUCTS COMPANY	PETAL	20.18	.00	.00
MSD098595317	ERGON REFINING, INC.	VICKSBURG	32.42	.00	.00
MSD050999127	ETHYL PETROLEUM ADDITIVES INC.	NATCHEA	150.65	.00	.00
MSD008183519	FERNWOOD INDUSTRIES, INC.	FERNWOOD	16.20	.00	.00
MSD048816953	FERSON OPTICS, INC	OCEAN SPRINGS	78.97	.00	.00
MSD033417031	FIRST CHEMICAL CORP.	PACAGOULA	8,552.13	.00	.00
MSD067695742	FMC CORP.	TUPELO	24.07	.00	.00
MSD000742668	GE PLASTICS	PEARLINGTON	602.82	.00	.00
MSD004001244	GENCORP POLYMER PRODUCTS	COLUMBUS	234.85	.00	.00
MSD007019623	HEATCRAFT, INC.	GRENADA	192.83	.00	.00
MSD985967595	HEATCRAFT, INC.	GRENADA	40.38	.00	.00
MSD008182081	HERCULES, INC.	HATTIESBURG	24.27	650.00	.00
MSD077655876	HOLNAM, INC.	ARTESIA	13.95	.00	.00
MSD052556693	HPG	PONTOTOC	18.57	.00	.00
MSD120438171	HUGHES AIRCRAFT OF MISSISSIPPI, INC	FOREST	75.54	.00	.00
MSD982110389	HUNTER-DOUGLAS TUPELO CENTER	SHANNON	150.91	.00	.00
MSD980799480	ICI ACRYLICS	OLIVE BRANCH	388.20	.00	.00

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MISSISSIPPI

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MSD985967900	INDEPENDENT STEEL CASTINGS COMPANY	OLIVE BRANCH	13.75	.00	.00
MSD098590615	INGALLS SHIPBUILDING EAST BANK	PASCAGOULA	114.23	.00	.00
MSD050648757	INGALLS SHIPBUILDING WEST BANK	PASCAGOULA	2,370.71	.00	.00
MSD980600084	INTERNATIONAL PAPER COMPANY	WIGGINS	31.15	.00	.00
MSD096076781	IPC CORINTH DIVISION, INC.	CORINTH	214.79	.00	.00
MSD008181562	JACKSON PLATING COMPANY	JACKSON	16.56	.00	.00
MSD985970300	JOHNSTON-TOMBIGBEE FURNITURE MFG. C	COLUMBUS	33.00	.00	.00
MS2570024164	KEESLER AIR FORCE BASE	KEESLER AFB	149.80	216.00	.00
MSD985980846	KEMPER PRESSURE TREATED FORREST PRO	SCOOBA	17.28	.00	.00
MSD008194144	KENSON WOOD RESERVING CORP.	PICAYUNE	56,084.11	.00	.00
MSD990866329	KERR-MCGEE CHEMICAL CORP.	COLUMBUS	28,310.67	.00	.00
MSD007027543	KOPPERS INDUSTRIES, INC.	TIE PLANT	277.57	.00	.00
MSD007039381	KRUEGER INTERNATIONAL	TUPELO	59.94	.00	.00
MSD982770745	LAVALLEY CONSTRUCTION COMPANY	BILOXI	29.54	.00	.00
MSD038260188	LUDLOW CORP	MERIDIAN	24.95	.00	.00
MSD075044651	MAGNETEK UNIVERSAL MANUFACTURING CO	GALLMAN	19.43	.00	.00
MSD041222878	MAGNETEK, INC.	MENDENHALL	33.80	.00	.00
MSD985971654	MOOG BATESVILLE	BATESVILLE	139.26	.00	.00
MSD980601512	MORTON INTERNATIONAL ELECT MATERIAL	MOSS POINT	459.53	54.00	.00
MSD008186587	MORTON INTERNATIONAL, INC.	MOSS POINT	502,311.28	.00	.00
MSD037971801	MOSS POINT MARINE INC.	ESCATAWPA	15.35	.00	.00
MSD050239698	NATIONAL PICTURE & FRAME COMPANY	GREENWOOD	34.77	.00	.00
MS1971590012	NAVAL AIR STATION - MERIDIAN	MERIDIAN	36.41	.00	.00
MS2170022626	NAVAL CONSTRUCTION BATTALION CENTER	GULFPORT	33.27	.00	.00
MSD008156283	ORLEANS FURNITURE, INC.	COLUMBIA	28.05	.00	.00
MSD033394602	PEAVEY ELECTRONICS, PLANT 3	MERIDIAN	192.85	.00	.00
MSD063947790	PIPER IMPACT, INC.	NEW ALBANY	631.81	.00	.00
MSD991277310	PLANTATION PIPELINE CO.	COLLINS	337.69	.00	.00
MSD066106923	PLATTE CHEMICAL COMPANY	GREENVILLE	1,378.92	348,147.00	.00
MSD982112872	PLYMOUTH TUBE COMPANY	EUPORA	238.06	.00	.00
MSD982173189	POLYFLEX FILM & CONVERTING, INC.	SUMMIT	28.40	.00	.00
MS0000043307	PRECOAT METALS	JACKSON	517.80	.00	.00
MSD008151730	PROCESS ENGINEERING COMPANY, INC.	JACKSON	23.25	.00	.00
MSD985969682	QUARTET MANUFACTURING	BOONEVILLE	31.33	.00	.00
MSD007037278	RANDALL TEXTRON	GRENADA	33.49	.00	.00
MSD000272385	RED PANTHER CHEMICAL COMPANY	CLARKSDALE	288.79	61,987.00	.00
MSD097909485	RELIABLE ELECTRIC UTILITY PROD	GREENVILLE	47.37	.00	.00
MSD982114712	REMAN, INC.	MORTON	90.00	.00	.00
MSD081341729	RINGIER AMERICA, INC.	CORINTH	301.94	.00	.00
MSD064102577	ROADMASTER CORPORATION	WEST POINT	43.81	.00	.00
MSD033395161	ROBINSON CHEMICAL COATINGS, INC.	MERIDIAN	13.27	.00	.00
MSD000776765	SAFETY-KLEEN CORP.	JACKSON	28.36	.00	.00
MSD050985191	SANDERSON PLUMBING PRODUCTS, INC.	COLUMBUS	30.28	.00	.00
MSD072602899	SIEMENS ENERGY & AUTOMATION	RICHLAND	13.16	110.00	.00
MSR000001446	SOUTHERN IONICS INC.-WEST POINT	WEST POINT	195.57	.00	.00
MSD982769663	SOUTHWIRE COMPANY (STARKVILLE PLAN	STARKVILLE	18.55	.00	.00
MSD002088474	SUPER SAGLESS CORP.	TUPELO	58.45	.00	.00
MSD003398294	TAYLOR MACHINE WORKS, INC.	LOUISVILLE	20.32	.00	.00
MSD980516249	TETCO CLINTON STATION	JACKSON	15.19	.00	.00
MSD980516488	TETCO KOSCIUSKO STATION	KOSCIUSKO	45.82	.00	.00
MSD980516363	TETCO UNION CHURCH STATION	UNION CHURCH	69.95	.00	.00
MSR000001800	THE SHERWIN-WILLIAMS CO. #7364	SOUTHAVEN	19.24	.00	.00
MSD980729206	THE THERMOS COMPANY	BATESVILLE	28.29	.00	.00
MSD000287417	THE THOMPSON-MINWAX CO.	OLIVE BRANCH	457.71	.00	.00
MSD130452501	THOMAS & BETTS	SOUTHAVEN	1,184.98	.00	.00

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MISSISSIPPI

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MSD054176052	TRINITY MARINE GULFPORT	GULFPORT	28.52	.00	.00
MSD985979780	TRUE TEMPER SPORTS OBII	DESOTO	23.57	.00	.00
MSD004010724	UNITED TECHNOLOGIES MOTOR SYSTEMS	COLUMBUS	592.48	14.00	.00
MSD982084667	US ELECTRICAL MOTORS	PHILADELPHIA	51.68	.00	.00
MSD982770547	VALVOLINE CAR CARE PRODUCTS(PYROIL	HERNANDO	159.17	.00	.00
MSD082008921	VAN LEER CONTAINERS, INC.	CANTON	99.18	.00	.00
MSD033359266	VICKERS, INC.	JACKSON	29.00	.00	.00
MSD990714081	VICKSBURG CHEMICAL COMPANY	VICKSBURG	54.26	108,520.00	.00
MS6210809871	WATERWAYS EXPERIMENT STATION	VICKSBURG	54.31	7.00	.00
MSD004014668	WEST POINT CASKET COMPANY	WEST POINT	18.72	.00	.00
MSD985967025	WOLVERINE TUBE, INC.	BOONEVILLE	35.71	.00	.00
MSD001473073	WONDURA PRODUCTS, INC.	TUPELO	1,015.33	.00	.00
MSD065490930	WOOD TREATING, INC.	PICAYUNE	7,610.51	.00	.00
MSD982106700	ZEON CHEMICALS MISSISSIPPI, INC.	HATTIESBURG	51.24	.00	.00

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MISSISSIPPI

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MSD092111723	ALLIED ELECTROPLATING INC.	EUPORA	5.70	.00	.00
MSD021019914	AMERICAN WOOD	RICHTON	8.70	.00	.00
MSD000829150	ASHLAND CHEMICAL, INC.	JACKSON	8.56	.00	.00
MSR000000679	COLONIAL PIPELINE CO. PAULDING	PAULDING	12.79	.00	.00
MSD061657250	COLTEC INDUSTRIES - HOLLEY AUTO	WATER VALLEY	10.46	.00	.00
MSD980579577	COLUMBIA GULF TRANS CO - INVERNESS	INVERNESS	8.35	.00	.00
MSD084668367	DELPHI PACKARD ELECTRIC - BROOKHAVE	BROOKHAVEN	3.25	.00	.00
MSD980729198	GORDON REDD TREATING PLANT	BROOKHAVEN	10.71	.00	.00
MSD030422489	HAGER INDUSTRIES	GREENVILLE	1.26	.00	.00
MSD008208696	HALTER MARINE, INC.	MOSS POINT	1.15	.00	.00
MSD980843114	ITW PASLODE	PONTOTOC	9.38	.00	.00
MSD000623017	KIMBERLY-CLARK CORP. - CORINTH MIL	CORINTH	5.29	.00	.00
MSD981002975	LA-Z-BOY CHAIR COMPANY	LELAND	8.72	.00	.00
MSD081338832	MASTER-BILT PRODUCTS	NEW ALBANY	10.12	.00	.00
MS6210020560	MISS ARMY AMMUNITION	STENNIS SPACE C	5.44	.00	.00
MSD008161432	MISS CHEMICAL CORP.	YAZOO CITY	12.18	.00	.00
MSD089533715	MULAY PLASTICS, INC.	HOLLY SPRINGS	10.17	.00	.00
MS3170024639	NAVAL STATION PASCAGOULA	PASCAGOULA	5.83	.00	.00
MSD981030984	SAFETY-KLEEN CORP.	SOUTHAVEN	1.35	.00	.00
MSD037483583	SUNBEAM-OSTER HOUSEHOLD PRODUCTS	SHUBUTA	13.07	.00	.00
MSD980514442	TETCO EGYPT STATION	ABERDEEN	9.68	.00	.00
MSD982120404	TETCO YAZOO CITY STATION	YAZOO CITY	3.60	.00	.00
MSD982095713	TRUE TEMPER SPORTS	OLIVE BRANCH	8.30	.00	.00
MSD007024698	VITAFOM INC	TUPELO	2.81	.00	.00

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MISSISSIPPI

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO CANNOT BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- LESS THAN 1.1 TONS RCRA HAZARDOUS WASTE, AND
- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MS0000145185	AMERICAN METAL WORKS	BRANDON	.70	.00	.00
MSD980579387	COLUMBIA GULF TRANS CO - BANNER COM	WATER VALLEY	1.07	.00	.00
MSD980579551	COLUMBIA GULF TRANS CO - CORINTH CO	CORINTH	.59	.00	.00
MSD048320030	MUELLER COPPER TUBE CO.	FULTON	.00	.00	.00

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MISSOURI

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
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- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MOD075892646	ABB POWER T & D CO	JEFFERSON CITY	100.13	.00	.00
MOD981725203	ABLE BODY INC	JOPLIN	15.06	.00	.00
MOD054076757	ABLE FIBERGLASS CO INC	JOPLIN	20.22	.00	.00
MOT300010022	ACF IND INC	NORTH KANSAS CI	47.52	.00	.00
MOD981508401	AERO METAL FINISHING	FENTON	14.96	.00	.00
MOD981722762	AEROFIL TECHNOLOGY INC	SULLIVAN	185.53	.00	.00
MOD029796331	AGCO MANUFACTURING GROUP	INDEPENDENCE	30.58	.00	.00
MOD056381510	ALBAUGH INC	ST JOSEPH	26.04	.00	.00
MOD046737524	ALL BRITE GALVANIZING CO	KANSAS CITY	21.87	.00	.00
MOD050226075	AMERICAN CYANAMID CO	SOUTH RIVER	193,977.90	74,079,800.00	.00
MOD985813484	AMERICAN CYANIMID NSY WAREHOUSE 2	BERKELEY	47.70	88,640.00	.00
MOD006300172	AMERICAN NATIONAL CAN	ST LOUIS CITY	434.37	.00	.00
MOD096728688	AMERICAN NATIONAL CAN	PEVELY	37.36	.00	.00
MOD007161425	AMOCO OIL CO-SUGAR CREEK	SUGAR CREEK	17.88	.00	.00
MOD046367033	ANALYTICAL BIO CHEMISTRY	COLUMBIA	36.40	.00	.00
MOD031005341	ASHLAND CHEMICAL COMPANY	ST LOUIS CITY	70.95	.00	.00
MOD980688881	ASHLAND CHEMICAL INC	KANSAS CITY	53.36	.00	.00
MOD007120652	AT&T	LEE'S SUMMIT	79.78	.00	.00
MOD056389828	BAYER CORP	KANSAS CITY	10,586.19	838,930.00	.00
MOD007146517	BEAZER EAST INC	KANSAS CITY	39.86	.00	.00
MO0000346221	BERG ELECTRONICS INC	LEE'S SUMMIT	26.97	.00	.00
MOD000624452	BFIKC MISSOURI CITY LF	MISSOURI CITY	3,263.85	.00	.00
MOD985791995	BIOCRAFT LABORATORIES	MEXICO	23,881.26	.00	.00
MOD007134091	BOEHRINGER INGELHEIN ANIMAL	ST JOSEPH	23.33	525.44	.00
MOD006313993	BORDEN DECORATIVE PRODUCTS	ST LOUIS	27.45	.00	.00
MOD981128648	BREWER SCIENCE INC	ROLLA	18.73	.00	.00
MOD985769066	BRIGGS & STRATTON CORPORATION	POPLAR BLUFF	78.46	.00	.00
MOD008908147	BROD-DUGAN COMPANY	ST L	20.19	.00	.00
MOD985774546	BROWN GRAPHICS	ST LOUIS	16.09	.00	.00
MOD006286934	BUCKMAN LABORATORIES INC	CADET	45.71	.00	.00
MOD003941424	BURLINGTON NORTHERN	SPRINGFIELD	24.58	.00	.00
MOR000001719	BURLINGTON NORTHERN	SHELBINA	1,876.50	.00	.00
MOD000687525	BUSSMANN DIV	ELLISVILLE	125,160.41	.00	.00
MOD985811751	CA BOOKS DIVISION INC	ST LOUIS	30.48	.00	.00
MOD066909128	CAMYER INDUSTRIES	MARSHFIELD	15.68	.00	.00
MOD006282347	CARBOLINE COMPANY	ST LOUIS	20.28	.00	.00
MOD985808203	CATERPILLAR BOONVILLE FACILITY	BOONVILLE	16.73	.00	.00
MOD006334577	CENTERLINE INDUSTRIES INC	ST LOUIS CITY	94.81	.00	.00
MOD054078324	CENTERLINE INDUSTRIES INC	SAVERTON	26.96	.00	.00
MOD059876318	CERRO COPPER TUBE CO	SHELBINA	36.86	.00	.00
MOD071957146	CHEMISPHERE INC	ST LOUIS	18.93	.00	.00
MOD068527704	CHEMSICO INC	ST LOUIS CITY	30.35	.00	.00
MOD985773712	CHEMSYN SCIENCE LABORATORIES	HARRISONVILLE	69.03	.00	.00
MOD043510056	CHESEBROUGH POND'S USA CO	JEFFERSON CITY	23.13	.00	.00
MOD085002319	CHRYSLER CORPORATION	FENTON	1,181.55	.00	.00
MOD042659714	CLARK REFINING & MARKETING INC	ST LOUIS	366.24	.00	.00
MOD985811587	COLOR ASSOCIATES INC	ST LOUIS	145.14	.00	.00
MOD000686873	CONOCO BELLE PRODUCTS TERMINAL	BELLE	112.59	.00	.00
MOD985771567	CONOCO INC RIVERSIDE PRODUCTS TERMI	RIVERSIDE	104.67	.00	.00
MOD000690016	CONOCO MOUNT VERNON PRODUCTS	MT VERNON	159.02	.00	.00
MOD054018288	CONTINENTAL CEMENT CO	HANNIBAL	387.31	.00	.00
MOD043504372	CONVATEC/CALGON VESTAL	ST LOUIS	198.07	2.00	.00
MOD056961105	CONVATEC/CALGON VESTAL	ST LOUIS	175.19	.00	.00
MOD086787371	COOK COMPOSITES AND POLYMERS	NORTH KANSAS CI	434.37	.00	.00
MOD006272223	CROWN CORK & SEAL CO INC	ST LOUIS CITY	23.63	.00	.00

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MISSOURI

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MOT300010204	CZ INKS DIV OF JAMES RIVER PAPER	ST LOUIS CITY	292.09	.00	.00
MOD007148265	DAVIS PAINT CO	NORTH KANSAS CI	123.26	.00	.00
MOD006278642	DENNIS CHEMICAL CO	ST LOUIS	20.21	.00	.00
MO4213820489	DEPARTMENT OF THE ARMY (LCAAP)	INDEPENDENCE	5,762.74	.00	.00
MOD006263925	DETROIT TOOL METAL PRODUCTS	LEBANON	29.38	.00	.00
MOD006311146	DIEMAKERS INC	MONROE CITY	22.74	.00	.00
MOD007143266	DONALDSON CO INC	CHILLICOTHE	21.34	.00	.00
MOD085902021	DRUMTECH INC	ST LOUIS	71.46	.00	.00
MOD029719200	DYNO NOBEL INC	CARTHAGE	299.98	597,319.00	.00
MOD060568599	E D INDUSTRIES INC	ROGERSVILLE	15.28	.00	.00
MOD000677781	E G AND G VACTEC	ST. LOUIS	27.30	.00	.00
MOD046740148	EAGLE-PICHER INDUSTRIES INC ELECTRO	JOPLIN	133.67	.00	.00
MOD981715824	EFCO CORPORATION	MONETT	204.21	.00	.00
MOP000001891	ELDON FOOD SHOP	ELDON	34.30	.00	.00
MOD006269633	ELECTRONICS AND SPACE CORP	ST. LOUIS	142.09	.00	.00
MOD094391778	EMERSON ELECTRIC	AVA	104.40	.00	.00
MOD006270318	EMERSON ELECTRIC CO	KENNETT	43.68	.00	.00
MOD092357821	EMERSON ELECTRIC, WHITE-ROGERS DIV	AFFTON	46.91	.00	.00
MOD006281711	ENGINEERED AIR SYSTEMS INC	OLIVETTE	86.47	.00	.00
MOD980632954	ENVIRONMENTAL SERVICES OF	SCOTT CITY	415.57	.00	.00
MOD091355966	ENVIRONMENTAL SPECIALISTS INC	KANSAS CITY	20.00	.00	.00
MOT300010220	ETHYL PETROLEUM ADDITIVES DIV	ST. LOUIS	17.32	.00	.00
MOD010643153	EVEREADY BATTERY CO., INC	MARYVILLE	30.36	.00	.00
MOD007452683	F.M. THORPE MANUFACTURING CO.	LAMAR	87.14	.00	.00
MOD042865816	FARMLAND INDUSTRIES, INC	ST. JOSEPH	248.88	212,744.00	.00
MOD006333975	FINDETT CORP	ST CHARLES	243.92	.00	.00
MOD056391113	FLINT INK CORP	N KANSAS CITY	23.98	.00	.00
MOD981705601	FLINT INK CORP	N KANSAS CITY	15.56	.00	.00
MOD007118078	FORD MOTOR CO	CLAYCOMO	1,978.61	.00	.00
MOD006272876	FORD MOTOR CO.	HAZELWOOD	1,121.58	.00	.00
MOD092355817	FUTURA COATINGS, INC	HAZELWOOD	29.08	.00	.00
MOD006491435	G.W. COMPOSITES, INC	O'FALLON	65.79	.00	.00
MOT300010261	GM BOC WENTZVILLE CTR	WENTZVILLE	7,543.40	.00	.00
MOD000822668	GM-LEEDS PLANT	KANSAS CITY	65.39	.00	.00
MO0000031823	GS TECHNOLOGIES OPERATING CO., INC	KANSAS CITY	12,253.80	.00	.00
MOD007131113	HALLMARK CARDS INC	KANSAS CITY	47.88	.00	.00
MOD003537271	HARMON ELECTRONICS COMPONENTS	WARRENSBURG	207.72	.00	.00
MOD980686992	HAWKER ENERGY PRODUCTS INC	WARRENSBURG	302.71	.00	.00
MOD000830414	HCI CHEMTECH DISTRIBUTION	ST LOUIS CITY	161.64	.00	.00
MOD042382424	HCI CHEMTECH DISTRIBUTION	NORTH KANSAS CI	51.80	.00	.00
MOD067944702	HCI CHEMTECH DISTRIBUTION	SPRINGFIELD	13.23	.00	.00
MOR000002261	HEETCO	KIRKSVILLE	455.40	.00	.00
MOD981505555	HERITAGE ENVIRONMENTAL SERVICES	KANSAS CITY	4,322.60	.00	.00
MOD007119555	HOECHST MARION ROUSSEL INC	KANSAS CITY	41.93	10.00	.00
MOD029729688	HOLNAM INC/SAFETY-KLEEN	CLARKSVILLE	148.01	.00	.00
MOD006308407	HUBBELL/AB CHANCE CO ALLEN STREET C	CENTRALIA	703.49	.00	.00
MO0000860908	HUFFY BICYCLE CO	FARMINGTON	180.20	.00	.00
MOD006267223	HUSSMANN CORP	BRIDGETON	348.66	.00	.00
MOD985798164	ICI EXPLOSIVES ENVIRONMENTAL;	JOPLIN	166.78	.00	.00
MOD077887909	ICI EXPLOSIVES USA, INC.	JOPLIN	796.70	.00	.00
MOD007129935	INTERNATIONAL PAPER CO	JOPLIN	398.43	.00	.00
MOD980863112	INTERNATIONAL PAPER CO.	PLEASANT HILL	14.35	.00	.00
MOD000668996	ITAPCO-MISSOURI TERMINAL, INC	CAPE GIRARDEAU	58.07	.00	.00
MOD006287619	JAMES RIVER PAPER CO	HAZELWOOD	1,208.83	.00	.00
MOD006301501	JEFFERSON PRODUCTS CO.	WASHINGTON	17.30	.00	.00

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- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MOD073046773	KANSAS CITY AREA TRANSPORTATION	KANSAS CITY	23.68	.00	.00
MOD031105406	KERR MCGEE REFINING CORP	ST LOUIS	125.18	.00	.00
MOD007129406	KERR-MCGEE CHEMICAL	SPRINGFIELD	119.40	.00	.00
MOT300011160	KIESEL CO (THE) \KIESEL MARINE	ST LOUIS CITY	67.13	.00	.00
MOD006306187	KING ADHESIVE CORP	ST LOUIS CITY	20.77	.00	.00
MOD981712425	L H B INDUSTRIES	BERKELEY	113.44	.00	.00
MOD981123854	LIBBY, INC	KANSAS CITY	35.50	.00	.00
MOD006269385	LINCOLN, A PENTAIR CO.	ST. LOUIS	35.87	.00	.00
MOR000005025	LITHOCRAFT STUDIOS, INC	HAZELWOOD	13.78	.00	.00
MOD007152903	LITTON SYSTEMS: ADVANCED CIRCUITRY	SPRINGFIELD	801.16	.00	.00
MOD007174485	LOZIER CORP	JOPLIN	76.89	.00	.00
MOD089378814	M & R PLANTING, INC.	WASHINGTON	97.54	.00	.00
MOD985793058	M & W PACKAGING	JACKSON	103.58	.00	.00
MOD096726484	MALLINCKRODT, INC.	ST. LOUIS	12,337.78	52,784.00	.00
MOD006265722	MALLINKRODT MEDICAL R. & D.	HAZELWOOD	13.46	10,036.70	.00
MOD000668970	MARATHON ELECTRIC MANUFACTURING	LEBANON	17.24	.00	.00
MOD006269195	MARQUETTE TOOL & DIE CO.	ST. LOUIS CITY	51.33	.00	.00
MOD000818906	MCDONNEL DOUGLAS ST. LOUIS TRACT II	BERKLEY	293.82	.00	.00
MOD000818963	MCDONNELL AIRCRAFT CO. TRACT 1	HAZELWOOD	1,096.40	610.00	.00
MOD075888487	MCDONNELL DOUGLAS ST. LOUIS TRACT V	ST. CHARLES	214.30	60.00	.00
MOD050232990	MERAMEC INDUSTRIES, INC.	SULLIVAN	112.11	.00	.00
MOD006278790	MID-STATES PAINT & CHEMICAL CO.	ST. LOUIS	23.72	.00	.00
MOD031294283	MIDWAY FORD TRUCK CENTER, INC.	KANSAS CITY	24.56	.00	.00
MOD007173453	MIDWEST RESEARCH INSTITUTE	KANSAS CITY	14.79	235.60	.00
MOD069232148	MIRACLE RECREATION EQUIPMENT	MONETT	17.96	.00	.00
MO4210090003	MISSOURI ARMY NTL. GUARD	SPRINGFIELD	45.15	.00	.00
MOD985771757	MISSOURI HWY & TRANSPORTATION DEPT.	ST. JOSEPH	14.86	.00	.00
MOD007139975	MISSOURI PLATING CO.	KANSAS CITY	65.15	.00	.00
MOD062439351	MODINE HEAT TRANSFER, INC.	CAMDENTON	30.22	.00	.00
MOD000610816	MODINE MANUFACTURING CO.	JEFFERSON CITY	86.32	.00	.00
MOD043942291	MODINE MFG CO	TRENTON	69.99	.00	.00
MOD001700848	MONSANTO CO - CARONDELET PLANT	ST. LOUIS CITY	9,529.60	.00	.00
MOD004954111	MONSANTO CO.	ST. LOUIS CITY	235.01	.00	.00
MOD980852677	MONSANTO CO.	ST. LOUIS	83.21	1,448.00	.00
MOD006266803	MONSANTO CO.- RESEARCH CENTER	ST. LOUIS	60.35	1,979.00	.00
MOD006270037	MOZEL INCORPORATED	ST. LOUIS	91.21	.00	.00
MOD003939907	NESCO CONTAINER CORP.	FENTON	18.99	.00	.00
MOD093750966	NORANDA ALUMINUM, INC	NEW MADRID	5,893.16	.00	.00
MOD081640344	NORFOLK AND WESTERN RAILWAY CO	MOBERLY	13.87	.00	.00
MOD981723943	OPTEC DD USA, INC.	MEXICO	49.34	.00	.00
MOD107100356	OZARK CIRCUITS, INC.	SPRINGFIELD	77.29	.00	.00
MOD066858192	PACKAGING CONCEPTS, INC	ST LOUIS CITY	67.27	.00	.00
MOD981704455	PARK-MARK, INC	KIRKWOOD	25.46	.00	.00
MOD007133887	PAUL MUELLER CO.	SPRINGFIELD	35.10	.00	.00
MOD007146095	PETERSON MFG CO.	GRANDVIEW	48.52	.00	.00
MOD006324099	PETROLITE CORP.	ST. LOUIS CITY	313.68	.00	.00
MOD058923269	PFIZER ANIMAL HEALTH MNFC TRNG	LEE'S SUMMIT	23.79	5.00	.00
MOD052612850	PLASTENE SUPPLY CO	PORTAGEVILLE	256.22	.00	.00
MOD980633358	PLATCO	MOBERLY	234.66	.00	.00
MOD041424243	PLAZA MOTOR CO.	CREVE COEUR	14.33	.00	.00
MOD985769520	PLAZE INCORPORATED	ST. CLAIR	89.15	.00	.00
MOD980858229	POSITRONIC INDUSTRIES, INC	SPRINGFIELD	20.50	.00	.00
MOD069277549	PPM, INC.	KANSAS CITY	1,887.54	.00	.00
MOD000474361	PRAXAIR SURFACE TECHNOLOGIES	N KANSAS CITY	71.46	.00	.00
MOD088703764	PRECOAT METALS	ST LOUIS	311.93	.00	.00

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MISSOURI

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MOD085908259	PURINA MILLS, INC	BRIDGETON	145.85	.00	.00
MOD985801430	QUALITY FINISHING INDUSTRIES INC	KANSAS CITY	46.78	.00	.00
MOD981709272	QUANTERRA	EARTH CITY	37.43	6.21	.00
MOD000924159	R B GRAPHICS SERVICE INC	ST PETERS	53.31	.00	.00
MO0000924159	R B GRAPHICS SERVICE INC	ST PETERS	53.31	.00	.00
MOD985818277	RAINBOW COATINGS CORPORATION	MARSHFIELD	79.96	.00	.00
MOD000690198	REICHHOLD CHEMICALS INC	VALLEY PARK	177.76	.00	.00
MOD006326904	RESOURCE RECOVERY CENTER UMC	COLUMBIA	65.12	66,598.00	.00
MOD985771864	RHONE-POULENC INC ST LOUIS	ST LOUIS CITY	8.74	30.00	.00
MOD007142623	RHONE-POULENIC AGRICULTURAL CO	ST JOSEPH	21.50	11,100.00	.00
MOD050232560	RIVER CEMENT CO SELMA PLANT	FESTUS	47.36	.00	.00
MOD000064550	S R FINISHING	PORTAGEVILLE	29.34	.00	.00
MO0000064550	S R FINISHING	PORTAGEVILLE	29.34	.00	.00
MOD029936689	S&K INDUSTRIES INC #1	LEXINGTON	22.12	.00	.00
MOD071987416	SABRELINER INC	PERYVILLE	172.31	.00	.00
MOD050715655	SABRELINER NEOSHO	NEOSHO	114.62	550.00	.00
MOD000669051	SAFETY KLEEN CORP	CAPE GIRARDEAU	93.75	.00	.00
MOD007118979	SCHROER MANUFACTURING CO	KANSAS CITY	58.05	.00	.00
MOD006266506	SEALED POWEWR DIVISION	MANCHESTER	75.94	.00	.00
MOD068549492	SECO PRODUCTS	WASHINGTON	103.77	.00	.00
MOD981117377	SERICOL INC	NORTH KANSAS CI	102.89	.00	.00
MOD006264675	SIEGEL-ROBERT PLATING CO	ST LOUIS CITY	33.21	.00	.00
MOD079928354	SIGMA CHEMICAL CO	ST LOUIS	7.35	9,142.00	.00
MOD006273726	SIGMA CHEMICAL COMPANY	ST. LOUIS	1,151.80	1,230,186.54	.00
MOD980962773	SIGMA CHEMICAL COMPANY	ST LOUIS	2,244.75	339.00	.00
MOD007139363	SILGAN CONTAINERS CORPORATION	MT VERNON	16.77	.00	.00
MOD050709054	SILGAN CONTAINERS INC.	ST JOSEPH	158.95	.00	.00
MOD985822428	SINCLAIR & RUSH	ST. LOUIS CITY	20.25	.00	.00
MOD006288526	SINNETT ELPACO COATINGS CORP	PAGEDALE	45.13	.00	.00
MOD980859607	SOLID STATE CIRCUITS	SPRINGFIELD	118.84	.00	.00
MOR000000604	SOMMER ALLIBERT INDUSTRIE	KANSAS CITY	29.83	.00	.00
MOD006286959	SOUTHERN GRAPHIC SYSTEMS INC	ST. LOUIS CITY	161.61	.00	.00
MOD985773100	SPICER AXLE DIVISION DANA CORP	CAPE GIRARDEAU	55.58	.00	.00
MOD006299200	SPORLAN VALVE COMPANY	WASHINGTON	5,017.37	.00	.00
MOD981502479	SPRINGFIELD REMANUFACTURING CENTER	WILLOW SPRINGS	152.66	.00	.00
MOD092356096	SQUARE D CO	COLUMBIA	43,903.33	.00	.00
MOD006288849	ST. LOUIS POST-DISPATCH	ST. LOUIS	28.52	.00	.00
MOD985820349	ST. LOUIS PUBLIC SCHOOLS WAREHOUSE	ST LOUIS	13.33	.00	.00
MOD006294813	STANDARD MACHINE & MANUFACTURING	ST LOUIS	65.21	.00	.00
MOD006307615	STELLWELD EQUIPMENT CO INC	ST CLAIR	14.53	.00	.00
MOD006291421	STERLING LACQUER MANUFACTURING CO	ST LOUIS	61.84	.00	.00
MOD006299853	STUPP BROTHERS BRIDGE & IRON CO	ST LOUIS CITY	15.23	.00	.00
MOD006288658	SUN CHEMICAL INC	ST LOUIS	20.41	.00	.00
MOD041707563	SUNBEAM OUTDOOR PRODUCTS	NEOSHO	170.21	.00	.00
MOD006291348	SUNNEN PRODUCTS CO	ST LOUIS CITY	22.12	.00	.00
MOD981129075	SUPERIOR SOLVENTS & CHEMICALS	SPRINGFIELD	34.73	.00	.00
MOD007161565	SWEETHEART CUP COMPANY	SPRINGFIELD	25.47	.00	.00
MOD007452154	SYNTEX AGRIBUSINESS INC	VERONA	17.83	34,000.00	.00
MOD095038329	SYNTEX ARGIBUSINESS INC	SPRINGFIELD	169.40	.00	.00
MOD006265474	SYSTEMS & ELECTRONICS INC (SEI)	WEST PLAINS	123.38	.00	.00
MOD007140874	TALBOT INDUSTRIES, INC	NEOSHO	168.87	.00	.00
MOD058924275	TEEPAK, INC	NORTH KANSAS CI	14.40	.00	.00
MOD048838189	TEMPSET, INC	ST. LOUIS CITY	20.60	.00	.00
MOD980859805	TEXAS EASTERN TRANSMISSION CORP.	ORAN	13.51	.00	.00
MOD981713894	TG USA CORP	PERRY VILLE	125.12	.00	.00

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MISSOURI

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MOT300010550	THE GATES RUBBER CO.	VERSAILLES	129.68	.00	.00
MOD109246546	THE GATEWAY CO.	ST. LOUIS	69.18	.00	.00
MOD057758922	THE LOXCREEN CO., INC	HAYTI	77.75	.00	.00
MOD006274732	THE P D GEORGE CO	ST. LOUIS CITY	1,568.47	.00	.00
MOD048835961	THOMAS AND BETTS AMERICAN ELECTRIC	OVERLAND	132.15	.00	.00
MOD007121841	TNEMEC CO., INC.	NORTH KANSAS CI	214.74	.00	.00
MOD991293564	TOASTMASTER, INC	MACON	46.19	.00	.00
MOD006272843	TOASTMASTER, INC.	BOONVILLE	18.63	.00	.00
MOD981123409	TRANS WORLD AIRLINES INC	ST. LOUIS	32.02	.00	.00
MOD043935048	TRANS WORLD AIRLINES, INC.	KANSAS CITY	568.75	.00	.00
MOD068527357	TRANSCHEMICAL, INC	ST. LOUIS	106.56	.00	.00
MOD006299135	TRUE MANUFACTURING COMPANY	O'FALLON	54.00	.00	.00
MO9890010524	U S DEPT OF ENERGY KANSAS CITY PLAN	KANSAS CITY	1,351.64	.00	.00
MOD095479978	U S PAINT CORPORATION	ST LOUIS CITY	164.74	.00	.00
MOD096728373	U S POLYMERS INC	ST LOUIS CITY	18.75	.00	.00
MOD073133647	UMKC HAZARDOUS WASTE MANAGEMENT FAC	KANSAS CITY	4.88	1,050.83	.00
MOD071999783	UMSL DANGEROUS CHEMICALS STORAGE BU	ST LOUIS CITY	3.60	190.95	.00
MOD120350798	UNION ELECTRIC CO LAKESIDE COMPLEX	LAKE OZARK	26.13	.00	.00
MOD106563562	UNION PACIFIC RAILROAD COMPANY	DESOTO	24.52	.00	.00
MOD985767870	UNIVERSITY OF MISSOURI-ETSRC	COLUMBIA	5.70	2,313.00	.00
MO3213720979	US ARMY ENGINEER CENTER	FORT LEONARD WO	74.62	1,036.00	.00
MOD039817051	VARCO-PRUDEN BUILDING	ST JOSEPH	42.44	.00	.00
MOD007155781	VICKERS INC	JOPLIN	39.87	.00	.00
MOT300010857	WASHINGTON UNIV SCHOOL OF MEDICINE	ST. LOUIS CITY	39.59	.00	.00
MOD006275481	WATLOW ST. LOUIS	ST. LOUIS	18.56	.00	.00
MOD038897658	WATLOW-COLUMBIA, INC.	COLUMBIA	22.23	.00	.00
MOD007179823	WELLS ALUMINUM CORPORATION	MONETT	73.76	.00	.00
MOD006271159	WESTERN LITHOTECH	ST. LOUIS	32.40	.00	.00
MOD006278907	WHITMIRE RESEARCH LABORATORY, INC.	ST. LOUIS	61.53	.00	.00
MOD985798131	WILCORP INDUSTRIES, INC	MARSHFIELD	145.53	.00	.00
MOD981496870	WILCORP INDUSTRIES, INC.	BILLINGS	18.29	.00	.00
MOD043937895	3M CO.	SPRINGFIELD	1,412.43	.00	.00
MOD054950670	3M CO.	COLUMBIA	377.24	.00	.00
MOD057894321	3M CO.	NEVADA	4,573.49	.00	.00
MO8571924549	509 CES/CEV	WHITMAN AFB	213.24	32.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MOT300011079	ABB POWER T & D COMPANY INC	ST. LOUIS	8.94	.00	.00
MOD985773472	AERO TRANSPORTATION	INDEPENDENCE	6.98	.00	.00
MOD073027948	ALLIED SIGNAL INC	NEVADA	1.80	.00	.00
MOD065756694	ALTEC INDUSTRIES INC	ST JOSEPH	9.87	.00	.00
MOD981720865	AMERICAN CLEANERS	UNIVERSITY CITY	1.14	.00	.00
MOD062442561	ARVIN NORTH AMERICAN AUTOMOTIVE	DEXTER	8.40	.00	.00
MOT300010899	BALL FOSTER GLASS CONTAINER CO	PEVELY	9.33	.00	.00
MOD980962765	BROOME OLDS INC	INDEPENDENCE	11.63	.00	.00
MOD006281075	BROWN SHOE CO	STEELVILLE	6.40	.00	.00
MOD059196352	CANAM STEEL CORPORATION	WASHINGTON	7.80	.00	.00
MOP000001393	CARGILL INC	KANSAS CITY	4.27	.00	.00
MOD985820190	COLT TECHNOLOGY CORPORATION	LEES SUMMIT	7.77	.00	.00
MOR000002691	CUPPLES PRODUCT INC	UNION	6.75	.00	.00
MOD981123375	DETROIT TOOL AND ENGINEERING CO	LEBANON	1.89	.00	.00
MOD006266373	DOE RUN CO	HERCULANEUM	4.07	.00	.00
MOD059200089	DOE RUN CO BUICK SMELTER	BOSS	3.72	.00	.00
MOD001829852	DOW CHEMICAL COMPANY	PEVELY	9.85	.00	.00
MOD046745824	DUPONT REFINISH SERVICE CENTER	KANSAS CITY	9.38	.00	.00
MOD980684989	EARL SCHEIB AUTO PAINT FINISH	SPRINGFIELD	8.00	.00	.00
MOD006283808	EG & G MISSOURI METAL SHAPING CO	ST LOUIS	4.30	.00	.00
MOD150191344	ESSEX SPECIALTY PRODUCTS	POPLAR BLUFF	9.47	.00	.00
MOD076265099	FASCO INDUSTRIES, INC	CASSVILLE	10.20	.00	.00
MOD122597388	GENCORP AUTOMOTIVE, BERGER PLANT	BERGER	12.61	.00	.00
MOD109240150	GREYHOUND LINES, INC	ST. LOUIS	4.67	.00	.00
MOD000298398	HARMON ELECTRONICS INC	GRAIN VALLEY	10.87	.00	.00
MOD006299689	HERCULES INC AQUALIN MCW	LOUISIANA	3.37	.00	.00
MOD006273635	HOMER A DOERR & SONS PLATING CO	ST LOUIS CITY	9.51	.00	.00
MOD985797349	HUBBELL/AB CHANCE WILSON ST PLANT	CENTRALIA	2.53	.00	.00
MOD006287486	INX INTERNATIONAL INK CO.	ST. LOUIS CITY	8.72	.00	.00
MOD981699598	KANSAS CITY AVIATION DEPT	KANSAS CITY	4.76	.00	.00
MOD007128978	KERR MCGEE CHEMICAL CORP	KANSAS CITY	5.30	.00	.00
MOD049563273	LA-Z-BOY MIDWEST	NEOSHO	9.14	.00	.00
MOD192203487	MANCHESTER TANK	HANNIBAL	2.07	.00	.00
MOD083028696	MARCHEM CORPORATION	MARYLAND HEIGHT	2.78	.00	.00
MOD985770536	MASTERCHEM INDUSTRIES, INC.	IMPERIAL	1.76	.00	.00
MOD980968457	MCDONNELL AIRCRAFT COMPANY	BERKELEY	7.53	.00	.00
MOD985771807	MCDONNELL DOUGLAS ST. LOUIS	EARCH CITY	4.81	.00	.00
MOD000818971	MCDONNELL DOUGLAS ST. LOUIS TRACT I	HAZELWOOD	10.18	.00	.00
MOD093750404	METAL CONTAINER, INC.	ARNOLD	6.29	.00	.00
MOD050225713	MID-WEST AUTOMOTIVE REGUILDERS, INC	TRUESDALE	3.52	.00	.00
MOD007146673	MIDLAND LITHOGRAPHING CO.	NORTH KANSAS CI	9.39	.00	.00
MO0000020271	MIRACLE RECREATION EQUIPMENT	MONETT	2.85	.00	.00
MO2572890026	MISSOURI AIR NATIONAL GUARD	ST. JOSEPH	4.45	.00	.00
MO1572890001	MISSOURI AIR NTL. GUARD	BRIDGETON	5.46	.00	.00
MOD985771377	MISSOURI HIGHWAY & TRANSPORTATION	JEFFERSON CITY	11.68	.00	.00
MOD985801380	MONSANTO CHEMICAL CO.	EARTH CITY	4.75	.00	.00
MOD981501331	NORDYNE, INC	ST LOUIS	12.11	.00	.00
MOD000830448	NORDYNE, INC.	BOONVILLE	4.89	.00	.00
MOR000011312	NORFOLK AND WESTERN RAILWAY CO	O'FALLON	6.63	.00	.00
MOD006267157	O'SULLIVAN INDUSTRIES, INC.	LAMAR	7.17	.00	.00
MOD985773316	ORBSEAL	CARROLLTON	1.29	.00	.00
MOD007184195	PACKAGE SERVICE COMPANY	NORTHMOOR	1.90	.00	.00
MOD980854913	PERMEA, INC	ST. LOUIS	12.24	.00	.00
MOD981721772	PPG CHEMFIL	O'FALLON	7.40	.00	.00
MOD006302277	QUAKER WINDOW PRODUCTS CO	FREEBURG	7.86	.00	.00

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MISSOURI

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- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

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MOD006292296	RHEOX INC	ST LOUIS CITY	8.42	.00	.00
MOD985771195	RHONE-POULENC AGRICULTURE COMPAN	ST LOUIS CITY	3.73	.00	.00
MOD981713167	S&K INDUSTRIES	LEXINGTON	10.60	.00	.00
MOD050217397	SCHITZER	ROLLA	2.70	.00	.00
MOD000246397	SILGAN CONTAINERS CORP.	NORTH KANSAS CI	2.15	.00	.00
MOD099673899	SMITHKLINE BEECHAM CONSUMER HEALTHC	ST LOUIS	7.02	.00	.00
MOD980855878	ST LOUIS COUNTY DEPT HIGHWAY	OVERLAND	2.99	.00	.00
MOD980633309	ST LOUIS METALLIZING CO	ST LOUIS	6.98	.00	.00
MOT300010709	ST. LOUIS POST-DISPATCH	MARYLAND HEIGHT	3.18	.00	.00
MOD006270524	SWING-A-WAY MANUFACTURING CO.	ST. LOUIS CITY	4.90	.00	.00
MOD981717689	TE PRODUCTS PIPELINE CO LP CAPE GIR	SCOTT CITY	8.94	.00	.00
MOD981722341	TRACKER MARINE L.P.	BOLIVAR	11.40	.00	.00
MOD981725336	TRACKER MARINE, L.P.	CLINTON	4.60	.00	.00
MOD122604721	TRI-RINSE, INC	ST. LOUIS CITY	3.08	.00	.00
MOD985799725	TRINITY CARUTHERSVILLE	CARUTHERSVILLE	12.15	.00	.00
MOD981126428	UNION ELECTRIC CO RAY COMPLEX	ST LOUIS	2.48	.00	.00
MOD055871529	UNITED PARCEL SERVICE	EARTH CITY	4.64	.00	4.00
MOR000000646	UNIVERSAL FOREST PRODUCTS INC	HARRISONVILLE	3.00	.00	.00
MOD000677773	UNIVERSITY OF MISSOURI ROLLA	ROLLA	5.47	.00	.00
MOD084396985	VAN WATERS & ROGERS INC	BERKELEY	1.90	.00	.00
MOD079778890	VON WEISE GEAR CO	ST CLAIR	5.53	.00	.00
MOR000001206	WALSWORTH PUBLISHING CO	MARCELINE	10.24	.00	.00
MOD086057064	WATERLOO INDUSTRIES, INC	SEDALIA	7.40	.00	.00
MOD980968739	WILCOX ELECTRIC, INC.	NORTH KANSAS CI	6.27	.00	.00
MOD007137185	WIRE ROPE, INC. OF AMERICA	ST. JOSEPH	6.82	.00	.00
MOD043496132	WOODSON PRODUCTS	ST. LOUIS CITY,	5.94	.00	.00
MOD095035242	YELLOW FREIGHT SYSTEM, INC.	KANSAS CITY	9.33	.00	.00
MOD006327274	YORK PRODUCTS(HALMARK)	MARSHFIELD	11.78	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MOP000001229	BURLINGTON NORTHERN RAILROAD DERAIL	ST LOUIS CITY	.00	.00	.00
MOD046370318	CUPPLES PRODUCTS	ST LOUIS	.39	.00	.00
MOD981124142	DATASTOR	BRENTWOOD	.00	.00	.00
MOP000001768	ENTERGY SYSTEM & SERVICES	CHESTERFIELD	.00	.00	.00
MOD985815851	GATEWAY CLEANERS	CRESTWOOD	.00	.00	.00
MOD073027609	INDUSTRIAL SERVICE CORP	KANSAS CITY	.68	.00	.00
MOD981127319	LONE STAR IND'S INC.	CAPE GIRARDEAU	.00	.00	.00
MOD985772409	MO HWY & TRANSPORTATION DEPT.	TOWN & COUNTRY	.00	.00	.00
MOP000001426	REIDEL ENVIRONMENTAL	WILLOW SPRINGS	.00	.00	.00
MOD000669069	SAFETY KLEEN	SPRINGFIELD	.09	.00	.00
MOD095486312	SAFETY KLEEN CORP	ST CHARLES	.13	.00	.00
MOD980971626	SAFETY KLEEN CORP	COLUMBIA	.00	.00	.00
MOD980973564	SAFETY KLEEN CORP	INDEPENDENCE	.00	.00	.00
MOD068559525	SHELL OIL CO	ST LOUIS	.00	.00	.00
MOD006264998	ST. LOUIS DIECASTING DIVISION	BRIDGETON	.39	.00	.00
MOD981120611	YELLOW FREIGHT SYSTEM, INC.	INDEPENDENCE	.00	.00	.00

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MONTANA

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MT0000992982	ALLWASTE CONTAINER SERVICES - EDGEW	MILES CITY	14.44	.00	.00
MTD093291656	ARCO COAL CO ANACONDA SMELTER	ANACONDA	.54	52.64	.00
MTT310010087	BN LIVINGSTON	LIVINGSTON	50.00	.00	.00
MTD980955660	BN - HAVRE	HAVRE	19.66	.00	.00
MTD986067247	CARL WEISSMAN & SONS WAREHOUSE	GREAT FALLS	44.23	.00	.00
MTD006238083	CENEX INC LAUREL REFINERY	LAUREL	469.57	208.26	.00
MTD986067197	CENEX PETROLEUM TERMINAL - GLENDIVE	GLENDIVE	362.11	.00	.00
MTD057561763	COLUMBIA FALLS ALUMINUM CO	COLUMBIA FALLS	3,971.00	.00	.00
MTD006229405	CONOCO REFINERY	BILLINGS	530.18	.00	.00
MTD010380574	EXXON BILLING REFINERY	BILLINGS	1,314.66	.00	.00
MTD006232276	IDAHO POLE COMPANY	BOZEMAN	94.62	.00	.00
MTD980807176	LOUISIANA PACIFIC CORP MISSOULA	MISSOULA	25.36	.00	.00
MT8571924556	MALMSTROM AFB	MALMSTROM AFB	31.54	.00	.00
MT0000971986	MALMSTROM AFB BOOTLEGGER SITE	GREAT FALLS	20.00	.00	.00
MTD986073583	MONTANA POLE AND TREATMENT	BUTTE	15.00	.00	.00
MTD000475194	MONTANA REFINING COMPANY	GREAT FALLS	40.58	.00	.00
MTD119730208	MONTANA TECH	BUTTE	5.55	690.01	.00
MTD010367738	MONTANA TECHNICAL RESEARCH CENTER	BUTTE	60.75	.00	.00
MT2890090036	MSE INC BUTTE WETO	BUTTE	16.58	.00	.00
MTD065569048	MSU BOZEMAN	BOZEMAN	7.99	40.50	.00
MTD035237940	RIBI IMMUNOCHEM RESEARCH INC	HAMILTON	22.96	.00	.00
MTD982648099	SEMITOOL INC RESERVE DR	KALISPELL	65.94	775.00	.00
MTR000001222	SOUTHEASTERN PUBLIC SERVICE CO / SE	BUTTE	3.63	850.03	.00
MTD079711198	TRANSBAS INC	BILLINGS	385.94	.00	.00

Note: Please refer to the introduction for an explanation of this list.

MONTANA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MTD071401368	A & S TRIBAL INDUSTRIES INC	POPLAR	3.90	.00	.00
MTD063728984	BIG SKY COAL COMPANY	COLSTRIP	6.51	.00	.00
MTD006237234	BN - KALISPELL POLE & TIMBER	KALISPELL	5.23	.00	.00
MTR000001115	BOZEMAN SOLVENT SITE	BOZEMAN	9.77	.00	.00
MTD986072999	CIRMOT INDUSTRIES	BILLINGS	2.01	.00	.00
MT0000253922	EDS FURNITURE STRIPPING	BILLINGS	1.20	.00	.00
MTD982648255	LIVINGSTON REBUILD CENTER INC	LIVINGSTON	7.20	.00	.00
MTR000000927	MONSANTO COMPANY LAB WAREHOUSE #2	MISSOULA	2.64	.00	.00
MTD980330609	MONTANA POWER CO COLSTRIP UNITS 3	COLSTRIP	1.52	.00	.00
MTD000710236	MONTANA POWER CO UNITS 1 & 2	COLSTRIP	3.96	2.00	.00
MTR000000562	MONTANA POWER CO - HARDY CAMP	CUTBANK	4.00	.00	.00
MTD982647711	MONTANA RAIL LINK MISSOULA DEFOE	MISSOULA	10.51	.00	.00
MTD981552771	MSU NORTHERN	HAVRE	2.53	.00	.00
MTR000000331	MT DFWP - HELENA SHOP	HELENA	1.69	.00	.00
MTD982647760	MT DOT GLENDIVE	GLENDIVE	1.75	.00	.00
MTD986069649	MT DOT GREAT FALLS 18TH AVE NE	GREAT FALLS	2.27	.00	.00
MT0000930537	MT DOT WOLF POINT	WOLF POINT	3.34	.00	.00
MT0000000356	PACIFIC RECYCLING BILLINGS	BILLINGS	5.10	.00	.00
MTR000000968	PRAIRIE ELEVATOR COMPANY	TERRY	1.23	.00	.00
MTR000000398	ST LABRE INDIAN SCHOOL	ASHLAND	1.93	.00	.00
MT9141790015	TW SERVICES YELLOWSTONE PARK DIVIS	GARDINER	7.36	.00	.00
MTD093301836	WESTERN ENERGY COMPANY ROSEBUD MIN	COLSTRIP	6.83	.00	.00
MT0001018381	WESTLAND SERVICE STATION	GLASGOW	1.75	.00	.00
MTD981545445	4TH AVENUE PLAZA	BILLINGS	.05	10.00	.00

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MONTANA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO CANNOT BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- LESS THAN 1.1 TONS RCRA HAZARDOUS WASTE, AND
- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
MT0000254094	BLUE RANGE MINING HEALTH MILL	LEWISTOWN	.42	.00	.00
MTD986069508	GRANITE TIMBER INC	PHILIPSBURG	.00	.00	.00
MT0000971994	MALMSTROM AFB - GF CITY / COUNTY SI	GREAT FALLS	.00	.00	.00
MTD144180304	MONTANA RESOURCES	BUTTE	.00	.00	.00

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NAVAJO NATION

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

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- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NNP600929025	NATIONAL PARK SERVICE	TONALEA	23.58	.00	.00
NND043015387	PACKARD HUGHES INTERCONNECT FT DEFI	FORT DEFIANCE	24.96	.00	.00
NND104150024	PEABODY WESTERN COAL CO	KAYENTA	95.46	.00	.00

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NAVAJO NATION

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NND042993725	BHP MINERALS INTERNATIONAL INC	FRUITLAND	4.14	.00	.00
NN2140909100	BIA BRANCH OF ROADS CHEU	FARMINGTON	11.73	.00	.00
NNP600929065	CANYON DE CHELLY NATIONAL	CHINLE	2.30	.00	.00
NNP601255641	CONSOLIDATION COAL CO	BURNHAM	2.38	.00	.00
NNR000000059	FORT DEFIANCE	FORT DEFIANCE	9.76	.00	.00
NND986668853	HUGHES MISSILE SYSTEM CO	FARMINGTON	6.82	.00	.00
NND074452426	SALT RIVER PROJECT	PAGE	7.57	.00	.00
NNR000000356	US BIA WESTERN NAVAJO AGENCY	TUBA CITY	5.90	.00	.00

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NEBRASKA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NED007265077	AMERICAN METER CO	NEBRASKA CITY	215.14	.00	.00
NED007259054	AMERICAN TELEPHONE & TELEGRAPH	OMAHA	180.96	.00	.00
NED980965974	ANACOMP INC	OMAHA	62.52	300.00	.00
NED099564684	APPLETON ELECTRIC COMPANY	COLUMBUS	241.21	.00	.00
NED007260672	ASH GROVE CEMENT CO	LOUISVILLE	18.87	.00	.00
NED007263197	BECTON DICKINSON	COLUMBUS	69.00	.00	.00
NED007268790	BEHLEN MFG. CO.	COLUMBUS	2,669.25	.00	.00
NED000822775	BURLINGTON NORTHERN SANTE FE	LINCOLN	209.51	.00	.00
NED986369338	CAE VANGUARD INC	LINCOLN	27.43	.00	.00
NED082724071	CAROL CORP DBY HILLAERO MOD CTR	LINCOLN	42.80	.00	.00
NED981723513	CLEAN HARBORS TECH CORP	KIMBALL	6,070.37	.00	.00
NED981708795	CONOCO INC.- SIDNEY TERMINAL	SIDNEY	79.54	.00	.00
NED007263353	CROWN CORK & SEAL CO. INC.	OMAHA	407.32	.00	.00
NED035093053	DALE ELECTRONICS	NORFOLK	86.39	.00	.00
NED000822817	DALE ELECTRONICS INC	COLUMBUS	31.32	.00	.00
NED091998567	DANA CORP, PERFECT CIRCLE PRODUCT D	HASTINGS	393.09	.00	.00
NED007272701	DEETER FOUNDRY INC	LINCOLN	186.00	.00	.00
NED980971733	DUNCAN AVIATION	LINCOLN	977.87	.00	.00
NED986387850	FLEXCON COLUMBUS	COLUMBUS	41.58	.00	.00
NED091995159	FOUR SEASONS PAINT CO	LINCOLN	60.87	.00	.00
NED981117153	HOUSTON J-M CORP. D/B/A	OMAHA	69.87	.00	.00
NED986387520	HUNT CLEANERS INC	COZAD	72.94	.00	.00
NED080219868	HYDRAULIC COMPONENTS	HARTINGTON	114.19	.00	.00
NED068652981	KAWASAKI MOTORS MFG	LINCOLN	574.71	.00	.00
NED045575552	LANCER LABEL INC	OMAHA	21.40	.00	.00
NED007281728	LINCOLN PLATING COMPANY	LINCOLN	51,345.86	.00	.00
NED000610691	LOZIER CORPORATION	OMAHA	272.22	.00	.00
NED000610709	LOZIER CORPORATION WEST PLANT	OMAHA	207.56	.00	.00
NED007285257	MAGNUS/FARLEY INC	FREMONT	226.36	.00	.00
NED007258213	MALNOVE INC.	OMAHA	34.45	.00	.00
NED007263619	MONROE AUTO EQUIPMENT CO	COZAD	279.12	83.40	.00
NED045275260	NASHUA CORP	OMAHA	25.90	.00	.00
NED065106270	NATIONAL CRANE CORPORATION	WAVERLY	17.54	.00	.00
NED035036201	NEW HOLLAND NORTH AMERICA INC	GRAND ISLAND	23.04	.00	.00
NED087069050	NUCOR STEEL NEBRASKA	NORFOLK	5,907.46	.00	.00
NED007262579	PETERSON MFG. CO. INC.	DEWITT	44.41	.00	.00
NED007274699	PFIZER ANIMAL HEALTH	LINCOLN	57.46	.00	.00
NED000050435	PFIZER ANIMAL WAREHOUSE	LINCOLN	17.13	.00	.00
NED000362525	PFIZER RETURN CENTER	LINCOLN	45.60	.00	.00
NED000819060	PLATTE CHEMICAL COMPANY	FREMONT	66.17	132,334.84	.00
NED000819078	PLATTE CHEMICAL COMPANY	FREMONT	872.65	.00	.00
NED986386696	PLATTE CHEMICAL COMPANY	FREMONT	11.09	21,095.02	.00
NED072902513	SQUARE D COMPANY	LINCOLN	46.56	.00	.00
NED007259518	STOREKRAFT MANUFACTURING CO	BEATRICE	14.79	.00	.00
NED980973580	SUNDSTRAND AEROSPACE	YORK	14.85	.00	.00
NED986387041	SUPRA COLOR LABS INC	OMAHA	25.20	.00	.00
NED043534635	TECHNICAL PRODUCTS GROUP INC	LINCOLN	26,644.93	.00	.00
NED089569024	TELEX COMMUNICATIONS INC	LINCOLN	14.35	.00	.00
NED020184412	THE ARNOLD ENGINEERING CO	NORFOLK	35.26	.00	.00
NED007266331	THE GOODYEAR TIRE & RUBBER CO	LINCOLN	96.17	60.00	.00
NET320010077	THERMO KING CORPORATION	HASTING	66.87	.00	.00
NED981707524	U S WEST BRI	OMAHA	15.59	.00	.00
NED000766816	UNIV OF NEBRASKA-EAST CAMPUS	LINCOLN	14.06	.00	.00
NED000766808	UNIV OF NEBRASKA-LINCOLN-CITY CAMPU	LINCOLN	18.70	.00	.00
NED000809475	UNIVERSITY OF NEBRASKA MEDICAL CENT	OMAHA	21.06	.00	.00

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NEBRASKA

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- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NED007267214	VALMONT INDUSTRIES INC	VALLEY	68.19	.00	.00
NED000809483	VAN WATERS & ROGERS INC.	OMAHA	8.43	450.00	.00
NED007286198	VICKERS INC	OMAHA	57.11	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NED007266935	AMERICAN SHIZUKI CORP	OGALLALA	11.47	.00	.00
NED986385193	AMERICAN TOOL COMPANIES INC BEATRIC	BEATRICE	8.31	.00	.00
NE0000004598	BIOCOR INC	OMAHA	6.18	.00	.00
NED000822783	BNSF RAILROAD	ALLIANCE	11.18	.00	.00
NED000822767	BURLINGTON NORTHERN SANTE FE	LINCOLN	3.06	.00	.00
NED981119548	CITY OF OMAHA TRAFFIC	OMAHA	3.52	.00	.00
NED068656560	CUSHMAN INC.	LINCOLN	9.66	.00	.00
NED065133167	EATON CORPORATION	BUFFALO	9.02	.00	.00
NED000325167	FARMLAND INDUSTRIES	BEATRICE	6.01	.00	.00
NED078024312	GRAND ISLAND ACCESSORIES INC	GRAND ISLAND	11.55	.00	.00
NED080209950	LACKAWANNA LEATHER CO	OMAHA	9.42	.00	.00
NED047038187	LEON PLASTICS INC	ALDA	8.18	.00	.00
NED109108183	MARSHALLTOWN INSTRUMENTS	HASTINGS	7.73	.00	.00
NET320010259	NEBRASKA DEPT OF ROADS	LINCOLN	10.25	.00	.00
NED072904543	OILGEAR	FREMONT	10.87	.00	.00
NED068646678	OMAHA STEEL CASTINGS CO.	OMAHA	1.17	.00	.00
NED042581363	PARKER HANNIFIN	LINCOLN	8.09	.00	.00
NED035120260	REAGAN BUICK INC	OMAHA	6.34	.00	.00
NED000687178	SAFETY KLEEN CORP	GERING	2.75	.00	.00
NED053316535	SAFETY KLEEN CORP	GRAND ISLAND	2.05	.00	.00
NEP000000432	SEARS UNIT #1041	OMAHA	1.26	.00	.00
NED981507338	SEARS UNIT 2191 AND 7191	LINCOLN	1.64	.00	.00
NED000001545	SURFACE TECHNOLOGY INC	OMAHA	8.62	.00	.00
NED070129028	UNIVERSITY OF NEBRASKA AT KEARNEY	KEARNEY	.67	7.00	.00

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NEBRASKA

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- LESS THAN 1.1 TONS RCRA HAZARDOUS WASTE, AND
- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NED981704174	GRA GRA INC	OMAHA	1.06	.00	.00
NED986387777	LYSTAD TANK SITE (ECOLAB INC)	LINCOLN	.50	.00	.00
NED981495724	SAFETY KLEEN CORP	OMAHA	.00	.00	.00
NED986375061	UNIV OF NEBRASKA-LINCOLN/AGRIC. RES	LINCOLN	.76	.00	.00

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NEVADA

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- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NVD009155631	AMERICAN WATER HEATER GROUP	RENO	80.27	.00	.00
NVD000626531	BARRICK GOLDSTRICK MINES INC	CARLIN	1,104.17	.00	.00
NVD990764961	CALNEV PIPE LINE CO	LAS VEGAS	83.40	.00	.00
NVD986769602	CARTER WALLACE INC	SPARKS	18.44	.00	.00
NVD982443947	CHROMALLOY NEVADA	CARSON CITY	15.64	.00	.00
NVD986774651	CHROMALLOY NEVADA	CARSON CITY	228.86	.00	.00
NVD986772671	COURTESY OLDSMOBILE	LAS VEGAS	15.10	.00	.00
NVD078143377	CRUMRINE JEWELERS	RENO	51.53	.00	.00
NVD982494924	DUPONT CARLIN TERMINAL	CARLIN	1.11	2,220.00	.00
NVD982467250	DURA-BOND BEARING CO	CARSON CITY	2,870.40	.00	.00
NVD982511826	EL DORADO CARTRIDGE CORP	BOULDER CITY	39.90	.00	.00
NVD074116500	ENVIRONMENTAL MONITORING SYSTEMS LA	LAS VEGAS	2.10	1,411.00	.00
NVD981428923	FAIRWAY CHEVROLET COMPANY	LAS VEGAS	36.05	.00	.00
NVD008477820	HAMILTON CO	RENO	14.68	.00	.00
NV1210090006	HAWTHORNE ARMY DEPOT	HAWTHORNE	119.08	.00	.00
NVD981575160	HOST INTERNATIONAL INC	LAS VEGAS	18.51	.00	.00
NVD008290330	KERR-MCGEE CHEMICAL CORP	HENDERSON	210.14	.00	.00
NVD982041345	LIFETOUCH PORTRAIT STUDIOS	RENO	106.33	.00	.00
NVD982461022	LOCKHEED ANALYTICAL LABORATORY	LAS VEGAS	97.04	.00	.00
NVD986775427	N B INDUSTRIES	LAS VEGAS	24.99	.00	.00
NVD982030520	NEVAD WOOD PRESERVING	SILVER SPRINGS	67.53	.00	.00
NVD980478143	NEVADA DIVISION OF AGRICULTURE	RENO	9.95	8,778.00	.00
NVD070307103	NEVADA PLATING CO	SPARKS	4,834.80	9,665,608.63	.00
NVD000627034	NEWMONT GOLD CO QUARRY	CARLIN	156.44	.00	.00
NVD092497999	PRECISION ROLLED PRODUCTS INC	RENO	31.41	.00	.00
NV3890090001	REYNOLDS ELECTRICAL & ENGINEERING	N LAS VEGAS	312.16	7,057.00	.00
NVD981641434	RR DONNELLEY & SONS CO	RENO	35.87	.00	.00
NVD982502684	SAINT MARY'S REGIONAL MED CNTR	RENO	106.71	.00	.00
NVD981625015	SHERWIN-WILLIAMS CO	SPARKS	58.91	.00	.00
NVD982518755	SIERRA CHEMICAL CO	SPARKS	20.81	.00	.00
NVD982443962	SIERRA MANUFACTURING	CARSON CITY	17.38	.00	.00
NVD000630970	SO CALIFORNIA EDISON CO	LAUGHLIN	32.39	.00	.00
NVD096905724	THE SHERWIN-WILLIAMS COMPANY	RENO	86.00	.00	.00
NVT330010182	UNIVERSITY OF NEVADA, LAS VEGAS	LAS VEGAS	7.94	308.00	.00
NVD981963549	UNIVERSITY OF NEVADA, RENO	RENO	35.89	18,845.00	.00
NV9170022173	US NAVY NAS FALLON	FALLON	39.75	.00	.00
NV5570024112	USAF - NELLIS RANGE COMPLEX	LAS VEGAS	19.06	.00	.00
NVD981570781	VEHICLE SERVICES-MAIN YARD	LAS VEGAS	14.13	.00	.00
NVD980895338	21ST CENTURY EMI DBA TRANSPORTER	FERNLEY	14.16	.00	.00
NV7570024110	99 ABW/CC	NELLIS AFB	156.58	.00	.00

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NEVADA

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- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

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NVR000001024	AUSTIN GOLD VENTURE	AUSTIN	1.84	.00	.00
NV0000148502	B-LINE SYSTEMS, INC.	RENO	3.73	.00	.00
NVD982488082	BILL PEARCE OLDS BMW VOLVO	RENO	1.93	.00	.00
NVD982479677	BTS GROUP	RENO	8.56	.00	.00
NVR000000562	CAMPBELL PUMPING STATION	LAS VEGAS	5.33	.00	.00
NVD981439847	CHAMPION CHEVROLET - GEO	RENO	1.33	.00	.00
NVD982434961	CLARK COUNTY SCHOOL DISTRICT	HENDERSON	7.71	.00	.00
NVD982430084	COMET INDUSTRIES, INC	CARSON CITY	7.48	.00	.00
NV0000453100	COSTCO WHOLESALE #138	HENDERSON	10.52	.00	.00
NV0000453076	COSTCO WHOLESALE #35	LAS VEGAS	11.77	.00	.00
NVD097868731	EG&G ENERGY MEASUREMENTS	N LAS VEGAS	2.85	.00	.00
NVD986774735	FIRST MISS GOLD INC GETCHELL MINE	GOLCONDA	5.29	.00	.00
NVD982472474	INCLINE CLEANERS	GARDENERVILLE	1.32	.00	.00
NVD986775195	INCLINE VILLAGE GNRL IMPROVEMENT DI	INCLINE VILLAGE	3.09	.00	.00
NVD981440209	JONES WEST FORD	RENO	3.83	.00	.00
NV0000879676	LAS VEGAS VALLEY WATER DISTRICT	LAS VEGAS	8.84	.00	.00
NVD056804487	LIFT ENGINEERING & MANUFACTURING CO	CARSON CITY	7.46	.00	.00
NVD986775369	LONE TREE MINE	VALMY	2.56	.00	.00
NVD982519316	LORAL AEROSPACE SERVICES DEPOT	LAS VEGAS	2.64	.00	.00
NVD986773505	NEVADA COM	SPARKS	5.89	.00	.00
NVD000627158	NEWMONT GOLD CO (MILL NO. 1)	CARLIN	4.80	.00	.00
NVD980892616	PORSCHE CARS NA, INC	RENO	2.47	.00	.00
NVD986766046	ROCKWELL INTL/ROCKETDYNE DIV	PALAMINO VALLEY	2.14	.00	.00
NVD058947086	SFPP, L.P.	SPARKS	4.41	.00	.00
NVD000631549	SHELL OIL COMPANY	SPARKS	3.00	.00	.00
NVD982373318	SIERRA PACIFIC POWER COMPANY	SPARKS	3.40	.00	.00
NVD982373342	SIERRA PACIFIC POWER COMPANY	RENO	2.07	.00	.00
NVR000000380	SUPER MARKET INFORMATION SYSTEMS	SPARKS	4.89	.00	.00
NVD981968852	THIOKOL/OMNECO INC.	CARSON CITY	6.42	.00	.00
NVD986775039	UNIVERSITY OF NEVADA, RENO-VALLEY	RENO	.78	25.00	.00
NV3150090022	USDOJ DEA	LAS VEGAS	2.89	11.60	.00
NVT000612176	VALENCE TECHNOLOGY INC	HENDERSON	4.62	.00	.00
NVD986772002	WAL MART 1 HOUR PHOTO	CARSON CITY	10.54	.00	.00

Note: Please refer to the introduction for an explanation of this list.

NEVADA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO CANNOT BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- LESS THAN 1.1 TONS RCRA HAZARDOUS WASTE, AND
- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NV5210090010	HAWTHORNE ARMY DEPOT	HAWTHORNE	.42	.00	.00
NVD986766137	LAIDLAW ENV SERVICES OF CA INC	SPARKS	.00	.00	.00
NVR000000018	POWER LOGISTICS	N LAS VEGAS	.00	.00	.00
NVD986772689	REDCO	CARSON CITY	.88	.00	.00
NVT330010208	SAFETY-KLEEN CORP	N LAS VEGAS	.00	.00	.00
NVT982401200	SIERRA X-RAY SERVICES	RENO	.00	.00	.00
NVT330010000	US ECOLOGY, INC.	BEATTY	.81	.00	.00

Note: Please refer to the introduction for an explanation of this list.

NEW HAMPSHIRE

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NHD982202673	ABC FABRICATORS INC	LACONIA	22.14	.00	.00
NHD986472249	ADVANCE CIRCUIT SYSTEMS INC	FRANKLIN	23.06	.00	.00
NHD048729685	BAILEY MANUFACTURING CORP	SEABROOK	59.82	.00	.00
NHD066755364	BATESVILLE CASKET COMPANY	NASHUA	20.73	.00	.00
NHD986469377	BIOPURE CORPORATION	DOVER	27.37	.00	.00
NHD001078740	BRONZE CRAFT CORP	NASHUA	38.38	.00	.00
NHD986483212	BUSINESS EXPRESS AIRLINES INC	PORTSMOUTH	20.62	.00	.00
NHD986483691	CAR COMPONENT TECHNOLOGIES	BEDFORD	145.64	.00	.00
NHD980525174	CHICAGO CUTLERY/GEN HOUSEWARES	ANTRIM	1,974.91	.00	.00
NHD986466688	CIRCUIT CONNECT INC	NASHUA	105.68	.00	.00
NHD986486488	CRESSONA ALUMINUM COMPANY	FRANKLIN	14.12	.00	.00
NHD001079896	CROWN PAPER CO.	BERLIN	16.50	77.00	.00
NHD986471324	CUMBERLAND FARMS #2803	SALEM	31.60	.00	.00
NHD041027822	DARTMOUTH COLLEGE	HANOVER	75.70	35.00	.00
NHD990717092	DEXTER CORPORATION	SEABROOK	106.68	.00	.00
NHD500003280	DEXTER ELECTRONIC MATERIALS	LONDONDERRY	20.93	.00	.00
NHD986484269	DOWN EAST ENERGY	NORTH HAMPTON	78.89	.00	.00
NHD986473643	EASTERN MOUNTAIN SPORTS	PETERBOROUGH	19.63	.00	.00
NHD040244428	ELECTROPAC CO INC	MANCHESTER	122.36	.00	.00
NHD040252744	ELEKTRISOLA INC	BOSCAWEN	32.80	.00	.00
NHD040245607	ELEXSYS INTERNATIONAL	NASHUA	279.91	.00	.00
NHD980671077	FLEX TECHNOLOGY INC	HUDSON	18.88	.00	.00
NHD073990418	FRAMATOME CONNECTORS USA	LINCOLN	105.15	.00	.00
NHD001084672	FREUDENBERG-NOK	BRISTOL	36.47	.00	.00
NHD066752734	FREUDENBERG-NOK GENERAL PARTNERSHIP	MANCHESTER	74.93	.00	.00
NHD071917371	G H BASS AND CO	BERLIN	39.10	.00	.00
NHD056330616	GAR-DOC INC	MILFORD	23.26	.00	.00
NHD001091073	GENERAL ELECTRIC CO	SOMERSWORTH	145.19	.00	.00
NHD000636134	GENERAL ELECTRIC CO AE	HOOKSETT	110.22	.00	.00
NHD001427475	GENERAL ELECTRIC COMPANY	HOOKSETT	180.57	.00	.00
NHD982749988	GETTY PETROLEUM CORP	DERRY	29.87	.00	.00
NHD986472561	GETTY PETROLEUM CORP	SOMERSWORTH	31.26	.00	.00
NHD991302522	HADCO CORP-HUDSON FACILITY	HUDSON	1,317.49	.00	.00
NHD046312559	HADCO CORPORATION	DERRY	1,467.68	.00	.00
NHD980668156	HADCO CORPORATION	SALEM	178.39	.00	.00
NHD048724173	HAMPSHIRE CHEMICAL CORPORATION	NASHUA	1,804.50	759.00	.00
NHD037695236	HEIDELBERG HARRIS	DOVER	219.79	.00	.00
NHD001079334	HENDRIX WIRE AND CABLE	MILFORD	35.02	.00	.00
NHD001078682	HITCHINER MANUFACTURING CO INC	MILFORD	203.57	.00	.00
NHD981211881	JANCO ELECTRONICS INC	SOMERSWORTH	15.70	2.00	.00
NHD048722466	K J QUINN & CO INC	SEABROOK	38.13	.00	.00
NHD001088624	KINGSTON-WARREN CORP	NEWFIELDS	36.02	.00	.00
NHD064441132	KOLLSMAN INC	MERRIMACK	11.41	70.00	.00
NHD001079219	LOCKHEED SANDERS INC	NASHUA	44.42	.00	.00
NHD980731996	LOCKHEED SANDERS INC	MANCHESTER	300.91	.00	.00
NHD000791889	LOCKHEED SANDERS, INC	NASHUA	42.25	81.00	.00
NHD986466290	M-TEK INC	NASHUA	15.82	.00	.00
NHD001085158	MARKEM CORPORATION	KEENE	72.82	.00	.00
NHD986472439	MARY HITCHCOCK MEMORIAL HOSPITAL	LEBANON	26.36	10.00	.00
NHD062002035	MILLIPORE CORPORATION	JAFFREY	82.73	.00	.00
NHD001082908	MINIATURE PRECISION BEARING	KEENE	19.79	.00	.00
NHD045013257	MOORE PRESSURE SENSITIVE SYSTEM	MANCHESTER	14.27	.00	.00
NHD986473460	N E TANYA FINISHES INC	LONDONDERRY	17.66	.00	.00
NHD101403509	NASHUA CIRCUITS INC	NASHUA	46.08	.00	.00
NHD000769869	NASHUA CORPORATION	MERRIMACK	60.95	.00	.00

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NEW HAMPSHIRE

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NHD001079433	NASHUA CORPORATION	NASHUA	25.49	.00	.00
NHD982542458	NEI/GTEL ENVIRONMRNTAL LABS INC	MILFORD	45.70	1,411.00	.00
NHD990717803	NEW ENGLAND BUISINESS SERVICE	PETERBOROUGH	37.14	.00	.00
NHD001086321	NEW HAMPSHIRE BALL BEARINGS INC	PETERBOROUGH	71.74	.00	.00
NHD986473320	NEW HAMPSHIRE INTERNATIONAL SPEEDWA	LOUDON	15.47	.00	.00
NHD001082304	NIM-COR INC	NASHUA	14.36	.00	.00
NHD048720544	NORMANDEAU ASSOCIATES INC	BEDFORD	17.10	.00	.00
NHD001422278	O'BRIEN D G	SEABROOK	139.82	.00	.00
NHD003941655	OSRAM SYLVANIA INC	EXETER	1,953.92	.00	.00
NHD005574223	OSRAM SYLVANIA INC	MANCHESTER	15.54	.00	.00
NHD073984288	OSRAM SYLVANIA INC	HILLSBORO	38.23	.00	.00
NHD986474476	PAK 2000	LANCASTER	17.61	.00	.00
NHD048727994	PARKER-CHOMERICS	HUDSON	24.21	.00	.00
NH7570024847	PEASE AIR FORCE BASE AFBCA, OLA, BL	PEASE AFB	293.26	.00	.00
NHD982716169	PHILLIPS EXETER ACADEMY	EXETER	28.90	.00	.00
NHD080027048	POLYCLAD LAMINATES INC	FRANKLIN	36.33	.00	.00
NHD099362048	POLYCLAD LAMINATES INC	FRANKLIN	30.44	.00	.00
NHD073998684	PREMIER INDUSTRIES	HUDSON	152.60	.00	.00
NHD986483378	PREMIER INDUSTRIES	HUDSON	52.90	.00	.00
NHD982195315	PROTOTYPE CIRCUITS INC	LONDONDERRY	47.58	.00	.00
NHD986466407	PURITAN PRESS INC	HOLLIS	15.79	.00	.00
NHD982195448	SPECTRUM DIRECT INC	PEMBROKE	16.97	.00	.00
NHD073964496	SPLIT BALLBEARING	LEBANON	17.43	.00	.00
NHD018953794	STURM RUGER & COMPANY INC	NEWPORT	371.92	.00	.00
NHD001078062	TELEDYNE ELECTRONIC TECH	HUDSON	88.15	.00	.00
NHD986467124	TELEDYNE HALCO	LONDONDERRY	52.62	.00	.00
NHD073974651	TERADYNE CIRCUITS OPERATION	NASHUA	243.41	.00	.00
NHD000842443	TERADYNE CONNECTION SYSTEMS	NASHUA	21.57	.00	.00
NHD001085026	TEXTRON AUTOMOTIVE INTERIORS	DOVER	42.04	.00	.00
NHD045011616	TEXTRON AUTOMOTIVE INTERIORS	FARMINGTON	140.81	.00	.00
NHD002059525	THOMPSON KW TOOL COMPANY INC	ROCHESTER	68.06	.00	.00
NHD980521843	TOTAL WASTE MANAGEMENT CORP	NEWINGTON	25.40	40.00	.00
NHD000790923	UNH -OFFICE ENV HEALTH/SAFETY	DURHAM	8.98	54.00	.00
NHD045513785	UNITRODE CORPORATION	MERRIMACK	37.81	.00	.00
NHD099357972	UNIVERSAL PACKAGING CORPORATION	BOW	39.32	.00	.00
NHD001038348	UPACO ADHESIVES	NASHUA	200.74	.00	.00
NHD001089465	VISHAY SPRAGUE INC	CONCORD	47.62	.00	.00
NHD058537960	WATTS REGULATOR/WEBSTER VALVE	FRANKLIN	299.48	.00	.00
NHD500003611	WEBBER ENERGY FUELS	SOMERSWORTH	16.82	.00	.00
NHD982203838	Z-TECH CORPORATION	BOW	33.35	.00	.00

Note: Please refer to the introduction for an explanation of this list.

NEW HAMPSHIRE

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NHD002576817	AAVID THERMAL TECHNOLOGIES INC	LACONIA	9.83	.00	.00
NHD000652065	AUTOMOTIVE TECHNOLOGY CENTER/TEXTRO	DOVER	5.64	.00	.00
NHD001083955	BEEDE ELECTRICAL INSTRUMENT CO INC	PENACOOK	5.69	.00	.00
NHD982746778	CHEMFAB CORPORATION	MERRIMACK	10.22	.00	.00
NH2971590003	DEFENSE FUEL SUPPORT POINT NEWINGTO	NEWINGTON	5.26	.00	.00
NHD982193005	DIGITAL EQUIPMENT CORP	CONTOOCOOK	8.51	.00	.00
NHD000479303	EASTERN AIR DEVICES INC	DOVER	5.57	.00	.00
NHD095506002	FOSS MANUFACTURING CO INC	HAMPTON	8.90	.00	.00
NHD073976904	GENCORP DESIGN CENTER	SALEM	11.71	.00	.00
NHD056329527	HYPERTHERM INC	HANOVER	5.84	.00	.00
NHD073973588	INGERSOLL-RAND CO	NASHUA	6.08	.00	.00
NHD046312591	JEWELL ELECTRICAL INSTRUMENTS	MANCHESTER	2.29	.00	.00
NHD052016540	JONES CHEMICALS INC	MERRIMACK	6.64	.00	.00
NHD001083609	LEWIS & SAUNDERS INC	LACONIA	6.65	.00	.00
NHD000791616	LOCKHEED SANDERS INC	MERRIMACK	8.84	5.00	.00
NHD073998106	LOCTITE LUMINESCENT SYSTEMS	LEBANON	2.38	.00	.00
NHD986471027	MINIATURE PRECISION BEARING	KEENE	13.01	.00	.00
NHD000791517	MOBIL OIL-28075 PORTSMOUTH TERMINAL	NEWINGTON	10.42	.00	.00
NHD991302597	MOORE BUSINESS FORMS INC	DOVER	7.45	.00	.00
NHD120299888	NEW ENGLAND POWER COMPANY	MONROE	2.73	.00	.00
NHD018925735	NEW HAMPSHIRE BALL BEARING INC ASTR	LACONIA	11.40	.00	.00
NHD500008420	PRIME TANNING CO INC	ROCHESTER	11.27	.00	.00
NHD002579399	PROCESS ENGINEERING	PLAISTOW	3.81	.00	.00
NHD982715625	SOUTHWORTH MILTON INC	HOPKINTON	8.07	.00	.00
NHD986466258	SOUTHWORTH MILTON INC	WARNER	8.51	.00	.00
NHD000477638	SPRAGUE ENERGY CORPORATION	NEWINGTON	2.45	.00	.00
NHD980913206	SULLIVAN INDUSTRIES INC	CLAREMONT	3.44	.00	.00
NHD000650101	TEXTRON AUTOMOTIVE COMPANY TEG	DOVER	6.52	.00	.00
NHD001080951	THERMAL DYNAMICS	WEST LEBANON	5.97	.00	.00
NHD037704459	UNICO	LACONIA	1.94	.00	.00
NHD982200685	VISHAY SPRAGUE INC	HUDSON	10.00	.00	.00

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NEW HAMPSHIRE

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO CANNOT BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- LESS THAN 1.1 TONS RCRA HAZARDOUS WASTE, AND
- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NHD980917660	HITCHNER NFG CO INC	LITTLETON	.00	.00	.00
NHD081257446	NORTH ATLANTIC ENERGY SERVICE CORP	SEABROOK	.95	.00	.00
NHD986473965	PH PRECISION PRODUCTS INC	PEMBROKE	.00	.00	.00
NHD986483832	SEAWARD CORPORATION	PORTSMOUTH	.00	.00	.00

Note: Please refer to the introduction for an explanation of this list.

NEW JERSEY

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NJD986583417	ABC TANK COMPANY INC	CLAYTON	112.76	.00	.00
NJD986586238	ABLE LABS	S PLAINFIELD	2.68	41.70	.00
NJD047354832	ACCURATE FORMING	HAMBURG	6,688.54	.00	.00
NJD982796310	ACTIVE OIL SERVICE, INC.	NEWARK	133.71	.00	.00
NJD002154086	ADCO CHEMICAL CO	NEWARK	423.45	.00	.00
NJD115342354	ADVANCE FOILS, INC.	ELIZABETH	20.50	.00	.00
NJD055541320	AFG INDUSTRIES	CINNAMINSON	18.90	.00	.00
NJD002171189	AGFA DIV. OF BAYER CORP.	TETERBORO	150.43	.00	.00
NJD986891240	AIR CRUISER COMPANY	WALL TOWNSHIP	15.60	.00	.00
NJD068682624	AKCROS CHEMICALS AMERICA	NEW BRUNSWICK	252.74	.00	.00
NJD052204633	AKZO NOBEL CHEMICALS INC	EDISON	614.57	.00	.00
NJD002142388	AKZO NOBEL COATINGS INC.	SOMERSET	190.11	.00	.00
NJD002156925	ALLIANT TECHSYSTEMS	KENVIL	7,463.98	.00	.00
NJD078714433	ALLIED SIGNAL AEROSPACE	TETERBORO	41.81	.00	.00
NJD002451490	ALLIED SIGNAL INC	ELIZABETH	695.26	.00	.00
NJD048794986	ALLIED SIGNAL INC	MORRISTOWN	423.03	506.21	.00
NJD986622439	ALLIEDSIGNAL AEROSPACE	TETERBORO	17.45	.00	.00
NJD980780241	ALLWASTE CONTAINER SERVICES	JERSEY CITY	71.27	.00	.00
NJD981142144	ALP LIGHTING & CEILING PRODS	PENNSAUKEN	59.20	.00	.00
NJD044664761	ALPHA ASSOCIATES, INC.	WOODBRIDGE	21.90	.00	.00
NJD001289610	ALPHA METALS INC.	JERSEY CITY	56.38	.00	.00
NJD002458297	ALPHA PROCESSING COMPANY, INC	CLIFTON	17.75	.00	.00
NJD002338267	ALUMINUM SHAPES L.L.C.	DELAIR	160.22	.00	.00
NJD045445483	AMERADA HESS CORPORATION	PORT READING	3,981.30	.00	.00
NJD986569770	AMERADA HESS CORPORATION	BAYONNE	13.75	.00	.00
NJD986651024	AMERADA HESS CORPORATION	PENNSAUKEN	30.01	.00	.00
NJD002200111	AMERASA HESS CORPORATION	PERTH AMBOY	75.90	.00	.00
NJD002173276	AMERICAN CYANAMID CO	BRIDGEWATER	154.18	.00	.00
NJD153795141	AMERICAN FUJI SEAL INC	FAIRFILED	43.74	.00	.00
NJD092870963	AMERICAN GALVANIZING CO INC	FOLSOM	301.50	.00	.00
NJD000764894	AMERICAN NATIONAL CAN CO.	DEANS	13.28	.00	.00
NJD986611127	AMOCO OIL CO	ENGLEWOOD	49.28	.00	.00
NJD000631895	AMOCO OIL COMPANDY	CARTERET	290.76	.00	.00
NJ0000056515	AMOCO SERVICE STATION # 839	EDISON	15.99	.00	.00
NJD986611432	AMOCO SERVICE STATION #839	EDISON	15.30	.00	.00
NJD981137292	ANADIGICS INC	WARREN	21.29	.00	.00
NJD002342046	ANCHOR HOCKING PACKAGING CO	GLASSBORO	49.86	.00	.00
NJ0000027094	ANDRE ORIGINALS	RAHWAY	32.90	.00	.00
NJD986576007	APPLIED GRAPHICS FLEETWOOD DIVISION	MOONACHIE	14.55	.00	.00
NJD011806189	ARISTON DIV.OF ENGRAPH,INC.	HILLSIDE	19.28	.00	.00
NJD002329621	ARMOTEK INDUSTRIES	PALMYRA	7,929.11	.00	.00
NJD000531707	ARROW GROUP INDUSTRIES,INC.	HASKELL	598.04	.00	.00
NJD039116207	ASARCO,INC.C/O BRIDGEVIEW MGR.,CO,I	PERTH AMBOY	159.80	.00	.00
NJD064286859	ASCO ELECTRIC PRODCTS CO INC	PARSIPPANY	70.83	.00	.00
NJD063173280	ASHLAND CHEMICAL	CARTERET	63.87	.00	.00
NJD020771648	AT+T CORP.	BASKING RIDGE	14.51	.00	.00
NJD006980924	AT&T BELL LABORATORIES	MURRAY HILL	43.68	184.00	.00
NJD059014589	AT&T CORP.	HOPEWELL TWP	28,091.48	280.00	.00
NJD064261985	ATLANTIC BATTERY CORP	PATERSON	456.84	.00	.00
NJD986615300	ATOTECH USA INC	SOMERSET	315.93	.00	.00
NJD048804488	AT7T BELL LABORATORIES	WHIPPANY	167.39	68.00	.00
NJD980753875	AUSIMONT USA INCORPORATED	THOROFARE	1,913.39	.00	.00
NJD002141778	AUTOMATIC SWITCH CO.	FLORHAM PARK	28.77	545.00	.00
NJD002203677	B&E ELECTROFORM	SPRINGFIELD	3.04	175.00	.00
NJD000691832	BALL-FOSTER GLASS CONTAINER CO.	CARTERET	43.60	.00	.00

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NEW JERSEY

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NJD000820167	BALL-FOSTER GLASS CONTAINER CO.,LLC	MILLVILLE	69.45	.00	.00
NJD002193829	BANNER PHARMACAPS INC.	ELIZABETH	5,159.75	.00	.00
NJD061350179	BARTLO PACKAGING INC	PASSAIC	15.23	4,720.60	.00
NJD082988056	BASF CORPORATION	BELVIDERE	808.64	.00	.00
NJD986645216	BAYONNE BRIDGE - NJ ABUTMENT	BAYONNE	73.27	.00	.00
NJD986645984	BAYWAY REFINING COMPANY	LINDEN	5,434.78	.00	.00
NJC876018557	BEAZER EAST INC	ROCKAWAY	21.39	.00	.00
NJD876018557	BEAZER EAST, INC.	ROCKAWAY	21.39	.00	.00
NJD000006940	BECHTEL CONTRUCTION	SWEDESBORO	22.14	.00	.00
NJD000304782	BECTON DICKINSON & CO.	EAST RUTHERFORD	35.20	.00	.00
NJD981134406	BELL COMMUNICATIONS RESEARCH INC	RED BANK	30.91	190.00	.00
NJD002456242	BENJAMIN MOORE & CO	NEWARK	1,487.29	.00	.00
NJD981131550	BERLEX LABORATORIES INC	WAYNE	5.08	390.00	.00
NJD980772370	BEST FOODS US	JERSEY CITY	2.80	180.00	.00
NJD986589364	BETA PLASTICS	CARLSTADT	14.18	.00	.00
NJD106235138	BIHLER OF AMERICA,INC.	NORTH BRANCH	30.26	.00	.00
NJD056356066	BIOCRAFT LABORATORIES	WALDWICK	4,784.77	.00	.00
NJD980765325	BIOMATRIX, INC.	RIDGEFIELD	87.40	.00	.00
NJD001220359	BLOCK DRUG COMPANY	JERSEY CITY	10.84	300.00	.00
NJD002386621	BOC GASES	RIVERTON	31.36	.00	.00
NJD063157150	BOG CREEK FARM SUPERFUND SITE	HOWELL	106.10	.00	.00
NJD009871401	BOYONNE BARREL & DRUM	NEWARK	372.75	.00	.00
NJD000768143	BP CHEMICALS AMERICA AT GATX TERMIN	CARTERET	2.74	110.00	.00
NJD079488821	BP EXPLORATION & OIL INC	WOODBURY	68.20	.00	.00
NJD067512814	BP OIL INC/TREMLEY POINT TERM	LINDEN	371.02	.00	.00
NJD001865534	BRISTOL MYERS SQUIBB	LAWRENCEVILLE	90.38	285.00	.00
NJD000818567	BRISTOL-MYERS PRODUCTS R&D	HILLSIDE	226.20	.00	.00
NJ0000083972	BRISTOL-MYERS SQUIBB CO.	EDISON	99.30	.00	.00
NJ0000041053	BUCKEYE PIPE LINE COMPANY L.P.	ELIZABETH	18.76	.00	.00
NJD981876675	BUCKEYE PIPE LINE COMPANY LP LINDEN	LINDEN	1,683.09	.00	.00
NJD986589059	BURLINGTON COUNTY RESOURCE{RECOVERY	MANSFIELD	46.21	1,666.00	.00
NJD001717040	C&C METAL PRODUCTS CORP	ENGLEWOOD	60.12	.00	.00
NJD982528176	CALVIN KLEIN COSMETICS COMPANY	WAYNE	25.94	.00	.00
NJD002457273	CAMPBELL FOUNDRY CO.	HARRISON	227.31	.00	.00
NJD986615037	CAPE MAY CO BRIDGE COMM	CAPE MAY COURT	40.43	.00	.00
NJD980783849	CARDOLITE CORP.	NEWARK	201.06	.00	.00
NJD054058003	CARLTON COOKE PLATING CORP	CARLSTADT	33.04	.00	.00
NJD002203438	CARPENTER TECHNOLOGY CORPORATION	UNION	63.68	.00	.00
NJD002168748	CARPENTER, L.E. & COMPANY	WHARTON	1,023.90	.00	.00
NJD002175313	CARTER- WALLACE, INC.	CRANBURY	293.51	481.00	.00
NJD067520890	CAS CHEM INC	BAYONNE	134.39	10.00	.00
NJD045995693	CASIE ECOLOGY OIL SALVAGE, INC.	VINELAND	8,045.99	.00	.00
NJD981874779	CELGENE CORPORATION	WARREN	10.20	50.00	.00
NJD980582878	CHAMBORD PRINTS INC.	HOBOKEN	23.10	.00	.00
NJD002199826	CHANEL INC	PISCATAWAY	60.27	.00	.00
NJD053522231	CHASE LABORATORIES, INC	NEWARK	31.93	.00	.00
NJD981080401	CHEM-FLEUR INTERNATIONAL	NEWARK	1,320.14	.00	.00
NJD108661737	CHEMICAL COMPOUNDS INC.	NEWARK	33.48	.00	.00
NJD089216790	CHEMICAL WASTE MANAGEMENT	NEWARK	10.09	1,359.47	.00
NJ0001020346	CHERRY STREET GARAGE	ELIZABETH	32.98	.00	.00
NJD081982902	CHEVRON PRODUCTS COMPANY	PERTH AMBOY	663.32	.00	.00
NJD001502517	CIBA-GEIGY	TOMS RIVER	35.83	.00	.00
NJD001316173	CIBA-GEIGY CORPORATION	SUMMIT	609.13	2,283.00	.00
NJD096872395	CIBA-GEIGY CORPRATION	WEST CALDWELL	3.73	7,330.00	.00
NJD002345247	CIRCUIT FOIL USA,INC	BORDENTOWN	53,726.87	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NJD986609279	CIRCUIT REPRODUCTION CO	MAYWOOD	25.70	.00	.00
NJD096838917	CIRCUIT TECHNOLOGY INC	PENNSAUKEN	13.83	.00	.00
NJD000691170	CITGO PETROLEUM CORP	LINDEN	4,134.38	.00	.00
NJD001213453	CLARIANT CORPORATION	FAIR LAWN	87.18	.00	.00
NJD061848867	CLAYTON ENVIRONMENTAL	EDISON	2.19	360.00	.00
NJD085644110	CO-STEEL RARITAN	PERTH AMBOY	1,210.98	.00	.00
NJD990753162	COASTAL EAGLE POINT OIL CO	WESTVILLE	768.10	13,880.00	.00
NJD068693167	COLGATE-PALMOLIVE COMPANY	PISCATAWAY	18.32	71.00	.00
NJD048613590	COLONIAL PIPELINE CO	WOODBURY	236.64	.00	.00
NJD068679760	COLONIAL PIPELINE CO	WOODBRIDGE	441.10	.00	.00
NJD000729640	COLONIAL PIPELINE CO.- PENNSAUKEN J	MT.LAUREL	68.93	.00	.00
NJD095171930	COLONIAL PRINTING INK CORP	EAST RUTHERFORD	73.92	.00	.00
NJD054747720	COLONIAL PROCESSING INC	CAMDEN	23.54	.00	.00
NJD001890185	COLORITE POLYMERS	BURLINGTON	115.38	.00	.00
NJR000001677	COLTS NECK MUNICIPAL COMPLEX	COLTS NECK	24.04	.00	.00
NJD981489925	COLUMBIA PRODUCTS INC	SOUTH PLAINFIEL	20.00	.00	.00
NJD002008605	COMPAC INDUSTRIES INC	EDISON	82.29	.00	.00
NJD080796782	CONGOLEUM CORPORATION	TRENTON	264.06	.00	.00
NJD980784631	CONSTABLE TERMINAL CORP.	BAYONNE	495.40	.00	.00
NJD002052017	CONTACT INDUSTRIES INC	ELIZABETH	38.72	.00	.00
NJD986568723	CONTINENTAL AIRLINES GSE A/S	NEWARK	54.56	.00	.00
NJD982275281	CONVATEC/BRISTOL-MEYERS SQUIBB CO	SKILLMAN	2.45	840.00	.00
NJD002334795	COOK COMPOSITED & POLYMERS CO	PENNSAUKEN	2,346.15	.00	.00
NJD002190627	COOKSON PIGMENTS, INC.	NEWARK	1,048.39	.00	.00
NJD084195742	CORE LABORATORIES INC	PRINCETON	.63	54.00	.00
NJD980536213	CORE LABORATORIES, INC.	EDISON	39.26	.00	.00
NJD093843258	CORNING CLINICAL LABS	TETERBORO	55.24	.00	.00
NJD064332273	COSAN CHEMICAL CORP	CARLSTADT	20.83	.00	.00
NJD981179914	COSMAIR INC	SOMERSET	22.70	10.00	.00
NJD986570000	COSMAIR INC	SOUTH BRUNSWICK	51.76	.00	.00
NJT350010260	COSMAIR, INC.	CLARK	73.82	.00	.00
NJ0000021485	COSTCO WHOLESALE #306	CLIFTON	14.82	.00	.00
NJD002329647	COURTAULDS AEROSPACE INC COMMERICAL	GLOUCESTER CITY	21.60	.00	.00
NJD002139228	COURTAULDS COATINGS	UNION	410.28	.00	.00
NJD002141950	CP CHEMICALS INC	SEWAREN	60.76	.00	.00
NJD982741068	CPC INTERNATIONAL	LYNDHURST	466.05	.00	.00
NJD067484022	CPC INTERNATIONAL (ECRA)	NEWARK	45.86	.00	.00
NJD002141190	CPS CHEMICALS CO INC	OLD BRIDGE	2,815.60	.00	.00
NJD000308817	CRAIG ADHESIVES & COATINGS COMPANY	NEWARK	28.17	.00	.00
NJD980772347	CRICKET CONVERTORS	HIGHTSTOWN	18.25	.00	.00
NJD986585081	CRODA INKS CORP	EWING	27.20	.00	.00
NJD062053178	CRODA STORAGE INC	ELIZABETH	16.08	.00	.00
NJD000694190	CROMPTON & KNOWLES COLORS INC.	NEWARK	33.37	.00	.00
NJD981182298	CROWN CONK & SEAL CO INC	SWEDESBORO	24.44	.00	.00
NJD077542033	CROWN ROLL LEAF INC	PATERSON	146.89	.00	.00
NJD093846301	CUSTOM CHEMICALS CORP	ELMWOOD PARK	161.75	.00	.00
NJD002173144	CYTEC INDUSTRIES INC.	LINDEN	83.07	.00	.00
NJT350010229	CYTEC INDUSTRIES INC.	LINDEN	70.02	.00	.00
NJD063143986	DANA TRANSPORT	AVENEL	114.00	.00	.00
NJD001340686	DANIEL PRODUCTS COMPANY, INC.	JERSEY CITY	202.46	.00	.00
NJD001660786	DATASCOPE CORP	OAKLAND	50.74	.00	.00
NJD002195303	DEGUSSA CORPORATION-METAL GROUP	S PLAINFIELD	35.22	.00	.00
NJ0001020809	DEMAG DELAVAL TURBOMACHINERY CORP	TRENTON	241.71	.00	.00
NJD986609154	DEPENDABLE IRON & METAL CO INC	AVENEL	85.00	.00	.00
NJD000310417	DEVOE COATINGS CO.	PENNSAUKEN	278.00	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NJD986586584	DISTRICT 2/SOUTHERN DIVISION	MT LAUREL	19.08	.00	.00
NJD986586592	DISTRICT 3	CROSSWICKS	30.91	.00	.00
NJD986586600	DISTRICT 4	MILLTOWN	136.57	.00	.00
NJD986586618	DISTRICT 5	ELZIBETH	96.80	.00	.00
NJD002177491	DOCK RESINS CORPORATION	LINDEN	239.21	.00	.00
NJ2160000202	DOL/EDISON JOB CORPS CTR	EDISON	35.11	.00	.00
NJD000831479	DONALD B. KELLY INC.	CAMDEN	192.08	.00	.00
NJD011614286	DRAGOCO, INC.	TOTOWA	112.00	.00	.00
NJD053518536	DREW INDUSTRIAL DIV ASHLAND CHEM CO	KEARNY	159.26	.00	.00
NJD091860437	DRI-PRINT FOILS INC	RAHWAY	218.35	.00	.00
NJD982541625	DRUM SERVICE OF NEWARK, INC.	NEWARK	18.77	.00	.00
NJD000765156	DUPONT REFINISH SVC CTR.	SPRINGFIELD	21.37	.00	.00
NJD002155943	DUREX INC	UNION	14.72	.00	.00
NJD002385730	E I DUPONT DE NEMOURS & CO INC	DEEPWATER	9,775,553.50	614.00	.00
NJD002373819	E. I. DUPONT-REDAUNO PLANT	GIBBSTOWN	938.86	.00	.00
NJD002006773	E.C. ELECTROPLATING	GARFIELD	66.10	.00	.00
NJD011550092	E.R. SQUIBB & SONS INC	NORTH BRUNSWICK	429.56	66.00	.00
NJD001386580	EAST COAST FINISHING	FAIRVIEW	14.44	.00	.00
NJD053514428	ECD INC.	HILLSIDE	1,813.31	.00	.00
NJD054118989	EDGEBORO DISPOSAL INC	EAST BRUNSWICK	19.88	.00	.00
NJD986650695	EDGEWOOD JUNIOR HIGH SCHOOL	ATCO	.21	427.00	.00
NJD002144541	EGAN DAVIS-STANDARD	SOMERVILLE	54.72	.00	.00
NJD053981056	EGG HARBOR YACHT CO. INC.	EGG HABOR CITY	13.40	.00	.00
NJD002444024	EI DUPONT DE NEMOURS & CO INC	PARLIN	855.83	.00	.00
NJD042895680	ELAN CHEMICAL CO.,INC.	NEWARK	195.72	.00	.00
NJD045133485	ELASTIMOLD DIVISION	HACKETTSTOWN	17.62	.00	.00
NJD986582898	ELECTROCATALYTIC INC.	UNION	183.10	.00	.00
NJC876021775	ELF ATOCHEM- WALLACE & TIERNAN	BELLEVILLE	31.80	.00	.00
NJD047499769	ELKEM INC	CLIFFWOOD	129.45	.00	.00
NJD043570316	ELKINS- SINN	CHERRY HILL	20.69	5,330.00	.00
NJD069043370	EM SCIENCE	GREENWICH/GIBBS	28.07	.00	.00
NJD011528346	EMIL A. SCHROTH, INC.	HOWELL	126.84	.00	.00
NJD002141489	ENGELHARD CORPORATION	EAST NEWARK	63.56	220.00	.00
NJD002178796	ENGINEERED PRECISION CASTING CO	MIDDLETOWN	7,351.99	.00	.00
NJD162357305	ENGLERT INC.	PERTH AMBOY	77.13	.00	.00
NJD986577781	EPOLIN/ACCORT LABS	NEWARK	36.98	.00	.00
NJD001601152	ETHICON INC	SOMERVILLE	50.40	.00	.00
NJD986579035	EWAL MFG CO INC	BELLEVILLE	20.60	.00	.00
NJD980761365	EWAN PROPEERTY SITE (SUPERFUND)	SHAMONG TOWNSHI	2,447.41	.00	.00
NJD002570893	EXXON CHEMICAL AMERICAS	LINDEN	46.83	128.00	.00
NJD000692905	EXXON CHEMICAL AMERICAS/BAYWAY CHEM	LINDEN	299.13	.00	.00
NJD986604841	EXXON CO USA #35026	EMERSON	15.70	.00	.00
NJD986608818	EXXON CO USA #35570	PATERSON	44.00	.00	.00
NJD986608693	EXXON CO. USA #35630	HASBROUCK HEIGH	40.30	.00	.00
NJD986608099	EXXON CO. USA 35331	MONTCLAIR	13.40	.00	.00
NJD062037031	EXXON COMPANY USA	LINDEN	169.21	.00	.00
NJD000692111	EXXON RESEARCH & ENGINEERING	ANNANDALE	24.03	129.00	.00
NJD061074571	EXXON RESEARCH AND ENGINEERING CO.	FLORHAM PARK	14.58	141.00	.00
NJ5690510024	FAA TECHNICAL CENTER	ATLANTIC CITY	174.31	.00	.00
NJD982533192	FACILE HOLDINGS INC	PATERSON	50.90	.00	.00
NJD080630049	FAIRFIELD TEXTILE CORP	FAIRFIELD	33.25	.00	.00
NJD079320495	FEDERATED METALS CORP (BRIDGEVIEW M	NEWARK	658.30	.00	.00
NJD002191690	FERRO CORP.-PDI	EDISON	14.61	.00	.00
NJD002189132	FIDELITY CHEMICAL PRODUCTS CORP	NEWARK	92.72	299.01	.00
NJD060056157	FIRMENICH INC	PLAINSBORO	71.53	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NJD986569101	FISHER SCIENTIFIC COM	SOMERVILLE	47.87	27.00	.00
NJD986628840	FLEXI-VAN	KENILWORTH	16.62	.00	.00
NJD070570122	FLORASYNTH, INC.	TETERBORO	130.63	.00	.00
NJD000586164	FMC CORPORATION	PLAINSBORO	207.86	2,604.00	.00
NJD002454163	FMC CORPORATION	CARTERET	110.18	.00	.00
NJD002143782	FORD MOTOR CO.	EDISON	522.19	.00	.00
NJD020783304	FRAGRANCE RESOURCES, INC.	KEYPORT	3,427.43	.00	.00
NJD054126164	FREEHOLD CARTAGE INC	FREEHOLD	31.52	.00	.00
NJD068684935	FREEWAY WAREHOUSE CORP	FARMINGDALE	21.39	.00	.00
NJD000631556	FRICK LABORATORY, PRINCETON UNVERSI	PRINCETON	8.75	100.00	.00
NJD011501798	G.J. CHEMICAL CO.,INC.	NEWARK	19.25	.00	.00
NJD068699107	G.M.C. DELPHI ENERGY & ENGINE MGT S	NEW BRUNSWICK	5,813.37	.00	.00
NJD980664114	GANDALF SYSTEMS CORPORATION	CHERRY HILL	37.59	.00	.00
NJD001213727	GANES CHEMICALS INC.	CARLSTADT	952.27	.00	.00
NJD064344575	GANES CHEMICALS INC.	PENNSVILLE	1,161.17	.00	.00
NJD060074101	GARLOCK BEARINGS INC	THOROFARE	80.32	.00	.00
NJD055933030	GATEWAY TERM SERV CORP	CARTERET	66.06	.00	.00
NJD980536676	GATX TERMINALS CORPORATION	CARTERET	70.86	.00	.00
NJD986574986	GATX TERMINALS CORPORATION	PAULSBORO	211.82	.00	.00
NJR000001990	GATX TERMINALS CORPORATION	CARTERET	923.85	.00	.00
NJD981184773	GEC MARCONI AEROSPACE INC	WHIPPANY	20.75	.00	.00
NJD003918570	GENERAL ELECTRIC CO	NORTH BERGEN	15.84	.00	.00
NJD081899007	GENERAL FOAM	EAST RUTHERFORD	30.34	.00	.00
NJD044132116	GENERAL FOAM CORP OF PMC INC	CARLSTADT	669.45	.00	.00
NJD041219437	GENERAL MAGNAPLATE CORPORATION	LINDEN	21.07	.00	.00
NJD002186690	GENERAL MOTORS CORP-LINDEN	LINDEN	672.98	.00	.00
NJD047501457	GENTEK BUILDING PRODUCTS	WOODBRIDGE	152.60	.00	.00
NJD049850910	GETTY PETROLEUM CORP	NEWARK	112.38	.00	.00
NJD980535736	GIVAUDAN ROURE FRAGRANCE SPECIALTIE	TOTOWA	221.59	.00	.00
NJD002156354	GIVAUDAN-ROURE CORPORATION	CLIFTON	2,228.01	.00	.00
NJD986598340	GIVAUDAN-ROURE CORPORATION	EAST HANOVER	266.34	129.80	.00
NJD980764203	GLASSEAL PRODUCTS, INC.	LAKEWOOD	17.63	.00	.00
NJD982794364	GLOSS TEX INDUSTRIES	MINE HILL	14.42	.00	.00
NJD002184109	GOMAR MFG., CO., INC	LINDEN	60.96	.00	.00
NJD002329449	GOODALL RUBBER COMPANY	TRENTON	78.00	.00	.00
NJD001340876	GOODY PRODUCTS, INC.	KEARNY	2.58	51.00	.00
NJD980764427	GREAT ATLANTIC & PACIFIC TEA COMPAN	MONTVALE	1.36	2,727.09	.00
NJD986616894	GROUP 11D, SITE 006	JERSEY CITY	26.33	.00	.00
NJD982532590	GSF ENERGY INC KEARNY LANDFILL GAS	KEARNY	109.92	.00	.00
NJD991291600	GULF OIL LIMITIED PARTNERSHIP	THOROFARE	97.73	.00	.00
NJD002181394	GUSNER DIV OF PMC INC	LAKEWOOD	107.63	.00	.00
NJD002181196	H&N CHEMICAL COMPANY	TOTOWA	505.64	.00	.00
NJD002143188	HARDMAN DIVISION OF HARCROS CHEMICA	BELLEVILLE	100.52	.00	.00
NJD057149148	HARGO FLEXIBLE PACKAGING	FLEMINGTON	160.45	.00	.00
NJD001337575	HARTIN PAINT	CARLSTADT	67.14	.00	.00
NJD046950424	HARTZ MOUNTAIN CORPORATION	BLOOMFIELD	121.41	.00	.00
NJD981137342	HARVARD INDUSTRIES ESNA DIVISION	UNION	33.39	.00	.00
NJD091399329	HATCO CORPORATION	FORDS	78.61	.00	.00
NJD001599604	HAWARD CORPORATION	NORTH ARLINGTON	210.34	.00	.00
NJD980505366	HELEN KRAMER LANDFILL	TRENTON	63.94	.00	.00
NJD065804064	HENKEL CORPORATION	HOBOKEN	124.10	.00	.00
NJD002521961	HERCULES INC	PARLIN	223.49	.00	.00
NJD002349058	HERCURLES INCORPORATED	GIBBSTOWN	1,033.91	.00	.00
NJD011391935	HETEM BROS. INC.	LINDEN	38.95	.00	.00
NJD001488295	HILL CROSS CO INC	WEST NEW YORK	41.37	.00	.00

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NJR000004556	HLUBIK FARMS	COLUMBUS	1.80	.00	3,600.00
NJD097413280	HOECHST CELANESE CORP	SOMERVILLE	106.23	.00	.00
NJD000603365	HOECHST CELANESE CORP.	SOMERVILLE	624.35	.00	.00
NJD045787991	HOECHST CELANESE CORP.	SOMERVILLE	80.95	10.00	.00
NJD062026281	HOECHST CELANESE CORPORATION	SUMMIT	29.81	51.00	.00
NJD079323044	HOECHST CELANESE CORPORATION	NEWARK	25.12	.00	.00
NJD001519107	HOEGANAES CORPORATION	RIVERTON	697.38	.00	.00
NJD002191211	HOFFMANN-LA ROCHE INC	NUTLEY	2,730.41	2,144.00	.00
NJD042321042	HOFFMANN-LA ROCHE INC	BELVIDERE	19.39	.00	.00
NJD002002699	HOKE INCORPORATED	CRESSKILL	68.05	.00	.00
NJD002159317	HOLLAND MFG CO INC	SUCCASUNNA	22.98	.00	.00
NJD002445583	HOWMET CORPORATION DOVER CASTING	DOVER	348.91	.00	.00
NJD011658481	HULS AMERICA INC.	PISCATAWAY	30.27	55.00	.00
NJD078259488	HUNTINGDON LIFE SCIENCE	EAST MILLSTONE	7.70	146.00	.00
NJD002482602	HUNTSMAN POLYPROPYLENE CORP	WEST DEPTFORD	89.06	.00	.00
NJD061076600	HYATT MANUFACTURING	UNION	45.73	.00	.00
NJD075484139	HYDROCARBON TECHNOLOGIES, INC	LAWRENCEVILLE	42.90	5.00	.00
NJD002177210	IBM CORPORATION	DAYTON	1.75	46.00	.00
NJD982183972	IEA INC	WHIPPANY	35.39	.00	.00
NJD152421061	IFF,INC. P.O.BOX 439	DAYTON	105.44	.00	.00
NJD982532202	IMMUNOBIOLOGY RES INST	ANNANDALE	1.98	272.00	.00
NJD981134307	INCHCAPE TESTING SERVICES CALEB BR	LINDEN	85.01	.00	.00
NJD079319414	INDUSTRIAL CORROSION MGT., INC.	RANDOLPH	32.46	.00	.00
NJD055936587	INTERNATIONAL FLAVORS & FRAG INC	HAZLET	48.32	.00	.00
NJD002194843	INTERNATIONAL FLAVORS & FRAGRANCES	UNION BEACH	8,075.11	.00	.00
NJD000813469	INTERNATIONAL FLAVORS AND FRAGRANCE	UNION BEACH	84.34	.00	.00
NJD061071890	INTERNATIONAL SPECIALTY PRODUCTS	WAYNE	50.71	.00	.00
NJD002146504	ISP VAN DYK INC	BELLEVILLE	3,325.75	.00	.00
NJD046943676	IVERS-LEE	WEST CALDWELL	43.16	1,000.00	.00
NJD980208946	J.JOSEPHSON INC.	S.HACKENSACK	19.45	.00	.00
NJD054120571	JAME FINE CHEMICALS INC	BOUND BROOK	104.15	.00	.00
NJD048585558	JANSSEN PHARMACEUTICAL INC	TITUSVILLE	4.53	310.00	.00
NJD980790893	JERSEY CITY OMS	JERSEY CITY	43.51	.00	.00
NJD002159507	JOHN C DOLPH COMPANY INC	MONMOUTH JCT	478.55	.00	.00
NJD000729798	JOHNSON & JOHNSON CONSUMER PROC.,IN	SKILLMAN	8.36	364.00	.00
NJD000631937	JOHNSON & JOHNSON PRODUCTS	NORTH BRUNSWICK	16.00	.00	.00
NJD986585438	JOHNSON ATELIER	MERCERVILLE	18.14	895.00	.00
NJD980755367	JOHNSON MATTHEY INC	WEST DEPTFORD	3,436.66	30.00	.00
NJD087277661	JOINT MEETING OF ESSEX AND UNION CO	NEWARK	19.44	.00	.00
NJD053509568	KEARFOTT GUID & NAVIGAT CORP HDQTS	WAYNE	64.86	.00	.00
NJD002148484	KEARFOTT GUIDANCE & NAVIGATION	LITTLE FALLS	383.69	15.00	.00
NJD001308212	KENRICH PETROCHEMICALS INC	BAYONNE	52.20	.00	.00
NJD002342087	KIMBLE GLASS INC.	VINELAND	11.15	30.00	.00
NJD002180834	KIRKER ENTERPRISES INC	PATERSON	107.62	.00	.00
NJD058118308	KNOLL PHARMACEUTICAL CO	WHIPPANY	23.37	4.00	.00
NJD065825341	KRAMER CHEMICALS INC	PATERSON;	23.46	.00	.00
NJD002150993	L.A. DREYFUS COMPANY	EDISON	195.15	.00	.00
NJD982727265	LA CROSS DIVISION	NEWARK	24.47	.00	.00
NJD986569044	LAB GLASS	VINELAND	180.20	.00	.00
NJD981564099	LABORATORY CORPORATION OF AMERICA	RARITAN	14.09	10.00	.00
NJD002158418	LAMART CORPORATION	CLIFTON	59.52	.00	.00
NJD980505382	LANG PROPERTY SUPERFUND SITE	BROWNS MILLS	92.76	.00	.00
NJD064332364	LEN RON MANUFACTURING CO.A DIV OF A	OAKLAND	44.39	.00	.00
NJD002325074	LENOX CHINA	POMONA	3,776.93	.00	.00
NJD064254147	LEONE INDUSTRIES INC	BRIDGETON	18.35	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NJD087102877	LIBRARY BUREAU STEEL DIV	VINELAND	17.43	.00	.00
NJD980765465	LIGHTOLIER / EDISON	EDISON	15.72	.00	.00
NJD067362087	LILLY INDUSTRIES (USA) INC	THOROFARE	197.74	.00	.00
NJD981142185	LINDEN BULK TRANSPORTATION CO INC	LINDEN	130.44	.00	.00
NJD980505424	LONE PINE LANDFILL	FREEHOLD	109.40	.00	.00
NJD986579894	LONZA INC.	ANNANDALE	.07	35.00	.00
NJD006979363	LTS LOHMANN THERAPY SYSTEM CORP	WEST CALDWELL	88.92	75,205.00	.00
NJD980755185	LUCAS AREOSPACE	ENGLEWOOD	51.18	.00	.00
NJD986592418	M & P COMPOUNDING	ASBURY PARK	53.81	.00	.00
NJD046956892	MA HANNA COLOR(FORMERLY WILSON COLO	NESHANIC STATIO	36.94	.00	.00
NJD981076177	MAC SPECIALITY COATINGS	PENNS GROVE	69.98	.00	.00
NJD011371580	MACARTHUR PETROLEUM & SOLVENT CO.	NEWARK	170.53	.00	.00
NJD002460855	MADISON INDUSTRIES INC	OLD BRIDGE	8,335.24	.00	.00
NJD981873755	MAGNESIUM ELEKTRON INC	FLEMINGTON	69.61	.00	.00
NJD001213487	MALLINCKRODT BAKER, INC.	PHILLIPSBURG	192.10	27.00	.00
NJD002349256	MANNINGTON MILLS, INC.	SALEM	206.62	.00	.00
NJD002454544	MARISOL INC	MIDDLESEX	131,625.93	.00	.00
NJD982737355	MARSULEX INC	SOUTH AMBOY	112.10	.00	.00
NJD986640522	MARTIN MARIETTA COMMUNICATIONS SYST	CAMDEN	17.39	.00	.00
NJD002342434	MARTIN MARIETTA GOVT. ELECTRONIC SY	MOORESTOWN	100.80	.00	.00
NJD043584101	MATLACK, INC.	SWEDESBORO	777.57	.00	.00
NJ2571824018	MCGUIRE AFB	BURLINGTON	172.14	.00	.00
NJD981483035	MELTON SALES AND SERVICE	BORDENTOWN	31.53	.00	.00
NJD001317064	MERCK & CO.,INC.	RAHWAY	9,133.08	3,960.00	10,100.00
NJD091859215	MERECK & CO INC	HAWTHORNE	408.91	.00	.00
NJD002139244	METEM CORPORATION	PARSIPPANY	50.97	.00	.00
NJD048608897	METHODE ELECTRONICS INC EAST	WILLINGBORO	33,717.95	.00	.00
NJD153788336	METROPOLITAN MICRODATA, INC.	FAIR LAWN	13.87	.00	.00
NJD986602043	MIDDLESEX	SOUTH PLAINFIEL	76.89	.00	.00
NJD002149508	MILLER & SON	BELLEVILLE	14.02	.00	.00
NJD000547950	MILTON CAN COMPANY INC.	ELIZABETH	68.67	.00	.00
NJD002572238	MINALEX CORPORATION	WHITEHOUSE STA	24.71	.00	.00
NJD002520484	MINNESOTA MINING AND MANUFACTURING	FREEHOLD	83.57	.00	.00
NJD980593404	MOBIL CHEMICAL CO./R&D LAB	EDISON	17.42	5.00	.00
NJD053101085	MOBIL CHEMICAL COMPANY CHEMICAL PRO	EDISON	1,008.99	.00	.00
NJD075481598	MOBIL R & D CORPORATION	PENNINGTON	32.22	417.00	.00
NJD073745945	MOBIL RESEARCH & DEVELOPMENT CORP.	PAULSBORO	149.90	91.00	.00
NJD064353899	MODERN HARD CHROME, INC.	CAMDEN	424.83	.00	.00
NJD002352045	MOLECU WIRE CORPORATION	WALL	24.97	.00	.00
NJD981566649	MOLECULAR REARRANGEMENT INC	NEWTON	148.68	.00	.00
NJD001700707	MONSANTO COMPANY	BRIDGEPORT	7,040.06	4,413.00	1,380.00
NJD986611861	MOORE'S TRUCKING COMPANY INC	PISCATAWAY	1.20	2,400.00	.00
NJD982739690	MORRIS COUNTY MOTOR SERVICE CENTER	CEDAR KNOLLS	40.83	.00	.00
NJD091394437	MORTON INTERNATIONAL NORTH BRUNSWIC	NORTH BRUNSWICK	150.78	.00	.00
NJD986640498	MOTION SYSTEMS CORPORATION	EATONTOWN	37.60	.00	.00
NJD002140101	MULBERRY METAL PRODUCTS INC	UNION	17.73	.00	.00
NJD048810337	MYKROY/MYCALEX CERAMICS	CLIFTON	120.20	.00	.00
NJ0000074278	NABISCO INC.	EAST HANOVER	2.40	129.00	.00
NJD980754824	NATIONAL DIE & BUTTON MOULD CO., I	MOONACHIE	24.38	.00	.00
NJD002182335	NATIONAL MANUFACTURING CO INC	CHATHAM	30.53	.00	.00
NJD094248002	NATIONAL METALLIZING	CRANBURY	61.97	.00	.00
NJD061843249	NATIONAL SMELTING OF NEW JERSEY	PEDERICKTOWN	1,985.82	.00	.00
NJD001519230	NATIONAL STARCH & CHEMICAL	BRIDGEWATER	4.69	285.00	.00
NJD002197325	NATIONAL STARCH AND CHEMICAL COMPAN	PLAINFIELD	285.61	.00	.00
NJ7170023744	NAVAL AIR ENGINEERING STATION	LAKEHURST	8,912.57	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NJ9170022694	NAVAL AIR WARFARE CENTER	TRENTON	419.60	.00	.00
NJ0170022172	NAVAL WEAPONS STATION EARLE	COLTS NECK	2,049.02	.00	.00
NJD981482177	NESOR ALLOY CORPORATION	FAIRFIELD	32.43	.00	.00
NJD002145886	NEW BRUNSWICK PLATING INC	NEW BRUNSWICK	11,294.75	.00	.00
NJD980648497	NEWARK INTERNATIONAL AIRPORT	NEWARK	873.36	.00	.00
NJD002147858	NEWARK WIRE CLOTH COMPANY	NEWARK	179.14	.00	.00
NJD986573715	NJ AIR NATIONAL GAURD	EGG HARBOR	48.01	.00	.00
NJD986638997	NJ TRANSIT	WOODBRIDGE	511.70	.00	.00
NJD986644482	NJ TRANSIT	WAYNE	28.50	.00	.00
NJ0000061846	NJ TRANSIT	SUMMIT	786.60	.00	.00
NJ0000061960	NJ TRANSIT	RARITAN	56.20	.00	.00
NJD981076011	NJ TRANSIT (MEADOWS MAINT.COMPLEX)	KEARNY	23.40	.00	.00
NJD981485667	NJ TRANSIT NEWARK BUS COMPLES	NEWARK	1,784.20	.00	.00
NJP003402112	NJDEP/ER II	JACKSON	16.40	.00	.00
NJ0000934604	NJDOT	BEDMINSTER	22.50	.00	.00
NJ0000003293	NJDOT BRIDGE PAINTING BIN #1815-151	NA	17.88	.00	.00
NJ0000934562	NJDOT BRIDGE PAINTING BIN 1817-150.	BEDMINSTER	16.62	.00	.00
NJD986641488	NJDOT BRIDGE PAINTING CONTRACT RT 3	SECAUCUS	24.85	.00	.00
NJD986646107	NJDOT BRIDGE PAINTING CONTRACT 93-2	FLANDERS	13.48	.00	.00
NJD986647303	NJDOT BRIDGE PAINTING CONTRACT 93-7	BORDENTOWN	45.31	.00	.00
NJD980769764	NJDOT FERNWOOD/THIOKOL COMPLEX	TRENTON	42.25	.00	.00
NJD986588531	NJDOT LAWRENCEVILLE FACILITY	LAWRENCE TWP	1,485.00	.00	.00
NJR000002634	NJDOT ROUT 33	EAST WINDSOR	75.18	.00	.00
NJD986646792	NJDOT ROUTE 295 CONTIGUOUS PROPERTY	TRENTON	34.54	.00	.00
NJD053096046	NORTH AMERICAN TECHOLOGIES	OCEAN	32.82	.00	.00
NJD980647242	NORTHVILLE LINDEN TERMINAL	LINDEN	67.02	.00	.00
NJD986607588	NU-TRONIC CIRCUIT CO INC	PATERSON	39.53	.00	.00
NJD078268208	NU-WORLD INC	METUCHEN	16.43	.00	.00
NJD043973122	OCCIDENTAL CHEMICAL CORPORATION	BURLINGTON	16.28	1.00	.00
NJD087092391	OCEAN YACHTS INC	WEEKSTOWN	37.32	.00	.00
NJD024506719	OMEGA CIRCUITS & ENGINEERING CORP.	NEW BRUNSWICK	19.78	.00	.00
NJR000004929	OMEGA PLASTICS CORP	LYNDHURST	33.36	.00	.00
NJD982721771	ORBEL CORPORATION	PHILLIPSBURG	106.62	.00	.00
NJD001399013	ORELITE TECHNICAL	IRVINGTON	14.28	.00	.00
NJD002152858	ORGANON INC.	WEST ORANGE	18.66	.00	.00
NJD068715424	ORTHO DIAGNOSTIC SYSTEMS INC	RARITAN	105.89	743.00	.00
NJ0000372409	ORTHO-MCNEIL/BRIDGEWATER DISTRBUTIO	BRIDGEWATER	6.76	680.00	.00
NJD085495778	OSTEONICS CORPORATION	ALLENDALE	13.91	.00	.00
NJD986645232	OUTERBRIDGE CROSSING NJ ABUTMENT	PERTH AMBOY	877.23	.00	.00
NJD099285264	OXFORD SUPERCONDUCTING TECH	CARTERET	22.12	.00	.00
NJD980775944	PACO PHARMACEUTICAL SERVICES	LAKEWOOD	40.01	10.00	.00
NJD002188654	PACQUET ONEIDA INC	CLIFTON	85.41	.00	.00
NJD062042809	PAMARCO INC	ROSELLE	527.75	.00	.00
NJD001344506	PARKE-DAVIS	MORRIS PLAINS	20.99	65.00	.00
NJD986599132	PASSAIC HIGH SCHOOL	PASSAIC	.22	257.00	.00
NJD065816969	PASSAIC VALLEY SEWERAGE COMMISSIONE	NEWARK	13.92	.00	.00
NJD002151553	PAXAR WOVEN LABEL GROUP	PATERSON	27.21	.00	.00
NJD002171122	PEERLESS TUBE COMPANY	BLOOMFIELD	96.45	.00	.00
NJD094244712	PERMABOND INTERNATIONAL	BRIDGEWATER	227.76	.00	.00
NJT350010112	PERMACEL NORTH BRUNSWICK FACILITY	NORTH BRUNSWICK	865.54	.00	.00
NJD000768051	PERSONAL PRODUCTS COMPANDY	NORTH BRUNSWICK	377.37	20.00	.00
NJD002037307	PHARMACEUTICAL FORMULATIONS INC	EDISON	12.92	54.00	.00
NJD002201705	PHELPS DODGE SPECIALTY COPPER PROD	ELIZABETH	23.72	.00	.00
NJD986614725	PHOTOTYPE COLOR GRAPHICS	PENNSAUKEN	15.64	.00	.00
NJD986573764	PITMAN COMPANY	TOTOWA	40.45	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NJD011417516	PLASTI-CLAD METAL PRODUCTS, INC.	WALL	220.52	.00	.00
NJD000692350	PNC, INC.	NUTTLEY	171.37	.00	.00
NJD064266000	POLYCHROME CORP A DIV OF SUN CHEMIC	CLARK	79.40	.00	.00
NJD000314682	POLYURETHANE SPECIALTIES CO.	LYNDHURST	14.46	.00	.00
NJD981489974	PORT AUTHORITY OF NY & NJ CENTRAL A	ELIZABETH	14.91	.00	.00
NJD980648547	PORT AUTHORITY OF NY&NJ-GEOR.WASH.B	FORT LEE	14.20	.00	.00
NJD980593339	POWELL DUFFRYN TERMINALS, INC.	BAYONNE	408.89	40,380.00	.00
NJD063137871	PRECISION CIRCUITS, INC	EATONTOWN	89.49	25.00	.00
NJD053523072	PRECISION PRODUCTS COMPANY	HAWTHORNE	24.22	.00	.00
NJD075418285	PRECISION PROTOTYPES,INC.	GARFIELD	13.53	.00	.00
NJD002561652	PRECISION ROLLED PRODUCTS INC	FLORHAM PARK	13.53	.00	.00
NJR000005298	PRICE CLUB #221	WAYNE	20.12	.00	.00
NJR000005199	PRICE CLUB #234	EDISON	13.82	.00	.00
NJD044081354	PRIDE SOLVENTS & CHEMICAL CO. OF NJ	AVENEL	26.21	.00	.00
NJD980533582	PSE&G CO.- CLIFTON HDQTRS	CLIFTON	16.03	.00	.00
NJD000574244	PSE&G CO.- IRVINGTON SUBHDQTRS	IRVINGTON	33.78	.00	.00
NJD094961042	PSE&G HUDSON GENERATING STATION	JERSEY CITY	21.36	.00	.00
NJD000574376	PSE&G LINDEN GENERATING STATION	LINDEN	25.56	.00	.00
NJD986631588	PSE&G MORRISTOWN GAS WORKS	MORRISTOWN	271.32	.00	.00
NJD000768028	PSE&G- HARRISON GAS PLANT	HARRISON	869.34	.00	.00
NJD000574392	PSE&G-CENTRAL GAS PLANT	EDISON	504.04	.00	.00
NJD096880265	PSE&G-PALISADES DIVISION	SECAUCUS	199.79	.00	.00
NJD000768234	PSE&G-WEST END GAS PLANT	JERSEY CITY	240.37	.00	.00
NJD080629959	PUBLIC SERVICE ELECTRIC & GAS CO	PATERSON	1,197.82	.00	.00
NJD011686326	QUADREL BROS.TRUCKING CO.,INC.	RAHWAY	14.22	.00	.00
NJD986644656	QUALA SYSTEMS INC	BRIDGEPORT	14.71	1,980.07	.00
NJD986575215	QUEENS GROUP NEW JERSEY	EDISON	23.17	.00	.00
NJP000795781	QUEST PROPERTY	RINGWOOD	46.55	.00	.00
NJD002187417	R+R ELECTROPLATING CO INC	LINDEN	39.35	.00	.00
NJD980777874	RAMSEY HIGH SCHOOL	RAMSEY	.34	60.00	.00
NJD002003846	RANDOLPH PRODUCTS COMPANY	CARLSTADT	20.04	.00	.00
NJD982737777	RAPID FORMS	THOROFARE	28.16	.00	.00
NJD982729980	RECKITT & COLMAN INC	WAYNE	2.89	80.00	.00
NJD982736639	REED-LANE INC	SOUTH HACKENSAC	1.70	1,000.00	.00
NJD981177645	REEVES INTERNATIONAL INC	WAYNE	17.66	.00	.00
NJD048797195	REICHHOLD CHEMICALS INC	NEWARK	60.44	.00	.00
NJD092217892	REICHHOLD CHEMICALS INC	NEWARK	308.25	.00	.00
NJD000317933	REISS CORPORATION	ENGLISHTOWN	35.29	.00	.00
NJD981133150	REPUBLIC ENVIRONMENTAL RECYCLING IN	CLAYTON	4,088.15	.00	.00
NJD986630002	REVLON CONSUMER PRODUCTS	HOLMDEL	278.13	.00	.00
NJD002173540	REVLON IMPLEMENTS	IRVINGTON	69.99	.00	.00
NJD055090815	RFE INDUSTRIES INC	JERSEY CITY	132.94	.00	.00
NJD002502466	RHEIN CHEMIE CORPORATION	TRENTON	101.87	2,800.00	.00
NJD002149409	RHONE-POULENC INC	DAYTON	643.99	.00	.00
NJD169077427	RHONE-POULENC INC	MIDDLESEX	65.70	.00	.00
NJD002184448	RHONE-POULENC SURFACTANTS & SPECIAL	NEW BRUNSWICK	99.77	.00	.00
NJD982533309	RIMETC CORPORATION	BURLINGTON	18.56	.00	.00
NJD982721516	RMP PENNSAUKEN	PENNSAUKEN	257.05	.00	.00
NJD106382013	ROBERT WOOD JOHNSON UNIVERSITY HOSP	NEW BRUNSWICK	3.38	3,730.00	.00
NJD000581363	ROCHE DIAGNOSTIC SYSTEMS,INC.	BELLEVILLE	6.89	68.00	.00
NJD002325991	ROLLER BEARING CO OF AMERICA	WEST TRENTON	13.49	.00	.00
NJD053288239	ROLLINS ENVIRONMENTAL	BRIDGEPORT	6,194.98	.00	.00
NJD099096984	ROWAN COLLEGE OF NEW JERSEY	GLASSBORO	.82	568.90	.00
NJD042902916	ROWE INTERNATIONAL INC.	WHIPPANY	20.75	.00	.00
NJD002160208	ROYAL LUBRICANTS COMPANY, INC.	EAST HANOVER	99.01	.00	.00

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NJD002179190	RUSSELL STANLEY CORP	WOODBRIDGE	116.01	.00	.00
NJD002182897	SAFETY KLEEN CORP	LINDEN	30,141.05	.00	.00
NJD986604510	SAFETY-KLEEN CORP	BURLINGTON	13.29	.00	.00
NJD982537888	SANCOA INTERNATIONAL	MOUNT LAUREL	23.51	.00	.00
NJD002147023	SANDOZ PHARMACEUTICALS CORP	EAST HANOVER	1,024.87	890.00	.00
NJD108657016	SANDY ALEXANDER,INC.	CLIFTON	58.26	.00	.00
NJD001317601	SCHERING CORPORATION	UNION	811.18	.00	.00
NJD054554290	SCHERING CORPORATION	KENILWORTH	111.12	180.00	.00
NJD047354881	SCHERING CORPORATION(LAFAYETTE FACI	LAFAYETTE	7.36	233.00	.00
NJD986640142	SCHERING PLOUGH RESEARCH INSTITUTE	KENILWORTH	103.74	.00	.00
NJD980757330	SCHULLER INTERNATIONAL, INC.	WINSLOW TOWNSHI	26.84	.00	.00
NJD063152243	SCHWEIZERHALL INC	SO PLAINFIELD	423.58	324.00	.00
NJD980593768	SCIENTIFIC DESIGH COMPANY,INC.	LITTLE FERRY	14.38	15,984.00	.00
NJD986573798	SEEGAR INC	SOMERSET	18.75	.00	.00
NJD000318717	SELECTIVE COATINGS & INKS, INC.	FARMINGDALE	21.62	.00	.00
NJD002138543	SERVOMETER CORPORATION	CEDAR GROVE	197.24	.00	.00
NJD079324315	SETON HALL UNIVERSITY	SOUTH ORANGE	25.46	183.49	.00
NJD034722157	SGS CONTROL SERVICES INK	CARTERET	30.13	10.00	.00
NJD002195220	SHELL OIL COMPANY	SEWAREN	963.53	.00	.00
NJC876092933	SHELL SERVICE STATION	NEWARK	70.00	.00	.00
NJD986588317	SHELL SERVICE STATION	SOUTH BRUNSWICK	67.58	.00	.00
NJD986596161	SHELL SERVICE STATION	NEWARK	74.82	.00	.00
NJD986597748	SHELL SERVICE STATION	WHIPPANY	208.35	.00	.00
NJD002179893	SIKA CORPORATION	LYNDHURST	379.37	.00	.00
NJD002161511	SILGAN CONTAINERS CORP	EDISON	48.66	.00	.00
NJD062052824	SISTERS OF CHARITY OF ST ELIZABETH	CONVENT STATION	52.73	.00	.00
NJD042896738	SMITHKLINE BEECHAM PHARMACEUTICALS	PISCATAWAY	1,189.01	.00	.00
NJD002180255	SOLAR COMPOUNDS CORPORATION	LINDEN	46.47	.00	.00
NJD980647713	SONOCO ENGRAPH LABEL GROUP	MOORESTOWN	23.59	.00	.00
NJD986596583	SPECIALTY TONER CORPORATION	FAIRFIELD	62.06	.00	.00
NJD986579449	SQUARE D COMPANY	BORDENTOWN	7,647.80	.00	.00
NJD009305772	SRI/DAVID SARNOFF RESEARCH CENTER	PRINCETON	9.64	28.00	.00
NJ0000279430	STAFLEX PRODUCTS	CARTERET	177.48	.00	.00
NJD001389352	STANDARD COATING CORP	RIDGEFIELD	67.82	.00	.00
NJD087620811	STANDARD-KELI/TAP-RITE	ALLENWOOD	39.25	.00	.00
NJD002454049	STANLEY TOOLS	NEWARK	195.23	.00	.00
NJD056349087	STAR-GLO INDUSTRIES INC	E RUTHERFORD	29.72	.00	.00
NJD002011294	STEPAN COMPANY	MAYWOOD	414.25	.00	.00
NJD041762840	STEPAN COMPANY	FIELDSBORO	223.46	.00	.00
NJD013616438	STOLTHAVEN PERTH AMBOY INC.	PERTH AMBOY	13.22	.00	.00
NJD001667807	STONEY-MUELLER INC	LYNDHURST	39.29	.00	.00
NJD011420205	STONHARD, INC.	MAPLE SHADE	28.58	.00	.00
NJ0000970004	STONYBROOK LABROATORIES INC	PENNINGTON	16.13	247.00	.00
NJD085661999	STRATUS PETROLEUM CORP	NEWARK	13.48	.00	.00
NJD002169233	SUFFERN PLATING CORP.	LODI	121.70	.00	.00
NJD000632299	SUN CHEMICAL CORP.	TETERBORO	44.41	.00	.00
NJD001563147	SUN CHEMICAL CORP.- TECHNICAL RESCH	CARLSTADT	16.12	.00	.00
NJD002188597	SWEPCO TUBE CORP	CLIFTON	333.56	.00	.00
NJR986623478	SYBRON CHEMICALS INC	HALEDON	1.92	84.00	.00
NJD986650240	TARGET GRAPHICS	BOONTON	13.45	.00	.00
NJD980791040	TEANECK OMS	TEANECK	16.20	.00	.00
NJD041511254	TECHNICAL COATINGS CO.	NUTLEY	58.60	.00	.00
NJD980755383	TELEGRAPH HILL	HOLMDEL	15.94	.00	.00
NJD002163673	TEMPIL DIVISION AIR LIQUIDE AMERICA	SOUTH PLAINFIEL	28.21	.00	.00
NJD002141596	TENAX FINISHING PRODUCTS CO.	NEWARK	33.30	.00	.00

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NEW JERSEY

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GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NJD051415909	TENNECO PACKAGING	CLAYTON	1,247.22	.00	.00
NJD067505958	TEXACO REFINING & MARKETING INC.	BAYONNE	120.00	.00	.00
NJD065808875	TEXACO/STAR ENTERPRISE SALES TERMIN	NEWARK	62.60	.00	.00
NJD980526933	TEXAS EASTERN TRANSMISSION CORP.	LAMBERTVILLE	42.96	.00	.00
NJD986633766	THE BALLANTINE GROUP	FRANKLIN	33.32	29,835.00	.00
NJD089205280	THE BOC GROUP INC TECHNICAL CENTER	MURRAY HILL	19.44	590.00	.00
NJD986597508	THE DUPONT MERCK PHARMACEUTICAL COM	DEEPWATER	573.53	.00	.00
NJD986647782	THE GEON COMPANY	PEDRICKTOWN	19.67	.00	.00
NJD073755787	THE LANGSTON CORPORATION	CHERRY HILL	29.59	.00	.00
NJD018469346	THE LIPSOME COMPANY INC	PRINCETON	66.25	12.00	.00
NJD002146660	THE MENNEN COMPANY	MORRISTOWN	16.58	9,969.00	.00
NJD098258726	THE P.F. LABORATORIES INC	TOTOWA	6.07	1,520.00	.00
NJD063144521	THE PROCTER & GAMBLE MANUFACTURING	AVENEL	2.15	4,255.00	.00
NJD981563711	THE RAMBACH CHEMICAL CO INC	NEWARK	14.60	.00	.00
NJD092225721	THE SOUTHLAND CORPORATION	GREAT MEADOWS	26.55	.00	.00
NJD002357242	THE TRANE COMPANY	TRENTON	21.67	.00	.00
NJD001399815	THE WELLA CORPORATION	ENGLEWOOD	3.99	4,845.70	.00
NJD096873724	THOMAS & BETTS	ELIZABETH	72.61	.00	.00
NJD069290260	TRANSCONTINENTAL GAS PILE LINE (204	CARLSTADT	52.60	.00	.00
NJD091398081	TRANSFER PRINT FOILS INC	EAST BRUNSWICK	2,617.35	.00	.00
NJD094350881	TRENTON GRAPHICS INC	TRENTON	17.87	.00	.00
NJD063144109	TRITECH	PISCATAWAY	605.00	.00	.00
NJD055930374	TUBED PRODUCTS	FREEHOLD	14.27	.00	.00
NJD000574491	U N C AIRWORK CORPORATION	MILLVILLE	79.84	.00	.00
NJD041443649	U.S. CAN COMPANY	SADDLE BROOK	48.90	.00	.00
NJD980652168	U.S. FUJI ELECTRIC,INC.	PISCATAWAY	56.27	.00	.00
NJ4213720275	U.S.ARMY TRAINING CENTER- FORT DIX	FORT DIX	213.51	50.00	.00
NJD982540890	UGIMAG INC	BOONTON	111.65	.00	.00
NJD047700711	UMDNJ NEWARK CAMPUS	NEWARK	4.12	583.00	.00
NJD980756712	UNIFOIL CORPORATION	PASSAIC PARK	109.46	.00	.00
NJD041994799	UNION CAMP CORPORATION FOLD.CARTON	ENGLEWOOD	89.88	.00	.00
NJD002444719	UNION CARBIDE CORP	PISCATAWAY	74.51	750.00	.00
NJD002460368	UNION CARBIDE CORPORATION	CARTERET	130.11	250.00	.00
NJD986653061	UNION COUNTY PARKS & RECREATION	KENILWORTH	15.85	.00	.00
NJD001389360	UNION INK CO INC	RIDGEFIELD	27.24	.00	.00
NJD986568566	UNITED AIRLINES NEWARK INT'L AIRPOR	NEWARK	47.00	.00	.00
NJD002347565	UNITED STATES PIPE & FOUNDRY COMPAN	BURLINGTON	864.00	.00	.00
NJD986572345	UNITED TECHNOLOGIES CORPORATION	HAWTHORNE	114.65	.00	.00
NJ0000204693	UNITED WATER NEW JERSEY HAWORTH LAB	HAWORTH	.95	44.00	.00
NJ6210090068	US AARMY SIEVER SANBERB USARC	PEDRICKTOWN	43.59	.00	.00
NJ3210020704	US ARMY ARMAMENT RESEARCH DEVELOPME	PICATINNY ARSEN	113.86	385.00	.00
NJ2210020978	US ARMY COMM ELEC COMMAND	FORT MONMOUTH	32.61	46.30	.00
NJD041559105	US CAN - TRENTON LITHO	TRENTON	140.89	.00	.00
NJ4690308024	US COAST GUARD STATION SANDY HOOK	HIGHLANDS	26.08	.00	.00
NJ1680090015	USEPA EDISON FACILITY	EDISON	1,993.36	2,008.00	.00
NJP000922211	USEPA 12TH STREET PLATING REMOVAL	NEWARK	125.86	.00	.00
NJD049487887	USR OPTONIX	HACKETTSTOWN	128.61	.00	.00
NJ7210090059	UTES	NEW EGYPT	38.56	.00	.00
NJD063143754	VAN WATERS & ROGERS INC	AVENEL	56.86	.00	.00
NJD990753493	VANGUARD RESEARCH INDUSTRIES INC	SOUTH PLAINFIEL	156.22	.00	.00
NJD000499293	VICTAULIC CO OF AMERICA APEX FACILI	NEW VILLAGE	416.90	.00	.00
NJD085494516	VORAC CO	CARLSTADT	203.01	.00	.00
NJD056699267	W BROOMES ENGELHARD CORPORATION	UNION	16.91	20.00	.00
NJ0000106849	W.R. GRACE	JERSEY CITY	688.54	.00	.00
NJD980773113	WARNER-LAMBERT RESEARCH LAB.	MORRIS PLAINS	12.30	400.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NJD981872138	WARNOCK AUTOMATIVE	E HANOVER	73.17	.00	.00
NJD054122668	WEBCRAFT TECHNOLOGIES	NO BRUNSWICK	282.46	.00	.00
NJD986649564	WEHTECH INC.	ROBBINSVILLE	48.22	.00	.00
NJD980791099	WESTFIELD OMS	WESTFIELD	47.30	.00	.00
NJD003855251	WHATMAN INC	CLIFTON	52.19	.00	.00
NJD002361947	WHITEHALL LABORATORIES INC	HAMMONTON	30.30	60.00	.00
NJD002165561	WITCO CORPORATION	PERTH AMBOY	566.96	.00	.00
NJD056602808	WITCO CORPORATION	PHILLIPSBURG	504.67	.00	.00
NJD101425270	WORLD CHEVROLET/GEO	WESTVILLE	22.24	.00	.00
NJD980753842	WYETH-AYERST RESEARCH	MONMOUTH JUNCTI	42.59	774.00	.00
NJD001787944	ZENECA INC.- BAYONNE SITE	BAYONNE	23,368.11	.00	.00
NJD000533877	ZENECA SPECIALTY INKS	LINDEN	32.08	.00	.00
NJD001479302	ZENITH GOLDLINE PHARMACEUTICALS	NORTHVALE	19.31	20.00	.00
NJD986639078	ZEUS INDUSTRIAL PRODUCTS INC	RARITAN	66.47	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NJR000002691	ABSDP INC	BLAIRSTOWN	1.77	.00	.00
NJD986617256	ACADEMY BUS TOURS,INC	HOBOKEN	1.75	.00	.00
NJD002186633	ACCURATE BUSHING CO	GARWOOD	4.84	.00	.00
NJD980777684	ACCURATE INDUSTRIES	WILLIAMSTOWN	5.05	.00	.00
NJD980777692	ACCURATE INDUSTRIES	ERIAL	5.05	.00	.00
NJD002151504	ACME ENGRAVING CO INC	PASSAIC	1.91	.00	.00
NJD986625473	ACTION GRAPHICS INC	LINCOLN PARK	3.91	.00	.00
NJD002016103	ADVANCE FIBER TECHNOLOGIES	HACKENSACK	9.10	.00	.00
NJD981130172	ADVANCED CARE PRODUCTS RESEARCH	NORTH BRUNSWICK	2.63	14.00	.00
NJD986596351	ADVANCED REMEDIES, INC.	SOMERSET	2.71	.00	.00
NJD980773105	AEROPANEL CORP.	BOONTON	3.25	.00	.00
NJR000002527	AEROPHARM TECHNOLOGY INC	EDISON	1.66	.00	.00
NJD986605913	AGFA DIVISION OF BAYER CORPORATION	DAYTON	3.88	.00	.00
NJD001367176	AGWAY ENERGY PRODUCTS	WASHINGTON	5.61	.00	.00
NJD980663413	AGWAY ENERGY PRODUCTS	AUGUSTA	3.61	.00	.00
NJD981487499	AIR CRUISERS COMPANY	WALL TWP	5.70	.00	.00
NJD065815771	ALCAN POWDERS & PIGMENTS	UNION TWP	10.16	.00	.00
NJR000003616	ALL AMERICAN OIL RECOVERY CO	WAYNE	7.53	.00	.00
NJD000764878	ALLIED SIGNAL AMORPHOUS METALS	PARSIPPANY	2.38	.00	.00
NJD060792801	ALLSTATE LEGAL	CRANFORD	10.54	.00	.00
NJD986571628	ALPHA METALS INC	JERSEY CITY	5.88	.00	.00
NJD061965877	ALTEON INC	RAMSEY	5.32	.00	.00
NJR000000331	AMALANCH ASSOCIATES	UNION	1.15	.00	.00
NJD986582567	AMCO FOLDING CARTON	TOWACO	4.82	.00	.00
NJD986614519	AMERICAN AIRLINES	NEWARK	2.95	.00	.00
NJD986652451	AMERICAN FIBER-VELOPE MFG CO	SWEDESBORO	2.82	.00	.00
NJD061059168	AMERICAN NATIONAL CAN CO	PISCATAWAY	9.70	.00	.00
NJD002189629	AMI-DOC, INC.	CEDAR KNOLLS	5.43	.00	.00
NJ0000056614	AMOCO SERVICE STATION # 84770	SADDLE BROOK	1.15	.00	.00
NJ0000325415	AMOCO SERVICE STATION # 955	ISELIN	1.15	.00	.00
NJD115342156	AMP LYTEL DIVISION	BRANCHBURG TOW	6.90	10.00	.00
NJD980776298	APA TRANSPORT CORP.	NORTH BERGEN	12.76	.00	.00
NJD986600310	ART DECO DIV OF POCHET OF AMERICA	WAYNE	3.36	.00	.00
NJD986646313	ASBURY PARK PRESS INC	FREEHOLD	3.02	.00	.00
NJD011211141	AST BEARINGS	MONTVILLE	4.62	.00	.00
NJD986649911	ATLANTIC DETROIT DIESEL ALLISON	LODI	8.04	.00	.00
NJD096983952	ATLANTIC DETROIT DIESEL-ALLISON	LODI	1.65	.00	.00
NJD002196624	ATLANTIC METAL PRODUCTS INC.	HILLSIDE;	9.00	.00	.00
NJD982186835	ATLANTIC POLYMERS & PRODUCTS INC	FARMINGDALE	6.88	.00	.00
NJD986567741	AUTOMOTIVE MACHINE INC	HILLSIDE	1.50	.00	.00
NJD001561414	AVDEL CHERRY TEXTRON	PARSIPPANY	4.18	.00	.00
NJD986626208	AVON PRODUCTS INC	TOTOWA	3.96	.00	.00
NJD001288711	BASF CORPORATION	LODI	5.94	.00	.00
NJD046941530	BASF CORPORATION	KEARNY	1.63	.00	.00
NJD078247905	BASF CORPORATION	JAMESBURG	10.40	.00	.00
NJD007854300	BAXTER HEALTHCARE CORP	EDISON	3.50	.00	.00
NJD986584688	BAYER CONSUMER CARE DIVISION	PRINCETON	5.97	2.00	.00
NJD981082043	BAYER CORP. (MILES)	NEWARK	5.80	.00	.00
NJD048809487	BAYONNE INDUSTRIES INC	BAYONNE	12.60	.00	.00
NJD001703289	BEACON LOOMS, INC.	TEANECK	5.95	.00	.00
NJD000542282	BEAZER EAST INC	PORT NEWARK	9.48	.00	.00
NJD986645448	BECTON DICKINSON AND COMPANY	FRANKLIN LAKES	5.62	.00	.00
NJD002145811	BEL-RAY COMPANY, INC	WALL	3.97	.00	.00
NJD980649198	BELL ATLANTIC- NJ	PASSAIC	1.25	.00	.00
NJD981138373	BELL COMMUNICATIONS RESEARCH INC	MORRISTOWN NJ 0	6.22	.00	.00

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NJD020771499	BELL COMMUNICATIONS RESEARCH,INC.	PISCATAWAY	4.49	.00	.00
NJD082970997	BENJAMIN MOORE & CO	FLANDERS	3.67	.00	.00
NJD002395259	BERGEN MACHINE & TOOL CO	HACKETTSTOWN	2.50	.00	.00
NJD001223577	BERLIN & JONES COMPANY INC.	EAST RUTHERFORD	4.35	.00	.00
NJD011268554	BEYER BROS.CORP.	FAIRVIEW	8.02	.00	.00
NJD986576916	BF GOODRICH AEROSPACE	EAST BRUNSWICK	4.27	.00	.00
NJD986653152	BIHLER OF AMERICA INC	PHILLIPSBURG	7.31	.00	.00
NJD144391596	BINDER MACHINERY CO	VOORHEES	2.59	.00	.00
NJD011806452	BINDER MACHINERY COMPANY	SO.PLAINFIELD	4.25	.00	.00
NJR000008268	BIO CLINICAL LABS	PHILLIPSBURG	4.13	.00	.00
NJ0000029397	BIOCHEMICAL SCIENCES INC.	SWEDESBORO	12.40	.00	.00
NJD049143563	BIRK PAINT MANUFACTURERS,INC.	JERSEY CITY	8.93	.00	.00
NJD982794216	BODA INDUSTRIES INC	SOUTH HACKENSAC	13.18	.00	.00
NJD986623809	BOOK COVERS REPAIR SHOP	SAYREVILLE	1.19	.00	.00
NJD980790745	BORDENTOWN CSMS	BORDENTOWN	6.65	.00	.00
NJD980790737	BORDENTOWN OMS	BORDENTOWN	3.10	.00	.00
NJR000001073	BP CHEMICALS-RIGAN WAREHOUSE	FAIRFIELD	1.28	.00	.00
NJD986603579	BREEN COLOR CONCENTRATES INC	LAMBERTVILLE	2.20	.00	.00
NJD000692327	BRODSON PROPERTIES	MONTVILLE	2.20	.00	.00
NJD078255593	BROOKDALE COMMUNITY COLLEGE	LINCROFT	9.89	4.00	.00
NJD042712372	C.B.L TRUCKING, INC.	DELANCO	2.36	.00	.00
NJD980785992	CAIRNS & BROTHER,INC.	CLIFTON	3.23	.00	.00
NJ0001005685	CALVIN KLEIN COSMETICS CO.	MT.OLIVE	6.74	.00	.00
NJD981555667	CAMDEN COGEN LP	CAMDEN	5.90	.00	.00
NJ0001033968	CAMDEN COUNTY VOC/TECH SCH	PENNSAUKEN	2.32	.00	.00
NJD980790786	CAPE MAY OMS	CAPE MAY	10.09	.00	.00
NJD986631513	CARCILLIOS AUTO BODY	HACKENSACK	1.42	.00	.00
NJD986586667	CENTRAL SHOP MAINTENANCE AREA	HIGHTSTOWN	4.24	.00	.00
NJD053516522	CERBERUS PYROTRONICS	CEDAR KNOLLS	3.21	.00	.00
NJD001283704	CETYLITE INDUSTRIES, INC.	PENNSAUKEN	2.09	.00	.00
NJD986642189	CHARLES PELLEGRINI	CLIFFSIDE PARK	1.24	.00	.00
NJD986584399	CHEMICAL LAND HOLDINGS	KEARNY	11.20	.00	.00
NJ0000997908	CHEMO DYNAMICS INC.	SAYREVILLE	4.88	.00	.00
NJR000000273	CITY OF TRENTON	TRENTON	1.57	.00	.00
NJD002140499	CLIFTON ADHESIVE INC	WAYNE	3.52	.00	.00
NJD986618635	COLEMANS GARAGE	CALIFON	10.15	.00	.00
NJD116281783	COLLA-TEC	PLAINSBORO	13.10	.00	.00
NJD051268704	COLUMBIA CLEANERS	SUMMIT	7.88	.00	.00
NJD986643039	COLUMBIA TERMINALS INC	KEARNY	1.83	.00	.00
NJD986568509	COMMAND WEB OFFSET	SECAUCUS	8.03	.00	.00
NJD011555323	CONDIT FORD	NEWTON	6.52	.00	.00
NJD064277502	CONTI CONSTRUCTION CO INC	SOUTH PLAINFIEL	1.87	.00	.00
NJD069896165	COOPER HOSPITAL/UNIVERSITY MEDICAL	CAMDEN	7.41	.00	.00
NJD000820126	COSMAIR, INC.	CLARK	10.67	.00	.00
NJ0000370585	COSTCO WHOLESALE #315	WHARTON	10.20	.00	.00
NJD040754012	COUNTY COLLEGE OF MORRIS	RANDOLPH	1.52	.00	.00
NJD002177186	CROMPTON AND KNOWLES COLORS INCORPO	NUTLEY	3.07	.00	.00
NJD002161834	CROSSFIELD PRODUCTS CORP	ROSELLE PK	9.18	.00	.00
NJD982722290	CROWN CASTINGS INC	MIDLAND PK	9.77	.00	.00
NJD003926896	CROWN CORK & SEAL CO INC	NORTH BERGEN	6.98	.00	.00
NJD061060950	CUMMINS METROPOWER INC	NEWARK	9.18	.00	.00
NJD982272940	DAP INC	PAULSBORO	2.20	.00	.00
NJ0000362095	DATASCOPE CORP.	FAIRFIELD	5.22	.00	.00
NJD064362379	DECORATING RESOURCES INC.	PITMAN	11.54	.00	.00
NJD981183601	DEGUSSA CORPORATION	EAST BRUNSWICK	3.47	.00	.00

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NJD986568939	DELTA CIRCUITS INC	LITTLE FALLS	2.84	.00	.00
NJD982739740	DENTON VACUUM INC	CHERRY HILL	10.83	10.00	.00
NJD047318043	DETREX CORPORATION	CINNAMINSON	6.16	.00	.00
NJD000307975	DICAR INC.	PINE BROOK	3.82	.00	.00
NJR000004457	DIGITAL COLOR	PENNSAUKEN	3.49	.00	.00
NJD156163438	DISPOSAL SYSTEMS INC	IMLAYSTOWN	8.50	.00	.00
NJD981873474	DONA-PAULSBORO	PAULSBORO	11.26	.00	.00
NJD980790802	DOVER OMS	DOVER	9.28	.00	.00
NJD980772636	DOW JONES & COMPANY, INC.	SOUTH BRUNSWICK	12.53	.00	.00
NJD981483738	DOWER FINISHING & RESEARCH CO	KEARNY	3.60	.00	.00
NJD986609584	DUKE FARMS	SOMERVILLE	3.01	.00	.00
NJD986592509	DYNALOY INC	EAST HANOVER	1.93	.00	.00
NJD071612196	E LAMBERT, INC.	PENNSAUKEN	5.75	.00	.00
NJD002164135	E.G.L. COMPANY INC.	NEWARK	7.01	.00	.00
NJD986596872	E.I.DUPONT NEMOURS & CO.	CLIFTON	10.89	.00	.00
NJD062035795	E.V.I. PRODUCTS, INC	UNION	1.60	.00	.00
NJD986570562	EAST WINDSOR MUA	EAST WINDSOR	6.26	.00	.00
NJD065821654	EASTERN ENGRAVING	STIRLING	3.30	.00	.00
NJD986614923	ELCAM PRINTING SERVICES	FAIRFIELD	1.88	.00	.00
NJD081898850	ELECTRO CERAMIC IND	HACKENSACK	2.18	.00	.00
NJD038475356	ELIZABETH GENERAL MED CTR	ELIZABETH	4.03	10.00	.00
NJD980781157	ELIZABETHTOWN GAS CO.(ERIE STREET)	ELIZABETH	1.82	.00	.00
NJD986617470	EMSL ANALYTICAL INC	WESTMONT	5.20	.00	.00
NJD041211392	ENGELHARD- CLAL LP	CARTERET	9.95	.00	.00
NJD000631846	ENGINERRING QUADRANGLE	PRINCETON	3.11	20.00	.00
NJD000811034	ENGLHARD CORPORATION	ISELIN	12.41	10.00	.00
NJD991291584	ENVIRONMENTAL TRANSFER CORPORATION	FLANDERS	2.03	.00	.00
NJD986609097	EVESHAM TOWNSHIP BOE	MARLTON	2.18	8.30	.00
NJD000765081	EXXON BIOMEDICAL SCIENCES,INC.	E.MILLSTONE	4.95	.00	.00
NJD986598639	EXXON CO USA #30094	HALEDON	4.60	.00	.00
NJD986598647	EXXON CO USA #30105	RIDGEWOOD	11.70	.00	.00
NJD986598852	EXXON CO USA #30987	CHATHAM	9.50	.00	.00
NJD986595726	EXXON CO USA #31467	WEST CALDWELL	12.30	.00	.00
NJR000004820	EXXON CO USA #31468	PARSIPPANY	1.30	.00	.00
NJD986599108	EXXON CO USA #32008	JERSEY CITY	10.60	.00	.00
NJD986599207	EXXON CO USA #32066	MORRISTOWN	4.90	.00	.00
NJD986599710	EXXON CO USA #32550	BRICKTOWN	2.50	.00	.00
NJD981137250	EXXON CO.USA # 38945	ROCKAWAY	4.00	.00	.00
NJR000002816	FELL BROTHERS INC	PENNSAUKEN	10.53	.00	.00
NJD982725897	FINGERS RADIATOR	NORTH BRUNSWICK	7.33	.00	.00
NJD001255678	FISHER SCIENTIFIC	SPRINGFIELD	.10	4.00	.00
NJD986569358	FLEX PRODUCTS	CARLSTADT	2.34	.00	.00
NJD986607349	FLORABELLE FLOWERS INC	JERSEY CITY	12.07	.00	.00
NJD002568384	FLUID PACKAGING CO INC	LAKEWOOD	2.48	12.00	.00
NJR000001917	FORMER TEXACO SERVICE STATION #1020	FT LEE	2.75	.00	.00
NJD980790869	FREEHOLD ARMORY	FREEHOLD	9.54	.00	.00
NJD002147411	FRIGIDARE CO HOME COMFRT PRD	EDISON	11.79	.00	.00
NJD986627016	FUJI PHOTO FILM USA,INC.	CARLSTADT	5.27	.00	.00
NJR000005652	GALLOWAY TOWNSHIP BOARD OF ED	ABSECON	1.20	.00	.00
NJD986632230	GALVANIC PRINTING & PLATE	MOONACHIE	1.87	.00	.00
NJO000353045	GE SOMERVILLE	SOMERVILLE	8.34	.00	.00
NJ0000353045	GE SOMERVILLE	SOMERVILLE	8.34	.00	.00
NJR000002584	GENERAL METAL & BLACK FINISHINGS	BLOOMFIELD	7.38	.00	.00
NJD002157139	GENERAL PLASTICS DIV OF PMC INC	BLOOMFIELD	11.08	.00	.00
NJD986629749	GETTY PETROLEUM CORP	SPOTSWOOD	1.83	.00	.00

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NEW JERSEY

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

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- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NJD986652493	GETTY PETROLEUM CORP	SOMMERSET	4.80	.00	.00
NJR000003269	GETTY PETROLEUM CORP	PLAINFIELD	1.61	.00	.00
NJR000005520	GETTY PETROLEUM CORP	PATTERSON	1.51	.00	.00
NJ0001020403	GETTY PETROLEUM CORP	PISCATAWAY	1.15	.00	.00
NJ0001018332	GETTY PETROLEUM CORP.	LAKEWOOD	4.38	.00	.00
NJD001632108	GLITTEREX CORP	BELLEVILLE	2.59	.00	.00
NJD986647402	GRAPHICDATE, L.L.C.	BURLINGTON	7.24	.00	.00
NJD002187177	GREATER NEW YORK BOX	CLIFTON	4.93	.00	.00
NJD986598001	GSA, NEDC	BURLINGTON	3.54	.00	.00
NJD000632174	GULF OIL LIMITED PARTNERSHIP	LINDEN	12.58	.00	.00
NJD100902154	HACKENSACK HIGH SCH HACKENSACK BD O	HACKENSACK	2.46	2.00	.00
NJD980790877	HACKETTSTOWN	HACKETTSTOWN	1.29	.00	.00
NJD986617660	HAMILTON TWP WATER POLLUTION CONTRO	HAMILTON	9.33	.00	.00
NJD982789745	HARRISON CAR MAINTENANCE FACILITY	HARRISON	7.22	.00	.00
NJD056718679	HART PRODUCTS CORP	JERSEY CITY	1.28	.00	.00
NJR000004788	HAWTHORNE PRESS INC.	HAWTHORNE	6.70	.00	.00
NJD077557684	HENKEL CORPORATION	HARRISON	10.81	11.00	.00
NJD055082531	HERCULES CHEMICAL CO INC	PASSAIC	9.80	.00	.00
NJD002181733	HEXACON ELECTRIC COMPANY	ROSELLE PARK	3.24	.00	.00
NJD986584134	HEXCEL CORPORATION	LODI	5.79	.00	.00
NJD981490261	HIGGINS FARM	FRANKLIN TWP	2.10	.00	.00
NJD986612406	HISHI PLASTICS USA INC	LINCOLN PARK	2.48	.00	.00
NJD980776389	HOLMAN LINCOLD MERCURY	MAPLE SHADE	5.10	.00	.00
NJR000002741	HOLT MACHINERY CO	CRANFORD	8.25	.00	.00
NJR000001032	HORCHST CELANESE CORP	EDISON	10.15	.00	.00
NJD991290701	HOWMET CORPORATION ALLOY OPERATION	ROCKAWAY	6.46	.00	.00
NJ0000128249	HULS AMERICA INC	HILLSIDE	12.82	.00	.00
NJR000008037	HUNTERDON RADIOLOGY ASSOCIATES	CLINTON	1.15	.00	.00
NJD047456058	HYGRADE PRINTING CORP.	WEST CALDWELL	3.38	.00	.00
NJD061822946	IMO INDUST INC DELAVAL TURBINE DIVI	TRENTON	4.63	.00	.00
NJD002395382	INGERSOLL-DRESSER PUMP CO.	PHILLIPSBURG	10.88	.00	.00
NJD986586535	INTERCHANGE 07A TOLL PLAZA	ALLENTOWN	3.48	.00	.00
NJD096867114	INX INTERNATIONAL INK CO	CLIFTON	10.83	.00	.00
NJD058112947	ITT AVIONICS DIVISION	NUTLEY	12.82	10.00	.00
NJ0000557611	IV LABS	LAKEWOOD	1.98	.00	.00
NJ0000557611	IV LABS	LAKEWOOD	1.98	.00	.00
NJD001222801	J. LANDAV INC	CARLSTADT	13.00	.00	.00
NJD986635803	J.J. MICHAEL INC	LITTLE FERRY	3.67	.00	.00
NJD986601706	JAERSY CENTRAL POWER AND LIGHT	FORKED RIVER	5.89	.00	.00
NJD980534010	JCP&L FARMINGDALE-HOWELL COMPLEX	FARMINGDALE	3.60	.00	.00
NJD980534028	JCP&L LAKEWOOD COMPLEX(SQUANKUM RD.	LAKEWOOD	6.61	.00	.00
NJD980534051	JCP&L MORRISTOWN COMPLEX	MORRISTOWN	2.10	.00	.00
NJD980534002	JCP&L YARDS CREEK PUMPED STORAGE	BLAIRSTOWN	2.00	.00	.00
NJD060803467	JEFFERSON BOARD OF EDUCATION	OAKRIDGE	1.76	10.00	.00
NJD982743197	JET AVIATION	TETERBORO	3.44	.00	.00
NJD986592020	JIM JOHNSON NUTRO LABORATORIES INC	S PLAINFIELD	1.54	.00	.00
NJD087618518	JOHNSON & JOHNSON RESEARCH CTR	NORTH BRUNSWICK	5.72	.00	.00
NJD002300051	JOHNSON & TOWERS, INC	MT LAUREL	1.15	.00	.00
NJ0000869974	JOSEPHINE SHENMAN	CLIFFWOOD BEACH	2.29	.00	.00
NJ0000450015	JOURNAL SQUARE TRANSPORTATION CTR.	JERSEY CITY	1.25	.00	.00
NJD986592129	KESTER SOLDER	NEWARK	3.74	.00	.00
NJD054120647	KEY INTERNATIONAL INC	ENGLISHTOWN	2.10	.00	.00
NJD091862177	KIKUCHI COLOR & CHEMICAL CORP	PATERSON	2.40	.00	.00
NJD056708688	KLEER KAST DIR OF PNC INC	KEARNY	1.51	.00	.00
NJD048806616	L P THE BEAULT CO.	PARSIPPANY	3.59	.00	.00

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NEW JERSEY

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NJD980778450	LAB-VOLT SYSTEMS INC	WALL	2.71	.00	.00
NJD982185407	LABORATORY RESOURCES	TETERBORO	9.41	.00	.00
NJD986630622	LAIDLAW TRANSIT INC	CLARKSBURG	1.35	.00	.00
NJD044358042	LANGER TRANSPORT CORP	JERSEY CITY	10.15	.00	.00
NJD980790901	LAWRENCEVILLE OMS	LAWRENCEVILLE	3.74	.00	.00
NJP000918433	LIQUID TRANSPORTERS,INC.	BAYONNE	1.25	.00	.00
NJD981179799	LIZ CLAIBORNE (COSMETICS)	DAYTON	8.26	.00	.00
NJD980790919	LODI OMS	LODI	12.04	.00	.00
NJD981563133	LP THE BAULT COMPANY	PARSIPPANY	8.26	.00	.00
NJD986577526	MAACO AUTO PAINTING	LAKEWOOD	4.40	.00	.00
NJD033792581	MAACO AUTO PAINTING & BODYWORKS	PINE BROOK	1.15	.00	.00
NJD082981648	MAACO PAINTING & BODYWORKS	ROCKAWAY	6.40	.00	.00
NJD052092616	MACNAUGHTON EINSON GRAPHICS	FAIR LAWN	2.28	.00	.00
NJD011510542	MAGRUDER COLOR CO INC	ELZABETH	5.87	.00	.00
NJD980651061	MAHER TERMINALS	ELIZABETH	2.96	.00	.00
NJD011415403	MAHWAH FORD	MAHWAH	5.98	.00	.00
NJD055098669	MARK LITHOGRAPHY	CEDAR KNOLLS	5.43	.00	.00
NJD000007054	MARUKA USA INC	ROCKAWAY	1.16	.00	.00
NJD070408554	MATLOCK/BRITE SOL	AVENEL	2.40	.00	.00
NJD085652576	MCI OPTRONIX	CEDAR KNOLLS	6.42	.00	.00
NJD986612109	MDC USP SERVICE	SOMERVILLE	4.12	1.00	.00
NJD981142029	MEDIN CORPORATION	PASSAIC	3.18	.00	.00
NJD010951523	MELNOR INC	MOONACHIE	4.34	.00	.00
NJD986574887	MEM COMPANY	NORTHVALE	2.00	.00	.00
NJD980790828	MERCER AASF	WEST TRENTON	2.84	.00	.00
NJD980790836	MERCER OMS	WEST TRENTON	6.85	.00	.00
NJD000729830	MERCK & CO.,INC./BRANCHBURG FARM	SOMERVILLE	2.45	.00	.00
NJD986651339	MESSINGER TRUCKING & WAREHOUSE	NEWARK	5.93	.00	.00
NJD064316714	METALFAB INC	VERNON	3.94	.00	.00
NJD986587830	MICRO STAMPING CORP.	SOMERSET	9.73	.00	.00
NJD070412812	MIDDLESEX COUNTY UTILITIES AUTH	SAYREVILLE	7.80	.00	.00
NJ0000466813	MIDDLETOWN PS - H.S. NORTH	MIDDLETOWN	.23	20.00	.00
NJR000006999	MIDDLETOWN PS - THORNE MIDDLE SCHOO	MIDDLETOWN	.57	20.00	.00
NJD986566396	MIDWAY AIRCRAFT INSTRUMENT CORP	LITTLE FERRY	3.16	.00	.00
NJ0210022752	MILITARY OCEAN TERMINAL	BAYONNE	6.57	.00	.00
NJ0000363911	MINTEY INTERNATIONAL INC	SAYREVILLE	1.82	.00	.00
NJD068698166	MONMOUTH UNIVERSITY	WEST LONG BRANC	.63	20.00	.00
NJD981184526	MORENG METAL PRODUCTS	TOTOWA	4.21	.00	.00
NJ0000900068	MORLEY SHIRT COMPANY	FRANKLIN	1.33	.00	.00
NJD981554751	MORRIS HILL HIGH SCHOOL	ROCKAWAY	8.58	.00	.00
NJD980790935	MORRISTOWN OMS	MORRISTOWN	9.50	.00	.00
NJD101241537	MOUNT HOPE ROCK PRODUCTS INC.	WHARTON	4.81	.00	.00
NJD101252377	MVAK TECHNOLOGIES, INC.	EAST HANOVER	4.18	.00	.00
NJD986615367	NABISCO, INC.	FAIR LAWN	6.64	.00	.00
NJD000813477	NAPPI TRUCKING CORPORATION	MATAWAN	8.40	.00	.00
NJD061073151	NATIONAL STARCH & CHEMICAL	BLOOMFIELD	7.14	.00	.00
NJD986611887	NEDCO CONVEYOR CO	UNION	1.59	.00	.00
NJD986576833	NET ATLANTIC INC	THOROFARE	5.92	.00	.00
NJ0000377309	NEW AGE METAL	FAIRFIELD	7.52	.00	.00
NJD002157782	NEW BRUNSWICK SCIENTIFIC INC	EDISON	2.39	.00	.00
NJD000572446	NEW JERSEY MARINE TERMINALS	PORT NEWARK	4.52	.00	.00
NJR000002600	NEW JERSEY-AMERICAN WATER COMPANY	DELRAN	3.90	.00	.00
NJD980790950	NEWARK OMS	NEWARK	2.91	.00	.00
NJD056605116	NEWCO INC.	NEWTON	4.52	.00	.00
NJD980790968	NEWTON ARMORY	NEWTON	9.82	.00	.00

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NJD064314115	NICKSTADT MOELLER	RIDGEFIELD	4.10	.00	.00
NJD986645224	NJ ABUTMENT- GOETHALS BRIDGE	ELIZABETH	1.96	.00	.00
NJP003401627	NJ DEPT OF LAW	FT DIX	7.51	.00	.00
NJD986574473	NJ NATURAL GAS COMPANY (TRMGP)	TOMS RIVER	1.80	.00	.00
NJD980647895	NJ SPORTS & EXPOSITION	E RUTHERFORD	2.50	.00	.00
NJD981076292	NJ TRANSIT (LAKE STREET GARAGE)	NEWARK	7.50	.00	.00
NJD986588614	NJAWC DOBBS AVENUE STATION	SOMERS POINT	1.53	.00	.00
NJP003402054	NJDEP/ ER II	S. PLAINFIELD	1.56	.00	.00
NJP000876110	NJDEP/BUR OF CONSTRUCTION	PATERSON	2.75	.00	.00
NJP003401320	NJDEP/ER II	OCEAN	1.23	.00	.00
NJP003401452	NJDEP/ER II	DEERFIELD RD	.00	5.00	.00
NJP003401593	NJDEP/ER II	LONG BRANCH	1.25	.00	.00
NJP003401734	NJDEP/ER II	JACKSON	4.60	.00	.00
NJR000007575	NJDOT	PISCATAWAY	1.75	.00	.00
NJD000556340	NJDOT BEDMINSTER FACILITY	BEDMINSTER	3.99	.00	.00
NJD986634244	NJDOT BRIDGDE PAINTING CONTRACT 91-	HADDON	2.70	.00	.00
NJD986634251	NJDOT BRIDGE PAINING BIN #0428-159	HADDON	2.38	.00	.00
NJD986641157	NJDOT BRIDGE PAINTING BIN #0229-153	PARSIPPANY	12.50	.00	.00
NJD986634129	NJDOT BRIDGE PAINTING BIN #0802-150	WESTVILLE	10.35	.00	.00
NJR000003384	NJDOT BRIDGE PAINTING BIN #1214-151	NORTH BRUNSWICK	6.74	.00	.00
NJD986641421	NJDOT BRIDGE PAINTING BIN #1415-154	MONTVILLE	6.70	.00	.00
NJD986641439	NJDOT BRIDGE PAINTING BIN #1419-189	HANOVER	7.26	.00	.00
NJD986641462	NJDOT BRIDGE PAINTING BIN #1419-194	HANOVER	3.87	.00	.00
NJD986641124	NJDOT BRIDGE PAINTING CONTRACT 91-1	PARSIPPANY TROY	10.72	.00	.00
NJD986634293	NJDOT BRIDGE PAINTING CONTRACT 91-4	AUBUBON	10.50	.00	.00
NJD986647295	NJDOT BRIDGE PAINTING PROJECT	MOUNT LAUREL	1.20	.00	.00
NJ0000052381	NJDOT BRIDGE PAINTING PROJECT	HAWTHORNE	5.00	.00	.00
NJD986634517	NJDOT BUENA FACILITY	BUENA	2.46	.00	.00
NJD982180275	NJDOT CHERRY HILL FACILITY	CHERRY HILL	4.59	.00	.00
NJC876001280	NJDOT DEPTFORD FACILITY	DEPTFORD TWP.	10.47	.00	.00
NJD982180291	NJDOT ELIZABETH NORTH AVENUE FACILI	ELIZABETH	1.88	.00	.00
NJD982533523	NJDOT MANAHAWKIN FACILITY	STAFFORD TWP	4.59	.00	.00
NJD986650281	NJDOT POMONA FACILITY	GALLOWAY TWP	2.75	.00	.00
NJD982180325	NJDOT SAYREVILLE FACILITY	SOUTH AMBOY	2.19	.00	.00
NJ0000860882	NJDOT 2 ORPAHN BRIDGES BIN	S AMBOY	6.30	.00	.00
NJ0000852368	NJDOT/ BRIDGE BLASTING	BEDMINSTER	12.50	.00	.00
NJD986573277	NORTH EAST AUTO MARINE TERMINAL	JERSEY CITY	1.38	.00	.00
NJ0001022367	NORTH WILDWOOD PUBLIC WORKS	N WILDWOOD	1.60	.00	.00
NJD001367473	NORTON & SONS INC.	BAYONNE	8.88	.00	.00
NJD081893927	NOVAMET SPECIALTY PRODUCTS CORP	WYCKOFF	1.47	.00	.00
NJD982271066	NOVICK CHEMICAL CO INC	NEWARK	9.24	.00	.00
NJD068701713	OCEAN COUNTY COLLEGE	TOMS RIVER	1.83	22.00	.00
NJD041829128	OLD DEERFIELD FABRICS INC.	CEDAR GROVE	8.21	.00	.00
NJD002342053	OWENS-BROCKWAY GLASS CONTAINER INC	BRIDGETON	12.68	.00	.00
NJD000545194	OWENS-CORNING KEARNY PLANT	KEARNY	10.30	.00	.00
NJD986588085	PABST ENGINEERING EQUIP. CORP.	ELIZABETH	2.54	.00	.00
NJD986602837	PACKAGING COORDINATORS INC	PENNSAUKEN	2.76	.00	.00
NJD002186625	PANELGRAPHIC CORPORATION	W WALDWELL	4.81	.00	.00
NJD097399695	PARKER HANNIFIN CORP	NORTH BRUNSWICK	2.80	.00	.00
NJD072713951	PASCACK VALLEY HOSPITAL	WESTWOOD	2.68	.00	.00
NJD986622231	PASSAIC COUNTY COMMUNITY COLLEGE	PATERSON	1.28	.00	.00
NJD065822454	PATERSON STAMP WORKS	CLIFTON	4.88	.00	.00
NJD991291642	PENICK CORPORATION	NEWARK	1.95	.00	.00
NJD986579969	PERMACEL	LAKEWOOD	4.24	.00	.00
NJD986567196	PERTH AMBOY DRY DOCK CO	PERTH AMBOY	1.50	.00	.00

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NJD980790976	PHILLIPSBURG OMS	PHILLIPSBURG	6.30	.00	.00
NJD001354513	PILOT TECHNOLOGIES CORP	PARSIPPANY	11.01	.00	.00
NJD002171502	PILOT TECHNOLOGIES CORP.	WAYNE	11.72	.00	.00
NJD048410799	PIONEER INDUSTRIES INC.	CARLSTADT	5.23	.00	.00
NJD075508895	PLY GEM MANUFACTURING	GLOUCESTER CITY	7.87	.00	.00
NJD980648539	PORT AUTH.OF NY&NJ LINCOLN TUNNEL	WEEHAWKEN	7.52	.00	.00
NJD980536668	PORT AUTH.TRANS-HUDSON CORP. WALDO	JERSEY CITY	8.35	.00	.00
NJD060792918	PORT AUTHORITY OF NY & NJ TECHNICAL	JERSEY CITY	7.42	.00	.00
NJD981139660	PORT AUTHORITY TRANSIT CORPORATION	LINDENWOLD	10.82	.00	.00
NJD054060884	POWER CONVERSION	ELMWOOD PARK	3.38	.00	.00
NJD000069401	PQ CORP.-RAHWAY SITE	AVENEL	9.13	.00	.00
NJD981566136	PRESTON TRUCKING COMPANY INC	HARRISON	5.61	.00	.00
NJ1960011152	PRINCETON PLASMA PHYSICS LABORATORY	PLAINSBORO	4.76	.00	.00
NJD981563299	PROCESS RESEARCH PRODUCTS	TRENTON	1.50	.00	.00
NJD000768036	PSE&G BURLINGTON GENERATING STATION	BURLINGTON	2.33	.00	.00
NJD077070811	PSE&G SALEM/HOPE CREEK GENER.STATIO	HANCOCK'S BRIDG	6.46	.00	.00
NJ0000939561	PSE&G-CENTRAL DIVISION HQ	SOMERSET	5.36	.00	.00
NJD089216915	PSE&G-MAPLEWOOD TESTING SERVICES	MAPLEWOOD	.81	16.00	.00
NJD000574285	PSE&G-NEW BRUNS.(FORMALLY CENT.DIV	NEW BRUNSWICK	1.90	.00	.00
NJD980644827	PSE&G-RESOURCE RECOVERY CENTER	GIBBSTOWN	8.26	.00	.00
NJD980533491	PUBLIC SERVICE ELECTRIC & GAS	EDISON	10.45	.00	.00
NJD986596732	PUBLIC SERVICE ELECTRIC & GAS CO	SEWAREN	3.57	.00	.00
NJR000006890	PYMAH CORP	FLEMINGTON	1.55	.00	.00
NJD986603934	QUAKER HARBOR PETROLEUM CORP	BURLINGTON	1.20	.00	.00
NJD986604007	QUALITY METAL CORPORATION	PATERSON	2.52	.00	.00
NJD986568756	R&D CIRCUITS INC	EDISON	11.14	.00	.00
NJD002452324	R&F ALLOY WIRES INC	FAIRFIELD	7.79	.00	.00
NJD039660915	RECORD PLATING	CARLSTADT	7.88	.00	.00
NJD982533176	RECYCLE INC	SOUTH PLAINFIEL	1.85	.00	.00
NJD986632065	REMSCO ASSOCIATES	OLD BRIDGE	3.44	.00	.00
NJD986589992	REPUBLIC CONTAINER CORP	JERSEY CITY	8.62	.00	.00
NJD002520542	REVLON CONSUMER PRODUCTS CORP	EDISON	5.06	.00	.00
NJD002340719	REXAM MEDICAL PACKAGING	MOUNT HOLLY	10.58	.00	.00
NJD986643328	REXHAM CORP.- REAR SHEDS AND PAD	FLEMINGTON	9.57	.00	.00
NJD096846522	RF PRODUCTS INC	CAMDEN	8.22	.00	.00
NJD097400345	RHONE-POULENC INC	CRANBURY	12.41	.00	.00
NJD986592186	RICHARDS MANUFACUCTURING	IRVINGTON	7.60	.00	.00
NJD002563237	RIGO INDUSTRIES,INC.	PATERSON	1.57	.00	.00
NJD980791016	RIVERDALE OMS	RIVERDALE	10.09	.00	.00
NJD981495377	RMP INC CINNAMINSON	CINNIMINSON	5.98	.00	.00
NJ0000910893	ROSE COLOR INC.	NEWARK	1.13	.00	.00
NJD001915578	ROSELLE PRECISION PRODUCTS INC	BERKELEY HTS	5.39	.00	.00
NJD091857169	ROYSONS CORPORATION	ROCKAWAY	9.90	.00	.00
NJD000582387	RUTGERS UNIVERSITY	PISCATAWAY	11.70	.00	.00
NJD982791683	RUTGERS UNIVERSITY COOK CAMPUS	NEW BRUNS	11.07	.00	.00
NJD982791709	RUTGERS UNIVERSITY DOUGLASS CAMPUS	NEW BRUNSWICK	1.00	10.00	.00
NJD030489850	RUTHERFORD MACHINERY	EAST RUTHERFORD	8.94	.00	.00
NJD001284884	S.GOLDBERG & CO.,INC.	HACKENSACK	1.25	.00	.00
NJD982744260	S&D ENVIRONMENTAL SERVICES	EDISON	1.25	.00	.00
NJD986613560	SAFAS CORPORATION	CLIFTON	3.30	.00	.00
NJD000768077	SAFETY-KLEEN CORP	BOUND BROOK	1.64	.00	.00
NJD000768101	SAFETY-KLEEN CORP	SOUTHAMPTON	5.08	.00	.00
NJD067520759	SAINT BARNABAS MEDICAL CENTER	LIVINGSTON	11.24	.00	.00
NJD980762397	SAR INDUSTRIAL FINISHING, INC.	CEDARBROOK	3.26	.00	.00
NJD986626794	SAWDUST PENCIL CO.	EDISON	3.37	.00	.00

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NEW JERSEY

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NJD000818716	SCIENTIFIC DESIGN COMPANY	LITTLE FERRY	1.35	.00	.00
NJD980791024	SEA GIRT OMS	SEA GIRT	10.46	.00	.00
NJD986615268	SEARS #1314 AND 7144	NEW BRUNSWICK	4.98	.00	.00
NJD986626745	SERNIO'S AUTO BODY	JERSEY CITY	4.46	.00	.00
NJD986586816	SERVICE AREA 1N JOHN FENWICK	OLDMANS	1.33	.00	.00
NJD986586717	SERVICE AREA 11N WILLIAM HALSEY	ELIZABETH	1.61	.00	.00
NJD986586774	SERVICE AREA 7 S MOLLY PITCHER	CRANBURY	1.61	.00	.00
NJD986586766	SERVICE AREA 8N JOYCE KILMER	EAST BRUNSWICK	1.38	.00	.00
NJD986586733	SERVICE ARERA 10 N GROVER CLEVELAND	SEWAREN	6.65	.00	.00
NJD012240289	SHAMROCK TECHNOLOGIES,INC.	NEWARK	11.16	.00	.00
NJD986594034	SHELL SERVICE STATION	MULLICA HILL	1.20	.00	.00
NJD986594125	SHELL SERVICE STATION	HILLSDALE	9.32	.00	.00
NJD094965662	SIDMAK LABORATORIES INC	EAST HANOVER PO	5.45	.00	.00
NJD986650042	SIDMAK LABORATORIES INC	EAST HANOVER	7.00	.00	.00
NJD065710261	SIEMANS ROLM COMMUNICATIONS	CHERRY HILL	11.44	10.00	.00
NJD981486004	SIEMENS ENERGY & AUTOMATION INC	LINDEN	3.67	.00	.00
NJD986572840	SILVER LINE BLDG PRODUCTS CORP	MIDDLESEX	4.90	.00	.00
NJD065710311	SILVERTON MARINE CORP	MILLVILLE	6.93	.00	.00
NJD011345816	SITE 063-BALDWIN OILS & COMMODITIES	JERSEY CITY	1.75	.00	.00
NJD980526339	SIX FLAGS GREAT ADVENTURE INC.	JACKSON	1.19	.00	.00
NJD002198018	SMITHKLINE BEECHAM CONSUMER HEALTHC	CLIFTON	12.81	.00	.00
NJD980766091	SMITHS INDUSTRIES	FLORHAM PARK	2.75	.00	.00
NJD980791032	SOMERSET OMS	SOMERSET	8.48	.00	.00
NJD083625061	SONOCO/ENGRAPH POLARIS PACKAGING	ROBBINSVILLE	7.48	.00	.00
NJD065719569	SOUTH SHORE FORD	MARMORA	2.31	.00	.00
NJ0000333492	SPECTRUM PRESS,INC.	ROSELAND	3.44	.00	.00
NJD075149419	STATEWIDE AUTOBODY	JERSEY CITY	1.67	.00	.00
NJD986577419	STEPHENS SCIENTIFIC	RIVERDALE	4.83	.00	.00
NJD982542128	STOLTHAVEN PERTH AMBOY INC (EASTMAN	PERTH AMBOY	7.95	.00	.00
NJD982540312	STULL CLOSURE TECHNOLOGIES	GARFIELD	4.92	.00	.00
NJD980650147	SUN CHEMICAL CORP.	EAST RUTHERFORD	7.58	.00	.00
NJD981485642	SUNDOR BRANDS INC	DAYTON	6.90	.00	.00
NJD986587608	SYNAPTIC PHARMACEUTICAL CORP	PARAMUS	9.42	.00	.00
NJD002159291	TECKNIT	CRANFORD	3.40	.00	.00
NJD982717605	TEKKOTE CORPORATION	MOONACHIE	11.44	.00	.00
NJD055932461	TEKNI-PLEX INC	BRANCHBURG	2.94	.00	.00
NJD986581213	TEMPO TECHNOLOGY CORP	SOMERSET	12.83	.00	.00
NJD981182686	TENNESSEE GAS PIPELINE	SUSSEX	1.57	.00	.00
NJD980663371	TENNESSEE GAS PIPELINE/COMPRESS.STA	MAHWAH	3.41	.00	.00
NJD986638922	TESTRITE INSTRUMENT CO INC	NEWARK	3.59	.00	.00
NJD073738551	TESTWELL CRAIG TESTINGS LABS	MAYS LANDING	3.55	.00	.00
NJD001774397	THE BECKLEY PRESS	FAIRFIELD	11.41	.00	.00
NJD049874415	THE BETHAM CORPORATION	MIDDLESEX	12.65	.00	.00
NJD055930549	THE CELOTEX CORP	PERTH AMBOY	3.98	.00	.00
NJD001512888	THE CHALLENGE PRINTING CO	WALLINGTON	1.83	.00	.00
NJD062049796	THE OKONITE CO	PATERSON	2.47	.00	.00
NJD001283845	THE RECORD	HACKENSACK	2.78	.00	.00
NJD986610285	THE RECORD	ROCKAWAY	4.09	.00	.00
NJD986610731	THE SHERWIN WILLIAMS CO	WALLINGTON	7.25	.00	.00
NJD070953252	THE SHERWIN-WILLIAMS CO	MOONACHIE	5.58	.00	.00
NJD986653483	THE WITTE CO INC	WASHINGTON	3.48	.00	.00
NJD054122569	THERMOMETRICS INC	EDISON	2.52	.00	.00
NJR000003590	THOMAS ESTATE	MENDHAM	2.21	.00	.00
NJR000000976	THURSTON PROPERTY	ALLENDALE	4.19	.00	.00
NJD002364107	TIMES OF TRENTON	TRENTON	4.03	.00	.00

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NEW JERSEY

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- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NJD980791057	TOMS RIVER OMS	TOMS RIVER	2.82	.00	.00
NJD982740938	TOPPAN PRINTING CO	SOMERSET	1.40	.00	.00
NJD982540726	TOWNSHIP OF MORRIS	MORRIS TOWNSHIP	12.90	.00	.00
NJD986575199	TRM COPY CORP	EDISON	8.73	.00	.00
NJD139689327	UDO FINISHING CO.	NEWARK	5.55	.00	.00
NJD981180474	UMDNJ-RWJMS NEW BRUNSWICK CAMPUS	NEW BRUNSWICK	.37	7.00	.00
NJD001495753	UNILEVER RESEARCH U.S.	EDGEWATER	4.67	20.00	.00
NJD002159812	UNION CAMP CORP. FOLDING CARTON DIV	CLIFTON	11.79	.00	.00
NJD001314160	UNION CAMP CORPORATION MYERS DIVI	MOONACHIE	6.33	.00	.00
NJD020785663	UNION CARBIDE CORP.	SOMERSET	2.99	.00	.00
NJC876088436	UNION RUBBER INC	TRENTON	3.96	.00	.00
NJD981566532	UNITED PARCEL SERVICE LAWNSIDE	LAWNSIDE	8.80	.00	.00
NJ0000202655	UNITED WATER NJ-HAWORTH TREATMENT P	HAWORTH	3.52	.00	.00
NJD002155679	UNITED WIRE HANGER CORP	HASBROUCK HEIGH	9.76	.00	.00
NJD980525851	UNIVERSAL MARITIME SERVICE CORP	PORT NEWARK	3.53	.00	.00
NJ3210020597	US ARMY COMM ELEC COMMAND	FORT MONMOUTH	8.06	2.20	.00
NJ4690308933	US COAST GUARD TRAINING CENTER	CAPE MAY	8.08	.00	.00
NJD986642775	US EAGLE LITHO CORPORATION	LAWERENCE	1.63	.00	.00
NJD986643153	US EPA, REGION II/ZSCHIEGNER REFINI	HOWELL TOWNSHIP	5.43	.00	.00
NJD095171948	US INK CORPORATION	EAST RUTHERFORD	11.27	.00	.00
NJR000003301	US OIL CORP.	HAWTHORNE	1.25	.00	.00
NJ5180000064	US POSTAL SERVICE	PATERSON	11.63	.00	.00
NJD980769889	USPFO	LAWRENCEVILLE	2.43	.00	.00
NJD056716285	UTZ ENGINEERING INC	CLIFTON	4.89	.00	.00
NJD002142479	VICTORY ENGINEERING	SPRINGFIELD	4.97	.00	.00
NJD980791073	VINELAND OMS	VINELAND	1.41	.00	.00
NJD086435070	VWR SCIENTIFIC PRODUCTS	BRIDGEPORT	7.21	.00	.00
NJD051302958	W W HENRY CO	SOUTH RIVER	1.29	.00	.00
NJD982536898	WAMPOLE LABORATORIES	EAST WINDSOR	.40	10.00	.00
NJD980530760	WARD PRODUCTS,CORP.	NORTH BRUNSWICK	2.48	.00	.00
NJD980768600	WARNER-LAMBERT CONSUMER PRODUCT RE	MORRIS PLAINS	6.59	.00	.00
NJD065789240	WAYNE GENERAL HOSPITAL	WAYNE	10.86	.00	.00
NJD980766703	WEBCRAFT TECHNOLOGIES	N BRUNSWICK	1.66	.00	.00
NJD011261187	WELSHS MOTOR SALES	FAR HILLS	2.24	.00	.00
NJD986637619	WEST JERSEY P&DC MAIL FACILITY	WHIPPANY	1.13	.00	.00
NJD980791107	WEST ORANGE OMS	WEST ORANGE	7.72	.00	.00
NJD980791115	WEST ORANGE OMS	WEST ORANGE	11.77	.00	.00
NJD982532434	WESTINGHOUSE ELECTRIC CORP	BLOOMFIELD	9.92	.00	.00
NJD981559875	WILKATA PACKAGING CORP	KEARNY	6.40	.00	.00
NJ0000442970	WILLIAM T HUCHINSON CO.	UNION	1.60	.00	.00
NJD065700106	WOOD RIVER INDUSTRIES	RIVERSIDE	11.90	.00	.00
NJD980791123	WOODBRIDGE ARMORY	WOODBRIDGE	3.87	.00	.00
NJD980791131	WOODBURY ARMORY	WOODBURY	6.98	.00	.00
NJD980791149	WOODSTOWN ARMORY	WOODSTOWN	9.36	.00	.00
NJD986629871	WYETH-AYERST RESEARCH	MONMOUTH JUNCTI	6.39	23.00	.00
NJD011267762	ZACK PAINTING COMPANY INC	FORDS	2.40	.00	.00
NJD980650154	0000-9233 NEWARK TERMINAL	NEWARK	11.45	.00	.00
NJP000922112	0013-9501 SUNOCO SERVICE STATION-A-	WATERFORD WKS	11.68	.00	.00
NJD002520088	3M	BELLE MEAD	6.87	.00	.00
NJD052441664	3M WEST CALDWELL	WEST CALDWELL	12.61	.00	.00

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NEW JERSEY

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- LESS THAN 1.1 TONS RCRA HAZARDOUS WASTE, AND
- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NJD118069814	ABC BUS CO	CAMDEN	.90	.00	.00
NJP000922005	ABC SUPPLY CO INC	NORTH BERGEN	.35	.00	.00
NJD002373579	AIR PRODUCTS AND CHEMICALS,INC.	PAULSBORO	.58	.00	.00
NJD986620169	AT&T CORP	SOUTH PLAINFIEL	.00	.00	.00
NJD980790729	ATLANTIC CITY ARMORY	ATLANTIC CITY	.23	.00	.00
NJD981487838	ATLANTIC CITY MUA WATER PLANT	PLEASANTVILLE	.95	.00	.00
NJD011300803	ATLNTIC WOOD INDUSTRIES INC	HAINESPORT	.00	.00	.00
NJP000795047	BASF CORPORATION AT BEELINE	FAIRFEILD	.00	.00	.00
NJD986583979	BASF CORPORATION AT BROOK WAREHOUSE	NEWARK	.10	.00	.00
NJD980644736	BASF CORPORATION AT BROOK WAREHOUSE	BRIDGEWATER	.00	.00	.00
NJD986597326	BASF CORPORATION AT FREY WAREHOUSE	NEWARK	.00	.00	.00
NJR000007740	BOC GASES	BRIDGEWATER	.20	.00	.00
NJD980790778	BURLINGTON ARMORY	BURLINGTON	.22	.00	.00
NJ0000325399	BURLINGTON COUNTY HIGHWAY	HAINESPORT	.00	.00	.00
NJR000002808	BURLINGTON COUNTY INSTITUTE OF TECH	MOUNT HOLLY	.25	.00	.00
NJD058128455	CHEMCOAT LABS CO INC	EAST HANOVER	.91	.00	.00
NJD011612553	CONTRACT PACKAGING CORP.	TOTOWA	.89	.00	.00
NJD986648772	CRANES CREEK	PERTH AMBOY	.00	.00	.00
NJD986647758	CREAMER BROS INC	FOLSOM	.06	.00	.00
NJD002496503	DECORATED PAPER CORP	CAMDEN	.00	.00	.00
NJD000820142	DEVRO INC. USA	BRIDGEWATER	.56	.00	.00
NJD000003236	DRAKE BAKERIES, INC.	E. BRUNSWICK	1.03	.00	.00
NJD986645679	E.G.L.COMPANY INC.	NEWARK	.28	.00	.00
NJD980790844	FLEMINGTON ARMORY	FLEMINGTON	1.00	.00	.00
NJD011370525	G&S MOTOR EQUIPMENT CO.,INC.	KEARNY	.80	.00	.00
NJR000005637	GALLOWAY TOWNSHIP BOARD OF ED	OCEANVILLE	.55	.00	.00
NJD065797813	GENERAL FILM PRODUCTS	ELIZABETH	1.08	.00	.00
NJD003951985	GRIFFIN PIPE PRODUCTS	FLORANCE	.00	.00	.00
NJD002181386	HARRISON ALLOYS INC	HARRISON	.00	.00	.00
NJD000004663	HENDRICKSON FARMS	HOLMDEL	.40	.00	.00
NJ0000044560	HENRY I SIEGEL CO INC	TETERBORO	.22	.00	.00
NJD053102232	HIGGINS DISPOSAL US EPA REGION II	KINGSTON	.00	.00	.00
NJP000795054	HOECHST CELANESE CORP	CONVENTRY	.92	.00	.00
NJD986603900	INGERSOLL-RAND AIR CENTER	EDISON	.97	.00	.00
NJD986618759	JASON INTERNATIONAL	WEST DEPTFORD	.00	.00	.00
NJD981142797	KEARNY STEEL CONTAINER	NEWARK	.53	.00	.00
NJD179164363	KMART FASHIONS	NORTH BERGEN	.47	.00	.00
NJD002501211	KONTES GLASS COMPANY	VINELAND	.00	.00	.00
NJD980766455	MAACO AUTO PAINTING	UNION	.35	.00	.00
NJD986615102	MERCK & CO INC	WHITEHOUSE STAT	1.04	.00	.00
NJD001626266	METRO LITHO INC	MOONACHIE	.00	.00	.00
NJD980790943	MOUNT HOLLY ARMORY	MOUNT HOLLY	.51	.00	.00
NJD084043264	NATIONAL PATENT DEVELOPMENT CORP	NEW BRUNSWICK	.97	.00	.00
NJD986607398	NAVIERAS, NPR, INC.	PORT ELIZABETH	.00	.00	.00
NJD986621134	NER DATA PRODUCTS INC	FRANKLINVILLE	.22	.00	.00
NJD986581825	NJ TRNPIKE LN 20C/TEXAS EASTRN TRAN	S BRUNSWICK	.14	.00	.00
NJP003401122	NJDEP/ER	NEWARK	.75	.00	.00
NJD052204864	OLD BRIDGE CHEMICALS INC	OLD BRIDGE	.00	.00	.00
NJD981561921	ONE HOUR CLEANERS	NUTLEY	.34	.00	.00
NJD986619351	OVERBROOK REGIONAL HIGH SCHOOL	PINE HILL	.33	.00	.00
NJD138008834	PARK RIDGE ELECTRIC DEPT	PARK RIDGE	.23	.00	.00
NJD981079296	PASSAIC VALLEY WATER COMM	LITTLE FALLS	.26	.00	.00
NJR000002568	PETER ORCINOLI PAPERDIRECT	SECAUCUS	.38	.00	.00
NJR000004135	RACLAUR INC	NUTLEY	.00	.00	.00
NJD000592139	REGION OIL	DOVER	.39	.00	.00

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NEW JERSEY

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO CANNOT BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- LESS THAN 1.1 TONS RCRA HAZARDOUS WASTE, AND
- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NJD986588945	RICHMOND INDUSTRIES INC.	METUCHEN	.11	.00	.00
NJD000768093	SAFETY-KLEEN CORP	NEWARK	.47	.00	.00
NJD986594141	SHELL SERVICE STATION	HOPELAWN	.52	.00	.00
NJD986609311	SITE 114 GARFIELD AVE SITE	JERSEY CITY	.00	.00	.00
NJD099295396	SQUIRE CORRUGATED CONTAINER	SOUTH PLAINFIEL	.00	.00	.00
NJ0000597617	STARLIGHT TRADING	NORTH BERGEN	.00	.00	.00
NJD011156650	STATE METAL INDUSTRIES INC	CAMDEN	.00	.00	.00
NJD002152205	THE OKONITE COMPANY	NORTH BRUNSWICK	.49	.00	.00
NJ3120507030	USDA APHIS PPQ	HOBOKEN	.00	.00	.00
NJD071630131	W.R. GRACE TREATMENT PLANT	WOODBURY	.00	.00	.00
NJD980785513	WARNER-LAMBERT COMPANY FLIGHT OPERA	MORRISTOWN	.40	.00	.00
NJD981872591	WECOM INC	GLASSBORO	1.09	.00	.00
NJD002486850	WILLING B WIRE CORP.	WILLINGBORO	.00	.00	.00
NJD986586741	0368-2978 SUNOCO SERVICE STATION	HAMILTON TWP	.00	.00	.00

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NEW MEXICO

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NMD000778597	ASARCO DEMING MILL	DEMING	38.48	85.00	.00
NM7572124454	CANNON AIR FORCE BASE	CANNON AIR FORC	97.76	.00	.00
NMD000708925	CHEVRON PRODUCTS CO./ALBQ. TERMINAL	ALBUQUERQUE	233.52	.00	.00
NMD980622773	EL PASO NATURAL GAS CO./ARCO-PREWIT	PREWITT	2,389.42	.00	.00
NMD052684578	GE AIRCRAFT ENGINES	ALBUQUERUQ	110.23	.00	.00
NMD089416416	GIANT REFINING CO.- BLOOMFIELD	BLOOMFIELD	188,264.66	.00	.00
NMD000333211	GIANT REFINING COMPANY-CINIZA	JAMESTOWN	222.66	.00	.00
NM6572124422	HOLLOMAN AIR FORCE BASE	HOLLOMAN AFB	161.84	65.00	.00
NMD000609339	INTEL CORPORATION	RIO RANCHO	9,368.30	.00	.00
NM9570024423	KIRTLAND AIR FORCE BASE	KIRTLAND AIR FO	77.85	56.00	.00
NM0890010515	LOS ALAMOS NATIONAL LABORATORY	LOS ALAMOS	1,372.58	176.05	.00
NMD980744551	MOTOROLA CERAMIC PRODUCTS	ALBUQUERQUE	540.03	.00	.00
NM8800019434	NASA JOHNSON SPACE CENTER	14MI E&6MI N OF	75.84	15,624.43	.00
NMD048918817	NAVAJO REFINING COMPANY	ARTESIA	378.50	.00	.00
NMD075088252	NEW MEXICO STATE UNIVERSITY/A-MOUNT	LAS CRUCES	19.48	265.00	.00
NM0001001320	NOVA BUS INCORPORATED	ROSWELL	44.25	.00	.00
NMD000709782	PHILIPS SEMICONDUCTORS	ALBUQUERQUE	261.97	.00	.00
NMD000792986	PHILLIPS PIPELINE CO. ALBQ. TERMINA	ALBUQUERQUE	88.20	.00	.00
NMD002208627	RINCHEM COMPANY, INC.	ALBUQUERQUE	31.36	.00	.00
NMD981597123	SAN JUAN COAL CO.- SAN JUAN MINE	WATERFLOW	16.59	.00	.00
NM5890110518	SANDIA NATIONAL LABORATORIES	ALBUQUERQUE	429.77	1,524.00	.00
NMD986676955	TRANSWESTERN PIPELINE CO.-COMP.STA.	ROSWELL	36.08	.00	.00
NMD980621197	UNIVERSITY OF NEW MEXICO	ALBUQUERQUE	29.32	152.00	.00
NM4890139088	US DOE WASTE ISOLATION PILOT PLANT	CARLSBAD	66.51	.00	.00
NM2750211235	WHITE SANDS MISSILE RANGE	WHITE SANDS MIS	64.71	241.00	.00

Note: Please refer to the introduction for an explanation of this list.

NEW MEXICO

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NM0000303255	AMERADA HESS CORP. - MONUMENT	MONUMENT	3.02	.00	.00
NMD986683464	ATSF RAILWAY CO	CLVOIS	2.70	.00	.00
NM0000992347	ATSF RAILWAY CO	LAS VEGAS	3.55	.00	.00
NMD035677244	BROTHERS PLATING CO., INC.	ALBUQUERQUE	3.20	.00	.00
NMP360075463	EL PASO NATURAL GAS CO - LAGUNA STA	NEW LAGUNA	3.89	.00	.00
NMD980622989	ETHICON ENDO-SURGEY	ALBUQUERQUE	4.05	.00	.00
NMD035686823	GULTON DATA SYSTEMS	ALBUQUERQUE	5.11	.00	.00
NMD000610303	HONEYWELL DEFENSE AVIONICS SYSTEMS	ALBUQUERUQE	11.30	.00	.00
NMD069892594	NOVA BUS INCORPORATED	ROSWELL INDUSTR	1.88	.00	.00
NMD981144132	NOVA BUS INCORPORATED	ROSWELL	3.10	.00	.00
NMD982552945	PHARMACIA INC. ONCOLOGY DIV.	ALBUQUERQUE	6.47	.00	.00
NMD035806405	PHELPS DODGE TYRONE, INC.	TYRONE	1.28	.00	.00
NMD007112345	RUST TRACTOR COMPANY	ALBUQUERQUE	9.68	.00	.00
NMD000804294	SAFETY-KLEEN CORP.	ALBUQUERQUE	5.55	.00	.00
NMD083212332	SPARTON TECHNOLOGY, INC.-COORS FACI	ALBUQUERQUE	2.36	.00	.00
NMD986667186	TRANSWESTERN PIPELINE CO.-COMP.STA.	THOREAU	4.18	.00	.00
NMD986676922	TRANSWESTERN PIPELINE CO./WT-1 COMP	CARLSBAD	1.82	.00	.00

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NEW MEXICO

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO CANNOT BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- LESS THAN 1.1 TONS RCRA HAZARDOUS WASTE, AND
- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NMD980698849	SAFETY-KLEEN CORP	FARMINGTON	.76	.00	.00
NM0000196519	TRANSWESTERN PIPELINE CO.	PORTALES	.57	.00	.00

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NEW YORK

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NYD059372664	A SCHONBEK & CO INC	PLATTSBURGH	20.38	.00	.00
NYR000016212	A. TARRICONE INC.	YONKERS	204.75	.00	.00
NYD077508091	AAR TECHNICAL SERVICE CENTER	GARDEN CITY	58.99	.00	.00
NYD982183857	ABB DAIMLER-BENZ	ELMIRA HEIGHTS	1,098.33	.00	.00
NYD986909026	ACCENT STRIPE INC	ORCHARD PARK	30.29	.00	.00
NYR000014753	ACCESSOCRAFT PRODUCTS INC	NEW ROCHELLE	8.17	10,381.00	.00
NYD981082209	ACCO USA INC	LONG ISLAND CIT	23.88	.00	.00
NY0000036830	ACCURATE WEB INC	CENTRAL ISLIP	14.05	.00	.00
NYD072366453	ACTION ANODIZING & PLATING CORP	COPIAGUE	114.65	.00	.00
NYD001707025	ACTION PACKAGING CORP	BROOKLYN	19.27	.00	.00
NYD986974491	ACTS TESTING LABS INC	BUFFALO	1.33	165.55	.00
NYD049207236	ADCHEM CORPORATION	WESTBURY	19.11	.00	.00
NYD001530138	ADEMCO	SYOSSET	28.59	.00	.00
NYD002204584	ADVANCE SCREW PRODUCTS CORP	ROCHESTER	28.76	.00	.00
NYD075801746	ADVANCED COATING TECHNIQUES INC	N BABYLON	41.30	.00	.00
NYD986913952	ADVANCED INTERCONNECTION TECHNOLOGY	ISLIP	21.23	.00	.00
NYD982744658	ADVANCED PRINTED CIRCUITS, INC.	HOLBROOK	27.27	.00	.00
NYD002040921	AIL SYSTEMS INC	DEER PARK	25.43	.00	.00
NYD981081011	AIR PRODUCTS/GSF ENERGY INC	STATEN ISLAND	64.78	.00	.00
NYD982181521	AIRCRAFT FINISHING CORPORATION	NORTH BABYLON	43.10	.00	.00
NYD043815158	AKZO NOBEL CHEMICALS INC	BURT	73.18	100.00	.00
NYD056301104	AKZO NOBEL CHEMICALS INC	ARDSLEY	46.64	.00	.00
NYD986944973	AKZO NOBEL CHEMICALS INC	DOBBS FERRY	14.25	180.00	.00
NYD030215529	AL TECH SPECIALTY STEEL CORP	DUNKIRK	369.90	.00	.00
NYD060545209	AL TECH SPECIALTY STEEL CORPORATION	WATERVLIET	825.08	30.00	.00
NYD020662169	ALBANY MEDICAL CENTER	ALBANY	23.31	.00	.00
NYD100368620	ALBANY PUBLIC SCHOOL DISTRICT PS 23	ALBANY	120.48	.00	.00
NYD980645774	ALBER EINSTEIN COLLEGE OF MEDICINE	BRONX	10.31	272.00	.00
NYD001213099	ALBERTS PLATING WORKS INC	BROOKLYN	62.01	.00	.00
NYD051853216	ALEXANDER'S REGO PARK	REGO PARK	3,049.50	.00	.00
NYD094174554	ALLEGHENY LUDLUM CORPORATION	LOCKPORT	391.29	.00	.00
NYD002081230	ALLIED SIGNAL INC BRAKING SYSTEMS	GREEN ISLAND	277.91	.00	.00
NYD000632315	ALLIED SIGNAL INC BUFFALO RESEARCH	BUFFALO	153.13	.00	.00
NYD980646434	ALLIED SIGNAL LAMINATE SYSTEMS	HOOSICK FALLS	29.07	.00	.00
NYD002232304	ALUMINUM COMPANY OF AMERICA	MASSENA	4,534.89	.00	.00
NY0000622449	AMERADA HESS - SYRACUSE TERMINAL	WARNERS	18.97	.00	.00
NYD046882247	AMERADA HESS CORP	RENSSELAER	15.42	.00	.00
NYD000691816	AMERADA HESS CORPORATION	VESTAL	128.20	.00	.00
NYD000707760	AMERADA HESS CORPORATION	BRONX	67.14	.00	.00
NYD986876167	AMERAIL HORNELL APPARATUS SHOP	HORNELL	59.10	.00	.00
NYD980758197	AMERAIL HORNELL CAR SHOP	HORNELL	37.80	.00	.00
NYD981555782	AMERAIL HORNELL MOTOR SHOP	HORNELL	18.70	.00	.00
NYD002127165	AMERICAN AXLE & MANUFACTURING INC	BUFFALO	958.56	.00	.00
NYD045201688	AMERICAN BOARD COMPANY	VESTAL	196.58	.00	.00
NYD986887123	AMERICAN HEATSET EAST INC	RONKONKOMA	18.40	.00	.00
NYD002204741	AMERICAN PACKAGING CORP	ROCHESTER	101.20	.00	.00
NYD986900215	AMERICAN PRECISION INDUSTRIES	ARCADE	15.35	.00	.00
NYD009901059	AMERICAN TECHNICAL CERAMICS	HUNTINGTON STAT	37.10	.00	.00
NYD002066330	AMERICAN THERMOSTATE SUPERFUND SITE	CATSKILL	999.28	.00	.00
NYD986984011	AMOCO-PHOENIX SERVICE STATIONS INC	NORTH BABYLON	16.56	.00	.00
NYD002044196	AMP-AKZO COMPANY RIVERHEAD CIRCUITS	AQUEBOGUE	160.14	.00	.00
NYD001827633	AMPHENOL CORP	SIDNEY	227.66	21.00	.00
NYD001360155	AMSTERDAM COLORWORKS INC	BRONX	165.92	.00	.00
NYD987031473	AMTRAK NATIONAL RAILROAD PASSENGER	ASTORIA QUEENS	779.52	.00	.00
NYD002218394	ANCHOR GLASS CONTAINER PLANT #41	ELMIRA HEIGHTS	27.10	.00	.00

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NEW YORK

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- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NYD010779098	ANITEC INTERNATIONAL PAPER	BINGHAMTON	110.30	200.00	.00
NYD002238582	ANOPLATE CORPORATION	SYRACUSE	116.83	.00	.00
NYD001635622	ARKAY PACKAGING CORPORATION	HAUPPAUGE	13.97	.00	.00
NYD000362871	ARTCO CHEMICAL INC	COHOES	5.65	1,480.00	.00
NYD046877775	ASHLAND CHEMICAL CO	RENSSELAER	39.27	.00	.00
NYD049199581	ASTRO ELECTROPLATING INC	FARMINGDALE	73.00	.00	.00
NYD086225596	AT&T NASSAU METALS	STATEN ISLAND	126.00	40,000.00	.00
NYD095240610	ATLANTIC WOOD INDUSTRIES, INC.	ATHENS	14.81	.00	.00
NYP000918995	ATLAS PLASTICS INC	ORCHARD PARK	15.42	.00	.00
NYD066785650	AUBURN STEEL CO INC	AUBURN	7,234.20	.00	.00
NYD002204543	AUGAT/LRC ELECTRONICS INC	HORSEHEADS	210.05	.00	.00
NYD001483494	AVON PRODUCTS INC	SUFFERN	81.97	8.00	.00
NYD002038453	AWARD PACKAGING CORP	GARDEN CITY	20.60	.00	.00
NYD002081396	AYERST LABORATORIES INC	ROUSES POINT	645.18	90.00	.00
NYD002227551	AZON CORPORATION	JOHNSON CITY	73.70	.00	.00
NYD002126878	B & B PLASTICS DIV METAL CLADDING I	LOCKPORT	18.35	.00	.00
NYD002239598	B F GOODRICH AEROSPACE SIMMONDS PRE	NORWICH	162.50	.00	.00
NYD987039203	BAB RADIOLOGICAL PC	HUNTINGTON	14.72	.00	.00
NYD041992728	BALCHEM CORPORATION	SLATE HILL	7.41	113.38	.00
NYD981132558	BANKNOTE CORP OF AMERICA	SUFFERN	31.11	.00	.00
NYD001291921	BARKER BROS INC	RIDGEWOOD	63.75	.00	.00
NYD044837086	BARR LABORATORES	POMONA	21.91	50.00	.00
NYD093249688	BASF CORPORATION	RENSSELAER	772.14	9,770.00	.00
NYD002207744	BAUSCH & LAUMB INCORPORATED	ROCHESTER	65.07	.00	.00
NYD002207751	BAUSCH & LOMB INCORPORATED	ROCHESTER	32.71	60.00	.00
NY0001002351	BEDFORD FREE LIBRARY	BEDFORD	13.20	.00	.00
NYR000004861	BEDFORD SHOPPING ARCADE	BEDFORD	14.05	.00	.00
NYD002256519	BESTWAY ENTERPRISES INC	CORTLAND	150.69	.00	.00
NYD002134880	BETHLEHEM STEEL CORP	LACKAWANNA	270.47	.00	.00
NYD981180664	BOROUGH OF MANHATTAN COMMUNITY COLL	NEW YORK	4.18	30.00	.00
NYD002204758	BRAINERD MANUFACTURING COMPANY	EAST ROCHESTER	21.29	.00	.00
NY0000884759	BREAD & CHEESE HOLLOW RD VIADUCT	EAST NORTHPORT	19.85	.00	.00
NY0001000165	BRENTSUN REALTY	BRENTWOOD	42.60	.00	.00
NYD013654082	BRIGHT BAY LINCOLN MERCURY	BAY SHORE	24.66	.00	.00
NYD002230902	BRISTOL-MYERS SQUIBB COMPANY	EAST SYRACUSE	962.49	.00	.00
NYD982796377	BRONX-WHITESTONE BRIDGE	NEW YORK	116.17	.00	.00
NY7890008975	BROOKHAVEN NATIONAL LABORATORY	UPTON	55.76	8.10	.00
NYD074333501	BROOKLYN COLLEGE-CUNY	BROOKLYN	3.02	125.00	.00
NY0000001107	BROOKLYN NAVY YARD COGENERATION PRO	BROOKLYN	48.20	.00	.00
NYD980534259	BROOKLYN PORT AUTHORITY MARINE TERM	BROOKLYN	66.25	.00	.00
NYD987017829	BROWNING-FERRIS IND OF NEW YORK INC	BRONX	332.80	.00	.00
NYD981878010	BRUNNER INC	MEDINA	27.04	.00	.00
NYD010783967	BUCKBEE-MEARS CORTLAND	CORTLAND	2,986.10	.00	.00
NYD981079627	BUFFALO AND FORT ERIE PUBLIC BRDG A	BUFFALO	143.89	.00	.00
NYD980653109	BUFFALO CHINA INC	BUFFALO	48.21	.00	.00
NYD986995843	BUFFALO MUNICIPAL HOUSING AUTHORITY	BUFFALO	38.30	.00	.00
NYD986995868	BUFFALO MUNICIPAL HOUSING AUTHORITY	BUFFALO	54.80	.00	.00
NYD064337298	C & D CHARTER POWER SYSTEMS	HUGUENOT	150.46	.00	.00
NYD987032620	C P WARD INC	ROCHESTER	24.28	.00	.00
NYD063784797	C R BARD INC	GLENS FALLS	43.60	.00	.00
NY0001020379	C/S ASSOCIATES LIMITED PARTNERSHIP	NEWBURGH	173.20	.00	.00
NYD093251056	CAE SCREENPLATES INC	GLENS FALLS	53.85	.00	.00
NYD002233997	CAMDEN WIRE CO INC	CAMDEN	25.79	.00	.00
NYD980593024	CAMDEN WIRE CO INC	CAMDEN	25.13	.00	.00
NYD071486583	CANISIUS COLLEGE	BUFFALO	.25	100.00	.00

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NEW YORK

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- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NYD986939080	CARBO INDUSTRIES	LAWRENCE	19.70	.00	.00
NYD000829606	CARBORUNDUM ABRASIVES COMPANY	NIAGARA FALLS	36.68	.00	.00
NYD981138647	CARBORUNDUM CORPORATION	NIAGARA FALLS	4,279.28	.00	.00
NYD981079213	CARMEL SHOP RITE	CARMEL	41.87	.00	.00
NYD002015766	CARNEGIE INDUSTRIES	UNIONVILLE	82.06	.00	.00
NYD001317072	CARRIER CORPORATION	SYRACUSE	157.70	.00	.00
NYD043070663	CASE-HOYT PRINTING CORP	CHURCHVILLE	17.71	.00	.00
NYD010757268	CAYUGA COMMUNITY COLLEGE	AUBURN	.28	60.00	.00
NYD080336241	CECOS INTERNATIONAL INC	NIAGARA FALLS	5,431.00	.00	.00
NY0000188201	CEDAR GRAPHICS INC	RONKONKOMA	119.29	.00	.00
NYD982534190	CELLO-PACK CORPORATION	CHEEKTOWAGA	116.80	.00	.00
NYD986899888	CENTRAL SHOPS	LONG ISLAND CIT	13.30	.00	.00
NYD002066173	CERAMASEAL	NEW LEBANON	54.46	.00	.00
NYD981082654	CHARLES GIBSON SITE/ OLIN CORPORATI	TOWN OF NIAGARA	237.45	.00	.00
NYD002100493	CHAUTAUQUA HARDWARE CORPORATION	JAMESTOWN	111.80	.00	.00
NYD000691154	CHEMCENTRAL CORPORATION/TONAWANDA	TONAWANDA	53.47	.00	.00
NYD050420512	CHEMPRENE INC	BEACON	21.73	.00	.00
NYD002230977	CHICAGO PNEUMATIC TOOL COMPANY	FRANKFORT	175.34	.00	.00
NYD002215507	CHOWNING REGULATOR CORPORATION	CORNING	49.61	.00	.00
NYD046337549	CHROMALLOY NEW YORK	ORANGEBURG	46.85	.00	.00
NYD041975715	CHROMIUM PLATING & POLISHING CORP	BROOKLYN	43.00	.00	.00
NYD013238480	CIBA GEIGY CORP	SUFFERN	20.96	190.00	.00
NYD001221845	CIBA-GEIGY CORPORATION	ARDSLEY	22.49	460.00	.00
NYD000818419	CIBA-GEIGY/SECURE LANDFILL	QUEENSBURY	107.20	.00	.00
NYD000707927	CINTICHEM, INC.	TUXEDO	129.75	.00	.00
NY0000187260	CIRCA PHARMACEUTICALS INC	COPIAGUE	11.16	182.00	.00
NYD089759658	CIRCUIT TECHNIQUES, INC.	YONKERS	264.22	.00	.00
NYD088658968	CITGO PETROLEUM CORP	VESTAL	16.26	.00	.00
NYR000003111	CITY OF NEW ROCHELLE	NEW ROCHELLE	520.12	.00	.00
NYR000006346	CITY OF NEW ROCHELLE	NEW ROCHELLE	144.67	.00	.00
NYR000005405	CITY OF ROCHESTER	ROCHESTER	35.00	.00	.00
NYD000887802	CLARENCE CENTRAL HIGH SCHOOL	CLARENCE	.78	210.00	.00
NYD980785190	CLARKSON UNIVERSITY	POTSDAM	2.48	57.00	.00
NYD982273955	CMP PUBLICATIONS, INC	MANHASSETT	58.90	.00	.00
NYD076673573	COASTAL OIL NEW YORK INC	NEW WINDSOR	16.80	.00	.00
NYD001326248	COLUMBIA CEMENT CO., INC.	FREEPORT	39.97	.00	.00
NYD080481765	COLUMBIA GREENE COMMUNITY COLLEGE	HUDSON	.90	716.42	.00
NYD048779326	COLUMBIA UNIVERSITY	NEW YORK	35.97	346.00	.00
NYD980534192	COLUMBIA UNIVERSITY	NEW YORK	11.17	60.00	.00
NYD980768626	COLUMBIA UNIVERSITY LAMONT-DOHERTY	PALISADES	2.36	140.00	.00
NYR000008110	COLUMBUS PROPERTIES CORP	MOUNT VERNON	1.81	1,000.00	.00
NYD002211415	COMBUSTION ENGINEERING	ROCHESTER	1,753.53	.00	.00
NYP000795039	COMMERCIAL DECAL INC	MT VERNON	28.44	.00	.00
NYD986991792	COMPUTER ASSOCIATES	ISLANDIA	22.85	.00	.00
NYD000706218	CON EDISON -	BROOKLYN	1,680.86	.00	.00
NYD987010964	CON EDISON -	FLUSHING	202.00	.00	.00
NYD137976247	CON EDISON - HELLGATE STATION	BRONX	847.80	.00	.00
NYP000921866	CON EDISON - 31ST ST & 7TH AVE	NEW YORK	76.30	.00	.00
NYD982177743	CON EDISON W 28TH ST SERVICE CENTER	NEW YORK	1,579.90	.00	.00
NYD080433592	CON EDISON-HUDSON AVE GENERATING ST	BROOKLYN	284.40	.00	.00
NYD003917960	CON EDISON-RAVENSWOOD GENERATING ST	LONG ISLAND CIT	16.60	.00	.00
NYD000706275	CON EDISON-59TH ST GENERATING STATI	NEW YORK	100.00	.00	.00
NYD003939824	CON EDISON-74TH ST GENERATING STA	NEW YORK	86.60	.00	.00
NYD096297544	CONAP INC	OLEAN	96.35	.00	.00
NYD982721649	CONCEPT PACKAGING INC	NEWBURGH	15.80	.00	.00

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- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NYD991290800	CONEY ISLAND YARD	BROOKLYN	415.50	.00	.00
NYD986870558	CONKLIN LIMITED	SYRACUSE	126.19	.00	.00
NY0000202358	CONNECTION TECHNOLOGY INC	LINDENHURST	45.67	.00	.00
NYD000810986	CORNELL UNIV ENV MENTAL HLTH & SFTY	ITHACA	36.94	1,983.00	.00
NYD986964054	CORNELL UNIVERSITY ENV COMPLIANCE O	ITHACA	53,456.87	.00	.00
NYD020396438	CORNELL UNIVERSITY MEDICAL COLLEGE	NEW YORK	10.09	109.00	.00
NYD001307735	CORNING INC-DECKER BUILDING	CORNING	26.84	.00	.00
NYD000824367	CORNING INCORPORATED	ERWIN	174.35	40.00	.00
NYD000824417	CORNING INCORPORATED	CORNING	51.20	.00	.00
NYD042352658	CORNING INCORPORATED	CANTON	28.77	.00	.00
NYD067919183	CORNING INCORPORATED	PAINTED POST	29.58	317.00	.00
NYD987036290	CORNING INCORPORATED	PAINTED POST	296.62	.00	.00
NYD000824425	CORNING INCORPORATED FALL BROOK PLA	CORNING	1,103.00	.00	.00
NYD000824433	CORNING INCORPORATED-ERWIN CERAMICS	ERWINS	420.50	.00	.00
NYD000824359	CORNING INCORPORATED-STEUBEN PLANT	CORNING	47.73	.00	.00
NYD013250618	COYNE TEXTILE SERVICES	SYRACUSE	314.59	.00	.00
NYR000012914	CRAIG HOUSE HOSPITAL	BEACON	17.00	.00	.00
NY0000196501	CROPSEY AVE BRIDGE OVER CONEY ISLAN	BROOKLYN	57.12	.00	.00
NY0000186296	CROSS BAY BLVD/NYC DOT	QUEENS	43.00	.00	.00
NYD002227973	CROUSE-HINDS DIVISION	SYRACUSE	57,761.87	.00	.00
NYD071596449	CRUCIBLE SPECIALITY METALS DIVISION	SOLVAY	1,064.20	.00	.00
NYD986942233	CUMBERLAND FARMS #3120	SCHENECTADY	22.83	.00	.00
NYD002106599	CURTIS SCREW CO INC	BUFFALO	126.98	.00	.00
NYD000128496	CUTLER-HAMMER	HORSEHEADS	75.38	.00	.00
NYD049836679	CWM CHEMICAL SERVICES, INC.	MODEL CITY	143,055.40	208,460,512.00	.00
NYD002214740	CYPRESS PACKAGING	ROCHESTER	57.20	.00	.00
NYD982189086	DANBURY PHARMACAL, INC	CARMEL	39.90	20.00	.00
NY0000277277	DARBY DRUG CO., INC.	WEST HEMPSTEAD	17.00	.00	.00
NYD002050177	DAYTON T BROWN INC	BHEMIA	34.61	22.00	.00
NYD002067932	DECORA MANUFACTURING	FORT EDWARD	136.34	.00	.00
NYD045658333	DECORATIVE INDUSTRIES	SLOATSBURG	36.64	.00	.00
NYD982721383	DEER HILLS RADIOLOGICAL PC	BAYSHORE	16.12	.00	.00
NYD001293166	DEL LABORATORIES INC	FARMINGDALE	82.30	.00	.00
NYD071084826	DELAWARE & HUDSON RAILWAY CO	ONEONTA	14.98	.00	.00
NYD002126852	DELPHI HARRISON THERM SYS-W LOCKPOR	LOCKPORT	301,624.57	.00	.00
NYD980592901	DELPHI HARRISON THERMAL SYSTEMS-WWT	LOCKPORT	492.50	.00	.00
NYD039288774	DEPARTMENT OF THE NAVY	BROOKLYN	28.75	.00	.00
NY2170084485	DEPARTMENT OF THE NAVY	STATEN ISLAND	1,287.89	.00	.00
NYD986972255	DERMATOPATHOLOGY ASSC OF NY PC	NEW ROCHELLE	31.25	.00	.00
NYD002110864	DERRICK CORPORATION	BUFFALO	13.33	.00	.00
NYD057722019	DEUTSCH RELAYS, INC.	EAST NORTHPORT	163.30	1,220.00	.00
NYD001274786	DEXTER CHEMICAL CORPORATION	BRONX	20.66	2.00	.00
NYD042569079	DEXTER ELECTRONIC MATERIALS DIVISIO	OLEAN	62.01	.00	.00
NY2570024438	DFSP VERONA	VERONA	15.43	.00	.00
NYD041868829	DIAL ACE UNIFORM SUPPLY CO INC	DEER PARK	18.00	.00	.00
NYD067902304	DIAMOND PACKAGING	ROCHESTER	21.78	.00	.00
NYD067532580	DIAZ CHEMICAL CORP	HOLLEY	582.23	.00	.00
NYD980651210	DIELECTRIC LABORATORIES INC	CAZENOVIA	37.13	.00	.00
NYD986867778	DINAIRE CORP	BUFFALO	13.47	.00	.00
NYD980654081	DIRECT PRESS/MODERN LITHO	HUNTINGTON STAT	71.00	.00	.00
NYD980653711	DISC GRAPHICS	HAUPPAUGE	16.46	.00	.00
NYD003930849	DISTILLATION PRODUCTS INDUSTRIES	ROCHESTER	113,532.16	.00	.00
NYD041427808	DOUGLAS J MARQUES INC	DEER PARK	34.10	.00	.00
NYD002226124	DOVATRON INT	KIRKWOOD	56.85	.00	.00
NYD002100352	DOWCRAFT CORP	FALCONER	14.01	.00	.00

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NYD063638670	DRESSER-RAND	WELLSVILLE	93.80	.00	.00
NYD002123644	DRESSER-RAND, TURBO PRODUCTS DIV	OLEAN	45.69	.00	.00
NYD002111078	DUNLOP TIRE CORPORATION	TONAWANDA	19.78	.00	.00
NYD000339176	DUNMORE CORPORATION	BREWSTER	78.20	.00	.00
NYD002123503	DUPONT	NIAGARA FALLS	207,838.78	23.00	.00
NYD045604964	DUPONT	ROCHESTER	36.19	.00	.00
NYD980536288	DUPONT	NIAGARA FALLS	27,081.00	.00	.00
NYD991292079	DUPONT PHOTOMASKS INC	POUGHKEEPSIE	28.86	.00	.00
NYD000799122	DYNO NOBEL INC	PORT EWEN	135.66	.00	.00
NYD001945039	E B METAL INDUISTRIES INC	WHITEHALL	18.12	.00	.00
NYD002056943	E C SUMEREAU & SONS INC	HUNTINGTON STAT	240.70	.00	.00
NYD002233757	E H TITCHENER & CO	BINGHAMTON	19.53	.00	.00
NYD002103513	E.I. DUPONT DDE NEMOURS CO INC	BUFFALO	135.44	.00	.00
NYD001287986	EAGLE ELECTRIC MFG INC	LONG ISLAND CIT	63.90	.00	.00
NYD991290677	EAST NEW YORK COMPLEX / NYCTA	BROOKLYN	61.00	.00	.00
NYD000877894	EASTERN NY CORRECTIONAL FACILITY	NAPANOCH	20.90	.00	.00
NYD980592497	EASTMAN KODAK COMPANY	ROCHESTER	40,688.13	20,179,865.00	1,806.00
NYD000809327	EASTMAN KODAK COMPANY-ELMGROVE PLAN	ROCHESTER	274.42	.00	.00
NY0000330118	ECOLOGY AND EVIROMENT, INC.	LANCASTER	12.16	90.00	.00
NYD005936075	EDEN RECYCLING INCOPORATED	EDEN	18.30	.00	.00
NYD001876440	EDO CORPORATION, MARINE & AIRCRAFT	COLLEGE POINT	46.90	.00	.00
NYD000632125	EI DUPONT DE NEMOURS & CO INC	ROCHESTER	44.50	.00	.00
NYD067905752	ELDERLEE INC	OAKS CORNERS	28.30	.00	.00
NYD001612423	ELDRE CORPORATION	ROCHESTER	26.34	.00	.00
NYD013415849	ELECTRONIC DEVICES INC	YONKERS	37.70	.00	.00
NYD002218436	ELF ATOCHEM N.A. INC	PIFFARD	1,509.84	.00	.00
NYD161327614	EMSIG MANUFACTURING CORPORATION	HUDSON	58.26	.00	.00
NYD982795221	ENBI CORP	WEST HENRIETTA	26.64	.00	.00
NYD091581868	EPNER TECHNOLOGY INC	BROOKLYN	16.30	.00	.00
NYD980211783	ERIE COMMUNITY COLLEGE NORTH CAMPUS	WILLIAMSVILLE	1.45	63.00	.00
NYD002068054	ESPEY MFG. & ELECTRONICS CORPORATIO	SARATOGA SPRING	12.88	500.00	.00
NYD000339309	ESSELTE PENDA FLEX CORP BOORUM & PE	SYRACUSE	15.58	.00	.00
NYD002234763	EVANS CHEMETICS/HAMPSHIRE CHEM CORP	WATERLOO	32.00	.00	.00
NYD982183329	EXCEL ELECTRONICS	BOHEMIA	44.04	.00	.00
NYD002011450	EXCELISOR TRANSPARENT BAG MFG CORP	YONKERS	86.83	.00	.00
NYD986953115	EXXON CO USA #31256	WEST HURLEY	16.90	.00	.00
NYD986955771	EXXON CO USA #31460	BRONX	43.60	.00	.00
NYD986953156	EXXON CO USA #32349	VALHALLA	26.50	.00	.00
NYD986959096	EXXON CO USA #37141	NEW HYDE PARK	28.30	.00	.00
NYD986949428	EXXON CO USA #37167	ROSLYN	33.20	.00	.00
NYD986947331	EXXON CO USA #37811	NEW YORK	70.60	.00	.00
NYD980592570	FENLEY & NICOL ENVIRONMENTAL INC	DEER PARK	15.59	.00	.00
NYD980508261	FERDULA LANDFILL;SPORTING GOODS PRO	FRANKFORT	1,768.65	.00	.00
NYD002081024	FINCH, PRUYN & CO INC	GLENS FALLS	13.84	.00	.00
NYD003926805	FINGER LAKES PACKAGING CO INC	LYONS	78.87	.00	.00
NYR000002782	FIREGOM INC	DEER PARK	20.00	.00	.00
NYD002219756	FISONS CORPORATION	ROCHESTER	29.10	135.00	.00
NYD982740433	FLAGSHIP AIRLINES	LATHAM	84.36	.00	.00
NYD002100568	FLEXO TRANSPARENT INC	BUFFALO	19.30	.00	.00
NY1141731199	FLOYD BENNETT FIELD GAS STA BLDG 26	BROOKLYN	94.61	.00	.00
NYD001264738	FLUSH METAL PARTITIONS INC	MASPETH	21.98	.00	.00
NYD002126845	FMC CORPORATION	MIDDLEPORT	367.14	648,375.50	.00
NYD074033101	FMC CORPORATION	TONAWANDA	473.79	.00	.00
NYD115502858	FORDHAM UNIVERSITY/CHEMISTRY	BRONX	1.65	3,307.61	.00
NYD001288281	FOREST LABORATORIES INC	INWOOD	32.97	.00	.00

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NYD101196046	FORMER JPF COACH AUTO BODY	SYOSSET	55.80	.00	.00
NYR000014415	FORT PLAIN CENTRAL SCHOOL DISTRICT	FORT PLAIN	.30	592.00	.00
NYD052783396	FOSROC INC	PLAINVIEW	23.13	.00	.00
NYD002205599	FOSTER WHEELER ENERGY INTERNATIONAL	DANSVILLE	21.30	.00	.00
NYR000015537	FOX MEADOW AKA FOX RUN/FDIC AS	MUTTONTOWN	.63	1,251.04	.00
NYD982792814	FRANKS VACUUM TRUCK SERVICE INC	NIAGARA FALLS	21.30	.00	.00
NYD001321611	FREQUENCY ELECTRONICS INC	MITCHEL FIELD	5.70	767.00	.00
NYD092369388	FRF CIRCUITS INC	DEER PARK	53.25	.00	.00
NY0000989434	FRIEDRICHSOHNS COOPERAGE	WATERFORD	176.61	.00	.00
NYD043815703	FRONTIER CHEMICAL WASTE PROCESS	NIAGARA FALLS	730.92	.00	.00
NYD981138605	FUJISAWA USA INC	GRAND ISLAND	14.10	.00	.00
NYR000007146	FULTON FERRY LIQUIDATORS, INC.	BROOKLYN	15.41	.00	.00
NYD982797136	FULTON TERM SITE REMEDIAL ACTION TR	FULTON	112.90	.00	.00
NYD000829598	FURON-HOOSICK FALLS FACILITY	HOOSICK FALLS	32.23	.00	.00
NYD001270867	FYN PAINT & LAQUER CO	BROOKLYN	17.51	.00	.00
NYD002217834	G. W. LISK COMPANY INC.	CLIFTON SPRINGS	43.02	.00	.00
NYD002210920	GARLOCK INC	PALMYRA	21.23	6.00	.00
NY0000939330	GAS TURBINE CORPORATION	JAMAICA	89.63	.00	.00
NYD066832023	GE PLASTICS-SELKIRK OPERATION	SELKIRK	7,383.00	.00	.00
NYD002084135	GENERAL ELECTRIC COMPANY	SCHENECTADY	195.24	.00	.00
NYD002084192	GENERAL ELECTRIC COMPANY	SCHENECTADY	35.91	.00	.00
NYD002231272	GENERAL ELECTRIC COMPANY	AUBURN	289.21	.00	.00
NYD093256063	GENERAL ELECTRIC COMPANY	FORT EDWARD	186.77	.00	.00
NYD071094197	GENERAL ELECTRIC CORPORATE R&D	NISKAYUNA	244.81	1,600.00	.00
NYD001230341	GENERAL GALVANIZING & SUPPLY CO. IN	BRONX	44.35	.00	.00
NYD000348474	GENERAL INSTRUMENT CORPORATION	WESTBURY	395.80	.00	.00
NYD002045466	GENERAL INSTRUMENT CORPORATION	HICKSVILLE	22.89	.00	.00
NYD002026565	GENERAL MOTORS CORP	NORTH TARRYTOWN	469.20	.00	.00
NYD002215234	GENERAL MOTORS CORP	ROCHESTER	229.79	.00	.00
NYD057939506	GENERAL RAILWAY SIGNAL CORPORATION	ROCHESTER	23.16	.00	.00
NYD982721656	GENERAL SUPER PLATING CO INC	EAST SYRACUSE	266.90	.00	.00
NY0000081893	GENOVESE DRUG STORE #137	ISLANDIA	23.08	.00	.00
NY0000040212	GENOVESE DRUG STORE #28	SELDEN	13.41	.00	.00
NYD986987675	GENOVESE DRUG STORES INC	MOUNT SINAI	14.45	.00	.00
NYD054067756	GEORGIA PACIFIC CORP	WARWICK	136.92	.00	.00
NYD986969806	GEORGICA SERVICES LTD	EAST HAMPTON	15.85	.00	.00
NYD981870868	GETTY PETROLEUM CORP	WEST BRENTWOOD	21.00	.00	.00
NYD982791857	GETTY PETROLEUM CORP	ST JAMES	15.00	.00	.00
NYD987003787	GETTY PETROLEUM CORP	OYSTER BAY	20.00	.00	.00
NYD987012481	GETTY PETROLEUM CORP	SYOSSET	20.00	.00	.00
NYD987032232	GETTY PETROLEUM CORP	SCOTIA	20.00	.00	.00
NYR000012963	GETTY PETROLEUM CORP	HEWLETT	20.55	.00	.00
NYR000012989	GETTY PETROLEUM CORP	CEDARHURST	40.27	.00	.00
NYR000014548	GETTY PETROLEUM CORP	LYNBROOK	60.00	.00	.00
NYR000014571	GETTY PETROLEUM CORP	EAST MEADOW	40.00	.00	.00
NYR000014589	GETTY PETROLEUM CORP	BAYSHORE	58.42	.00	.00
NYD089802995	GETTY TERMINALS CORP	BRENTWOOD	17.66	.00	.00
NYD013726443	GIBRALTAR STEEL CORPORATION	BUFFALO	36.40	.00	.00
NYD002205755	GLEASON WORKS	ROCHESTER	85.18	.00	.00
NYD001231661	GLOSS-FLO CORPORATION	BROOKLYN	94.27	.00	.00
NYD981877004	GMC-DELPHAI ENERGY & ENGINE MGMT SY	WEST HENRIETTA	90.50	.00	.00
NYD047683776	GOODMAN BROS. STEEL DRUM CO. INC.	BROOKLYN	45.30	.00	.00
NYD986871432	GOTHAM INK AND COLOR COMPANY	STONY POINT	67.40	.00	.00
NYD002225100	GOULDS PUMPS INC ENGINEERED PRODUCT	SENECA FALLS	69.90	.00	.00
NYD986947034	GRAND BASKET CO INC	MASPETH	13.82	.00	.00

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NYD001560879	GRAPHITE METALLIZING CORPORATION	YONKERS	39.13	420.00	.00
NYD002040277	GREAT NECK SAW MFGRS INC	MINEOLA	38.20	.00	.00
NYD982736563	GREATNECK SCHOOLS-SOUTH	GREAT NECK	1.80	492.00	.00
NYD981562739	GREEN BUS LINES INC	JAMAICA	18.10	.00	.00
NYD002105849	GREIF BROS CORPORATION	NIAGARA FALLS	22.12	.00	.00
NY4571924451	GRIFFISS AFB	GRIFFISS AFB	174.51	22.00	.00
NYD002047967	GRUMMAN AEROSPACE CORPORATION	BETHPAGE	40,738.08	1,150.00	.00
NYD003995198	GRUMMAN AEROSPACE CORPORATION	CALVERTON	245.54	.00	.00
NYD981182249	GRUMMAN AEROSPACE CORPORATION	BETHPAGE	14.34	70.00	.00
NYD002206449	GSP COMPONENTS	ROCHESTER	43.42	.00	.00
NY0000997692	GUARANTEED RETURNS INC	EAST SETAUKET	.28	551.00	.00
NYD001329945	GUILD PLATERS INC	LONG ISLAND CIT	23.70	.00	.00
NYD000632430	GULF OIL LIMITED PARTNERSHIP	OCEANSIDE	358.92	.00	.00
NYD010026151	H L I LORDSHIP INDUSTRIES INC	HAUPPAUGE	60.38	.00	.00
NYD002229326	H M QUACKENBUSH INC	HERKIMER	315.88	.00	.00
NYD002241982	HADCO CORPORATION	OWEGO	953.05	.00	.00
NYD002213502	HAMMER LITHOGRAPH CORP	ROCHESTER	42.20	.00	.00
NYD002234003	HARDEN FURNITURE INC	MCCONNELLSVILLE	24.30	.00	.00
NYD980646103	HARDINGE INC	ELMIRA	56.90	.00	.00
NYD980525976	HAUPPAUGE RECORD MANUFACTURING LTD	HAUPPAUGE	95.07	.00	.00
NYD982796401	HENRY HYDSON BRIDGE	NEW YORK	38.81	.00	.00
NYD986875326	HERAEUS PMR	ALDEN	241.09	.00	.00
NYD061204319	HHC/METROPOLITAN HOSPITAL CENTER	NEW YORK	.71	708.92	.00
NYD053649430	HIGHLAND HOSPITAL OF ROCHESTER	ROCHESTER	8.05	113.00	.00
NYD986993830	HILLSIDE MAINTENANCE COMP	HOLLIS	35.00	.00	.00
NYD065949604	HILORD CHEMICAL CORP	HAUPPAUGE	26.90	.00	.00
NYD079680203	HOBART & WILLIAM SMITH COLLEGES	GENEVA	1.00	2,009.00	.00
NYD987017506	HONEOYE STORAGE CORP	CANANDAIGUA	37.19	.00	.00
NYD002114924	HOPE'S ARCHITECTURAL PRODUCTS INC.	JAMESTOWN	30.26	.00	.00
NYP000920611	HOWARD FARM	SHERBURNE	57.17	.00	.00
NY0214020281	HQ 10TH MTN DIV (LI) & FORT DRUM	FORT DRUM	360.65	158.00	.00
NYD982793820	HUDSON CORRECTIONAL FACILITY	HUDSON	17.81	.00	.00
NYD068211291	HUNTER COLLEGE	NEW YORK	3.44	130.00	.00
NYD144855251	HUNTINGTON ANALYTICAL SERVICES	MIDDLEPORT	11.39	78.00	.00
NYD077299246	HUNTINGTON PENNYSAVER INC	HUNTINGTON	15.05	.00	.00
NY0000204479	HUNTS POINT AVENUE BRIDGE	HUNTS POINT	28.10	.00	.00
NYD002220739	HUNTSMAN DESIGN PRODUCTS CORP	MACEDON	169.10	.00	.00
NYD057943011	HYDROACOUSTICS INC	HENRIETTA	71.02	.00	.00
NYD084006741	IBM CORP TJ WASTOSN RESEARCH CENTER	YORKTOWN HEIGHT	28,828.20	75.10	.00
NYD000707901	IBM EAST FISHKILL	HOPEWELL JUNCTI	3,414.97	354.00	.00
NYD000799148	IBM HANGAR	WAPPINGER FALLS	20.93	.00	.00
NYD052077054	ICN PHARAMACEUTICALS, DIAGONISTICS	ORANGEBURG	.10	36.90	.00
NYD002227296	INDIUM CORPORATION OF AMERICA	UTICA	24.31	.00	.00
NYD001306547	INDUSTRIAL ACOUSTICS COMP	BRONX	29.20	.00	.00
NYD986932945	INDUSTRIAL FINISHING PRODUCTS INC	BROOKLYN	20.32	.00	.00
NYD002221430	INDUSTRIAL SERVICE CORPORATION	ELMIRA	117.40	.00	.00
NYD987009214	INSL-X PRODUCTS/HULS AMERICA INC	STONY POINT	20.00	.00	.00
NYD085503894	INSTRUMENTATION LABORATORY	ORANGEBURG	4.86	65.00	.00
NYD052987096	INSULATING MATERIALS INCORPORATED	SCHENECTADY	567.99	.00	.00
NYD002233039	INTERNATIONAL BUSINESS MACHINES	ENDICOTT	5,204.91	.00	.00
NYD080480734	INTERNATIONAL BUSINESS MACHINES COR	POUGHKEEPSIE	937.58	.00	.00
NYD108618745	INTERNATIONL IMAGINING MATERIALS IN	AMHERST	277.77	.00	.00
NYD002215226	ITT AUTOMOTIVE - ELEC. SYSTEM INC.	ROCHESTER	276.51	.00	.00
NYD001486968	IW INDUSTRIES INC	MELVILLE	148.70	.00	.00
NYD097533236	IZUMI CORPORATION	YAPHANK	70.82	.00	.00

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NYD980781322	J MANHEIMER INC	LONG ISLAND CIT	13.51	.00	.00
NYP000919662	J O COOK INC	BRIGHTON	15.87	.00	.00
NYD071601108	J.M.MURRAY CENTER INC.	CORTLAND	29.01	.00	.00
NYD002415404	JAMECO INDUSTRIES	WYANDANCH	19.11	.00	.00
NYD002115152	JAMESTOWN ELECTRO PLATING WORKS INC	JAMESTOWN	37.93	.00	.00
NYD021745179	JASCO SUN STEEL TREATING INC	FAIRPORT	57.65	.00	.00
NY0001046143	JEFFERSON AVENUE SITE	BUFFALO	23.10	.00	.00
NY0001021260	JENSEN FITTINGS CORPORATIOM-PLANT 2	NORTH TONAWANDA	13.29	.00	.00
NYD053076907	JENSEN FITTINGS CORPORATION	NORTH TONAWANDA	15.36	.00	.00
NY0000926436	JOHNSON & JOHNSON CLINICAL DIAGNOS	ROCHESTER	546.98	142.00	.00
NYD986956860	KAMINE/BESICORP S GLENS FALLS L.P.	SOUTH GLENS FAL	29.37	.00	.00
NYD094407822	KENNEDY VALVE	ELMIRA	63.82	.00	.00
NYD003959251	KEYMARK CORPORATION	FONDA	843.20	.00	.00
NYD041848334	KEYWELL L.L.C. VAC AIR DIVISION	FREWSBURG	31.45	.00	.00
NYD001325992	KINGS ELECTRONICS CO INC	TUCKAHOE	36.65	.00	.00
NYD002056679	KONICA IMAGING USA INC	GLEN COVE	49.51	1.00	.00
NYD056347206	KYTO DIAGNOSTICS	NEW CITY	28.57	.00	.00
NYD002076073	L & B PRODUCTS CORP	HUDSON	98.00	.00	.00
NYD002233872	L & JG STICKLEY INC	MANLIUS	21.27	.00	.00
NYD013440169	LABELON CORPORATION	CANANDAIGUA	111.91	.00	.00
NYD000632372	LAIDLAW ENVIRONMENTAL SERVICES (BDT	CLARENCE	1,550.90	182,770.16	.00
NYD074034141	LAPP INSULATOR CO	LEROY	92.19	315.00	.00
NYD064730294	LAWRENCE RIPAK COMP INC	WEST BABYLON	115.19	.00	.00
NYD001941053	LAWSON MARDON LABEL	NEW HYDE PARK	72.94	.00	.00
NYD986937753	LAWSON MARDON RADISSON	BALDWINSVILLE	20.71	.00	.00
NYD001325661	LEA RONAL INC	FREEPORT	93.91	.00	.00
NYD986886208	LEA RONAL INC	FREEPORT	98.31	.00	.00
NYD054065909	LEDERLE LABORATORIES,	PEARL RIVER	2,524.23	666.00	.00
NY0000113134	LEHMAN COLLEGE	BRONX	.82	77.00	.00
NYD002100295	LEICA INC OPD	CHEEKTOWAGA	20.83	.00	.00
NYD002034957	LEN RON MANUFACTURING	MELVILLE	66.36	.00	.00
NYD001482124	LEPEL CORPORATION	EDGEWOOD	20.90	.00	.00
NYD013563390	LIBERTY INDUSTRIAL FININSHING CORP	BRENTWOOD	247.47	.00	.00
NY0000879650	LIBERTY INDUSTRIAL FINISHING	FARMINGDALE	48.84	.00	.00
NYD059647412	LIGHTNIN	ROCHESTER	19.32	.00	.00
NYD061352217	LIGHTRON OF CORNWALL INC	NEW WINDSOR	48.72	.00	.00
NYD980648216	LILCO - BELLMORE OPERATIONS CENTER	BELLMORE	62.68	.00	.00
NYD980648174	LILCO - HOLTSVILLE GAS TURBINE SITE	HOLTSVILLE	18.60	.00	.00
NYD980648166	LILCO-HEWLETT OPERATIONS CENTER	HEWLETT	35.62	.00	.00
NYD006866008	LILCO-HICKSVILLE OPERATIONS CENTER	HICKSVILLE	22.69	200.00	.00
NYP000919043	LILCO-MANHOLE	HEMPSTEAD	18.20	.00	.00
NYP000919282	LILCO-MANHOLE	EAST ISLIP	16.80	.00	.00
NYD055050157	LILLY INDUSTRIES INC	JAMESTOWN	72.41	.00	.00
NYD980776827	LINOTYPE	HAUPPAUGE	20.08	.00	.00
NYD986884286	LINOTYPE	MELVILLE	105.30	.00	.00
NYD002235182	LOCKHEED MARTIN CONTROL SYSTEMS	JOHNSON CITY	13.81	.00	.00
NYR000013797	LONG ISLAND CITY-FREIGHT YARD	LONG ISLAND CIT	100.00	.00	.00
NYD987023157	LONG ISLAND DIAGNOSTIC IMAGING	EAST SETAUKET	37.97	.00	.00
NYD986980183	LONG ISLAND POWER AUTHORITY	WADING RIVER	13.72	.00	.00
NYD075796037	LORAL DEFENSE SYSTEMS EAST	GREAT NECK	898,055.31	.00	.00
NYD061956470	LORAL FAIRCHILD SYSTEMS	SYOSSET	27.77	.00	.00
NY0000146126	LORAL FEDERAL SYSTEMS - OWEGO	OWEGO	36.27	.00	.00
NYD002038586	LORAL MICROWAVE - NARDA	HAUPPAUGE	79.90	.00	.00
NYD002244911	LUCAS AEROSPACE POWER TRANSMISSION	UTICA	33.93	.00	.00
NYD002033710	LUITPOLD PHARMACEUTICALS INC	SHIRLEY	12.91	1,000.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NYD002216125	LUSTER-COATE METALLIZING CORP	CHURCHVILLE	66.39	.00	.00
NYD982278764	M K ENGINE SYSTEMS CO	LATHAM	26.44	.00	.00
NYD030488266	MACBETH - A DIVISION OF KOLLMORGEN	NEW WINDSOR	49.45	.00	.00
NYD987040417	MADISON AVE BRIDGE OVER HARLEM RIVE	MANHATTAN	94.84	.00	.00
NYD057381535	MAIMONIDES MEDICAL CENTER	BROOKLYN	14.05	16.00	.00
NYD986951895	MANCHESTER WOOD INC	GRANVILLE	26.81	.00	.00
NYD986932515	MANHATTAN BRIDGE NYCDOT	BROOKLYN	37.40	.00	.00
NYD002235166	MANTH BROWNELL INC	KIRKVILLE	61.06	.00	.00
NYD010959757	MARATHON BATTERY SUPERFUND SITE	COLD SPRING	74.66	.00	.00
NYD010765394	MARIETTA CORP	CORTLAND	81.29	.00	.00
NYD980785620	MARJORIE POST PARK	MASSAPEQUA	15.16	.00	.00
NYD002214484	MARKIN TUBING DIVISION	WYOMING	92.11	.00	.00
NYD002247377	MARTIN MARIETTA	SYRACUSE	25.64	.00	.00
NYD000521971	MARTIN MARIETTA CORP	UTICA	3,436.43	849.00	.00
NYD059385120	MARTIN MARIETTA CORP	SYRACUSE	104.63	.00	.00
NYD068886621	MATCO TOOLS-JAMESTOWN PLANT	LAKEWOOD	34.76	.00	.00
NYD001386077	MATERIALS RESEARCH CORP	ORANGEBURG	27.75	.00	.00
NYD981086937	MATTITUCK AIR BASE INC	MATTITUCK	13.73	.00	.00
NYD091662726	MCALPIN INDUSTRIES MONROE PLATING D	ROCHESTER	109.63	.00	.00
NYD096932124	MDS HUDSON VALLEY LABS	POUGHKEEPSIE	.20	400.00	.00
NYD075265157	MEMORIAL SWAN - KETTERING CANCER CE	NEW YORK	46.72	4,455.00	.00
NYD987029659	MERCHANTS PRESS INC	POUGHKEEPSIE	13.30	.00	.00
NYD986911519	MERCURY PHOTO ENGRAVERS CORP	LYNBROOK	17.00	.00	.00
NYD048148175	MERCURY REFINING COMPANY, INC.	ALBANY	491.78	.00	.00
NY0000448829	MERYE GROMES & WEINER INC	BROOKLYN	936.50	.00	.00
NYD982530313	METALADE INC	ROCHESTER	31.13	.00	.00
NYD002001923	METALLIZED CARBON CORPORATION	OSSINING	135.50	.00	.00
NYD067902551	METRO CIRCUITS DIV OF PJC TECH INC	ROCHESTER	41.48	.00	.00
NYD084006477	METRO-NORTH RAILROAD	CROTON	9,607.11	.00	.00
NYD982740664	METRO-NORTH RAILROAD	NEW YORK	57.55	.00	.00
NYD987031655	METRO-NORTH RAILROAD	VARIOUS	396.70	.00	.00
NYD987031663	METRO-NORTH RAILROAD	VARIOUS	46.81	.00	.00
NYD986944148	MIC TECHNOLOGY	PEARL RIVER	76.84	.00	.00
NYD131804924	MICHAEL ANTHONY JEWELERS	MOUNT VERNON	68.20	.00	.00
NYD065939902	MILL-MAX MANUFACTURING CORPORATION	OYSTER BAY	64.45	.00	.00
NYD986954147	MILLER/DUVA SITE -	CLAY	15,502.30	.00	.00
NYD982189102	MITSUI-PATHTEK CORPORATION	ROCHESTER	18.76	.00	.00
NYD000708008	MOBIL OIL	UTICA	21.36	.00	.00
NYD000824516	MOBIL OIL	STATEN ISLAND	1,788.48	.00	.00
NYD000824524	MOBIL OIL	SYRACUSE	66.47	.00	.00
NYD010021764	MOBIL OIL	INWOOD	88.72	.00	.00
NYD000707976	MOBIL OIL-GLENWOOD LANDING TERMINAL	GLENWOOD LANDIN	151.48	.00	.00
NYD002079630	MOHAWK FINISHING PRODUCTS INC	AMSTERDAM	134.50	.00	.00
NYD002248235	MONARCH CORTLAND	CORTLAND	18.14	.00	.00
NYD067921585	MONROE COMMUNITY COLLEGE	ROCHESTER	1.72	195.00	.00
NYD982537029	MOOG CONTROLS INC	EAST AURORA	17.90	.00	.00
NYD002103166	MOOG INC-PRONER AIRPORT	EAST AURORA	44.20	.00	.00
NYD058302266	MOUNT SINAI MEDICAL CENTER	NEW YORK	13.50	.00	.00
NYD050481688	MTP INDUSTRIES INC	BRONX	13.80	.00	.00
NYD030207104	MURRAY RECON INC.	WEST SENECA	13.91	.00	.00
NYD986950889	N Y S T S	ROCHESTER	67.70	.00	.00
NYD980534374	N.Y.S. THRUWAY AUTHORITY	EAST SYRACUSE	50.07	.00	.00
NY0000852475	N.Y.S.D.O.T.	NEW YORK	117.82	.00	.00
NYD066829599	NASHUA CORP	WATERVLIET	26.21	.00	.00
NYD002014595	NEPERA INC	HARRIMAN	51,450.51	.00	.00

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NYD990690216	NESS PRECISION PRODUCTS	ROCHESTER	32.12	.00	.00
NYD044127355	NEW ENGLAND LAMINATES CO IN	WALDEN	75.44	.00	.00
NYD159408202	NEW LEBANON CENTRAL SCHOOL DISTRICT	LEBANON SPRINGS	22.73	.00	.00
NYD986934743	NEW YORK AIR BRAKE	WATERTOWN	100.51	.00	.00
NYD124869298	NEW YORK CITY POLICE DEPT	NEW YORK	14.70	.00	.00
NYD030214738	NEW YORK POWER AUTHORITY - NIAGARA	LEWISTON	14.18	.00	.00
NYD085503746	NEW YORK POWER AUTHORITY-IP3	BUCHANAN	29.10	.00	.00
NYD981484447	NEW YORK STATE D E C	SODUS	40.80	.00	.00
NYD000512335	NEW YORK STATE D.E.C.	NASSAU	523.64	.00	.00
NYD003601960	NEW YORK STATE D.E.C.	WEST BABYLON	29.96	.00	.00
NYD980528491	NEW YORK STATE D.E.C.	PATTERSON	30.92	.00	.00
NYD986878775	NEW YORK STATE D.E.C.	OLEAN	52.54	.00	.00
NY0000894766	NEW YORK STATE D.E.C.	ONONDAGA	16.93	.00	.00
NYD986911402	NEW YORK STATE DEC	BINGHAMTON	3.70	7,400.00	.00
NYP000917427	NEW YORK STATE DEC	NEDROW	146.19	.00	.00
NYP000920066	NEW YORK STATE DEC	NEW YORK	13.64	.00	.00
NYP000921460	NEW YORK STATE DEC	BROOKLYN	23.52	.00	.00
NYP000922278	NEW YORK STATE DEC	MCGRAW	17.15	.00	.00
NYP003601895	NEW YORK STATE DEC	HEMPSTEAD	5.68	50.00	.00
NYP003602034	NEW YORK STATE DEC	BUFFALO	581.38	.00	.00
NYP003602083	NEW YORK STATE DEC	HEMPSTEAD	8.20	80.00	.00
NYD986973006	NEW YORK STATE DEPT OF TRANSPORATIO	MARATHON	13.20	.00	.00
NYD982795262	NEW YORK STATE DEPT OF TRANSPORTATI	BABYLON	37.10	.00	.00
NYD986972990	NEW YORK STATE DEPT OF TRANSPORTATI	MARATHON	18.00	.00	.00
NYD987010980	NEW YORK STATE DEPT OF TRANSPORTATI	HOMER	22.20	.00	.00
NYD987010998	NEW YORK STATE DEPT OF TRANSPORTATI	HOMER	21.60	.00	.00
NYD987011012	NEW YORK STATE DEPT OF TRANSPORTATI	HOMER	20.60	.00	.00
NYD987011046	NEW YORK STATE DEPT OF TRANSPORTATI	GROTON	41.60	.00	.00
NYD982183485	NEW YORK STATE THRUWAY AUTHORITY	WEST NYACK	20.50	.00	.00
NYD986990398	NEW YORK STATE-OGS-SHERIDAN AVE STM	ALBANY	299.88	.00	.00
NYD077515237	NEW YORK TESTING LABORATORIES	WESTBURY	28.38	2.00	.00
NYD981566607	NEW YORK UNIVERSITY	NEW YORK	13.89	.00	.00
NYD986891588	NEW YORK UNIVERSITY DENTAL CENTER	NEW YORK	11.44	155.00	.00
NYD000632489	NEW YORK UNIVERSITY MEDICAL CENTER	NEW YORK	19.81	656.00	.00
NYP000795054	NEWARK-WAYNE COMMUNITY HOSPITAL	NEWARK	.24	34.00	.00
NYD051583862	NEWCUT INC	NEWARK	25.02	.00	.00
NYD052782497	NEWSDAY INC	MELVILLE	48.20	.00	.00
NYD000730382	NIAGARA MOHAWK POWER CORP	LIVERPOOL	24.42	.00	.00
NYD000730408	NIAGARA MOHAWK POWER CORP	ALBANY	40.69	.00	.00
NYR000011403	NIAGARA MOHAWK POWER CORP	HUDSON	2,853.19	.00	.00
NY0000127605	NIAGARA MOHAWK POWER CORP	LIVERPOOL	123.99	.00	.00
NYD002082519	NIBCO INC	SOUTH GLENS FAL	33.33	.00	.00
NYD049830987	NNIAGARA CUTTER INC	NORTH TONAWANDA	15.76	.00	.00
NYD013293519	NOCO ENERGY CORPORATION	TONAWANDA	92.20	.00	.00
NYD057770109	NORTHEAST ENVIRONMENTAL SERVICES IN	WAMPSVILLE	16,080.89	.00	.00
NYD981495120	NORTHEAST PLATING INC	MOUNT VERNON	20.50	.00	.00
NYR000012179	NORTHPORT - EAST NORTHPORT U.F.S.D.	NORTHPORT	.14	278.00	.00
NYD986968170	NORTHVILLE INDUSTRIES CORP	HUNTINGTON STAT	34.80	.00	.00
NYD002083954	NORTON COMPANY	WATERVLIET	67.18	20.00	.00
NYD987025285	NORTON COMPANY RESTORATION SITE	COLONIE	2,655.35	.00	.00
NYD052980893	NORTON PERFORMANCE PLASTICS CORP	GRANVILLE	15.92	.00	.00
NYD980770721	NTU CIRCUITS INC	BAY SHORE	13.78	.00	.00
NYD000799254	NU-KOTE INTERNATIONAL INC.	ROCHESTER	21.00	.00	.00
NYD982279606	NY INSTITUTE OF TECHNOLOGY	CENTRAL ISLIP	767.90	.00	.00
NYD981185200	NYC DEP OF HEALTH / OFICE OF CHF ME	NEW YORK	1.44	54.00	.00

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NY0000977272	NYC DEPT OF SANITATION	NEW YORK	14.60	.00	.00
NYD981487051	NYC DEPT OF SANITATION BRONX DIST 9	BRONX	18.57	.00	.00
NYD982529778	NYC DEPT OF SANITATION BRONX DIST 9	BRONX	30.32	.00	.00
NYD982725509	NYC DEPT OF SANITATION QUEENS 11A G	QUEENS	14.78	.00	.00
NYD981879737	NYC DEPT OF SANITATION SHEA STADIUM	QUEENS	34.08	.00	.00
NYD000298885	NYC DOT	BROOKLYN	146.40	.00	.00
NY0001037654	NYC ECONOMIC DEVELOPMENT CORPORATIO	BROOKLYN	35.86	.00	.00
NYD982181554	NYCDEP BWS DWQC KENSICO LABORATORY	VALHALLA	.13	60.00	.00
NYD083626077	NYCOMED INC	RENSSELAER	9,085.78	145.00	.00
NYR000003251	NYCTA - FOREST AVENUE STATION	QUEENS	14.10	.00	.00
NYD987030145	NYNEX	BELLMORE	19.92	.00	.00
NYP000795013	NYNEX-MANHOLE	JAMAICA	23.85	.00	.00
NYD986870319	NYNEX-MATERIAL RECYCLING CENTER	ORANGEBURG	23.21	.00	.00
NYD986972248	NYS ARMORY-HUNTINGTON STATION	HUNTINGTON STAT	27.84	.00	.00
NYD986927390	NYS DEPARTMENT OF TRANSPORTATION RE	ALBANY	230.60	.00	.00
NYD986964492	NYS DEPARTMENT OF TRANSPORTATION RE	ALBANY	19.60	.00	.00
NYD986964500	NYS DEPARTMENT OF TRANSPORTATION RE	ALBANY	21.30	.00	.00
NYD986992915	NYS DEPARTMENT OF TRANSPORTATION RE	WESTPORT	32.00	.00	.00
NYD986992964	NYS DEPARTMENT OF TRANSPORTATION RE	NORTH HUDSON	44.80	.00	.00
NYD986996262	NYS DEPARTMENT OF TRANSPORTATION RE	BALLSTON SPA	38.00	.00	.00
NYD987022860	NYS DEPARTMENT OF TRANSPORTATION RE	SHUSHAN	35.60	.00	.00
NYR000000521	NYS DEPARTMENT OF TRANSPORTATION RE	ALBANY	16.10	.00	.00
NYR000000539	NYS DEPARTMENT OF TRANSPORTATION RE	ALBANY	15.50	.00	.00
NYR000000547	NYS DEPARTMENT OF TRANSPORTATION RE	HOOSICK	101.20	.00	.00
NYD148615263	NYS DEPT OF HEALTH - WADSWORTH CTR	ALBANY	21.10	.00	.00
NY0000359802	NYS DOT	FLUSHING	45.00	.00	.00
NY0000359810	NYS DOT	FLUSHING	84.50	.00	.00
NY0001015734	NYS DOT BIN 1-01169-0	DUNKIRK	46.50	.00	.00
NY0000133389	NYS DOT BRIDGE BIN 1002239	UTICA	30.60	.00	.00
NYR000000927	NYS DOT BRIDGE BIN 105 1512	WASHINGTON MILL	17.20	.00	.00
NYR000000919	NYS DOT BRIDGE BIN 1051511	WASHINGTON MILL	17.20	.00	.00
NY0000087361	NYS DOT BRIDGE BIN 4051180 AND	ILION	23.60	.00	.00
NYD982728578	NYS DOT CONSTRUCTION FIELD OFFICE	BROOKLYN	351.90	.00	.00
NY0000463265	NYS DOT FIELD OFFICE	BRONX	19.30	.00	.00
NYD982187940	NYS DOT ONEIDA EAST SPECIAL CREWS	UTICA	39.07	.00	.00
NYD980531271	NYS ELECTRIC & GAS	ONEONTA	29.30	.00	.00
NYD980531453	NYS ELECTRIC & GAS	OWEGO	141.60	.00	.00
NYD002429355	NYS THRUWAY AUTHORITY	ALBANY	17.41	.00	.00
NYD980534317	NYS THRUWAY AUTHORITY TAPPAN ZEE BR	TARRYTOWN	50.17	.00	.00
NY0000560995	NYS-DOT BIN 4-45411-0	LOCKPORT	24.80	.00	.00
NYD986979987	NYS-DOT BIN 4-45417-0	LOCKPORT	40.00	.00	.00
NYD074359472	NYSDEC - MORGAN TERMINAL SITE	BROOKLYN	19.60	.00	.00
NY0000234500	NYSDOT BIN #1005950	PERU	54.00	.00	.00
NYR000012542	NYSDOT BIN 1018341	BABYLON	28.90	.00	.00
NYR000012559	NYSDOT BIN 1018342	BABYLON	31.60	.00	.00
NYR000004663	NYSDOT BIN 1058770	WEST ISLIP	141.00	.00	.00
NYD986886737	NYSDOT BIN 1058811	WEST ISLIP	86.00	.00	.00
NYD986887032	NYSDOT BIN 1058812	WEST ISLIP	73.00	.00	.00
NYD987021110	NYSDOT BIN 1064139	MEDFORD	17.00	.00	.00
NYD986994002	NYSDOT CONSTRUCTION FIELD OFFICE	NEW YORK	55.00	.00	.00
NYD987012853	NYSDOT CONSTRUCTION FIELD OFFICE	FLUSHING	583.20	.00	.00
NY0000038745	NYSTA N 4.24 BIN5520159	BUFFALO	365.30	.00	.00
NYD982282055	NYTEST ENVIRONMENTAL INC	PORT WASHINGTON	69.60	.00	.00
NY0000229005	NYU MEDICAL CENTER	NEW YORK	.30	50.00	.00
NYD010969079	NYU MEDICAL CENTER - LANZA LABS	TUXEDO PARK	1.64	60.00	.00

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NYD008916504	O W HUBBELL & SONS INC	NEW YORK MILLS	449.89	.00	.00
NYD981567126	O-Z/GEDNEY	BROOKLYN	30.48	.00	.00
NYD080460215	OAK-MITSUI INC	HOOSICK FALLS	887.81	1,000.00	.00
NYD002106938	OCCIDENTAL CHEMICAL	NORTH TONAWANDA	802.10	.00	.00
NYD000767657	OCCIDENTAL CHEMICAL CORP	NIAGARA FALLS	51.53	102,248.00	.00
NYD002103216	OCCIDENTAL CHEMICAL CORP	NIAGARA FALLS	980.70	18,400.00	.00
NYD000824482	OCCIDENTAL CHEMICAL CORPORATION	NIAGARA FALLS	3,236.53	261,026.00	.00
NYD000831644	OCCIDENTAL CHEMICAL CORPORATION	TOWN OF NIAGARA	355.29	570,753.00	.00
NYD083539759	OCCIDENTAL CHEMICAL CORPORATION	GRAND ISLAND	11.78	534.00	.00
NYD094816329	ODYSSEY CIRCUITS INC	WYANDANCH	61.34	.00	.00
NYD063656128	OLEA & ADVANCED PRODUCTS	OLEAN	445.42	.00	.00
NYD002123461	OLIN CORP	NIAGARA FALLS	26.30	.00	.00
NYD002220804	OLIN CORPORATION	ROCHESTER	114,235.61	6,430.00	.00
NYD980776561	OMS #23	BROOKLYN	2.38	150.00	.00
NYD981076540	OMS #41	JAMAICA	1.60	400.00	.00
NYD982744039	ONE HOUR MOTOPHOTO INC	HUNGTINTON STAT	82.53	.00	.00
NYD058519539	ONEIDA MOLDED PLASTICS CORPORATION	ONEIDA	14.70	.00	.00
NYD002229128	ONEIDA SILVERSMITHS MAIN PLANT	SHERRILL	309.41	.00	.00
NYD986883403	ONONDAGA SUPERFUND SITE	ONONDAGA	501.67	.00	.00
NYD002112944	OSMOSE WOOD PRESERVING INC	BUFFALO	16.39	.00	.00
NYD000632083	OUTOKUMPU AMERICAN BRASS INC.	BUFFALO	934.29	.00	.00
NYD010761815	OWENS-BROCKWAY GLASS CONTAINER INC	FULTON	26.38	.00	.00
NYD055864011	OWI CORPORATION-CAMDEN FACILITY	CAMDEN	18.30	699.00	.00
NYD000343558	PAJCO PRODUCTS INC	LOWVILLE	41.98	.00	.00
NYD002054419	PALL CORPORATION	GLEN COVE	7.04	55.00	.00
NYD980768642	PALL CORPORATION	EAST HILLS	1,423.92	.00	.00
NYD003907318	PALL RAI MANUFACTURING COMPANY	HAUPPAUGE	108.44	.00	.00
NYD002043396	PALL TRINITY MICRO DIV OF PALL CORP	CORTLAND	49.89	.00	.00
NYD000511659	PAS OSWEGO SITE PARTICIPATION AGREE	OSWEGO	1,164.15	.00	.00
NYD002228799	PASS & SEYMOUR LEGRAND	SOLVAY	80.97	.00	.00
NYD056303266	PAXAR CORPORATION	ORANGEBURG	45.87	.00	.00
NY0000263392	PELHAM PKWY/NYC DOT	BRONX	34.40	.00	.00
NYD991292053	PENDLETON (FRONTIER CHEMICAL) SITE	PENDLETON	26.17	.00	.00
NYD002043198	PERMAGILE INDUSTRIES INC	PLAINVIEW	15.61	.00	.00
NYD093760775	PFIZER INC	QUEENS VILLAGE	87.51	.00	.00
NYD986936904	PFIZER INC	BROOKLYN	267.09	.00	.00
NY0000055384	PFIZER INC	BROOKLYN	93.12	.00	.00
NYD002209989	PHILIPS LIGHTING CO	BATH	282.65	.00	.00
NYD096920483	PHOTOCIRCUITS CORPORATION	GLEN COVE	2,128.52	.00	.00
NYD002108629	PIERCE & SSTEVENS CORP	BUFFALO	39.97	.00	.00
NYD001521343	PITTSBURGH TUBE COMPANY	MONROE	76.20	.00	.00
NYD002228690	PLANT 2 STRATHMORE PRODUCTS INC	LIVERPOOL	104.60	.00	.00
NYD982528606	PLASMACO INC	HIGHLAND	44.27	.00	.00
NY4571924774	PLATTSBURGH AIR FORCE BASE	PLATTSBURGH	465.20	181.00	.00
NYD986936789	PLATTSBURGH TERMINAL COMP	KEESEVILLE	58.74	.00	.00
NYD000818773	POLY PAK INDUSTRIES INC	MELVILLE	42.70	.00	.00
NYD066076225	POLYTECHNIC UNIVERSITY	BROOKLYN	24.24	.00	.00
NYD981182280	PORT AUTH OF NY/NJ GEORGE WASHINGTO	NEW YORK	410.30	.00	.00
NYD981077480	PORT AUTHORITY OF NY & NJ	NEW YORK	24.76	.00	.00
NYD980648562	PORT AUTHORITY OF NY & NJ JFK AIRPO	JAMAICA	85.79	.00	.00
NYD002113322	PRATT & LAMBERT INC	BUFFALO	138.03	.00	.00
NYD099333858	PRECIOUS PLATE INC	WHEATFIELD	58.12	.00	.00
NYD057938136	PRECISION GRINDING & MFG	ROCHESTER	18.01	.00	.00
NY0001006022	PRECISION PHOTO FAB INC	BUFFALO	98.50	.00	.00
NYD982530347	PRESTOLITE ELECTRIC INC	ARCADE	85.47	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NY0000929497	PRICE CLUB #237	MELVILLE	19.52	.00	.00
NYD987037462	PRICE CLUS SMITHTOWN	NESCORSET	18.29	.00	.00
NYD986905529	PRIDE SOLVENTS & CHEMICAL CO OF NY	HOLTSVILLE	15.92	.00	.00
NYD982279713	PRINTING ASSOCIATES	HAUPPAUGE	28.30	.00	.00
NYD045256500	PROCTER & GAMBLE PHARMACEUTICALS	NORWICH	.46	60.00	.00
NYD075825281	PROCTER & GAMBLE PHARMACEUTICALS	NORWICH	37.06	11.10	.00
NYD002968246	PRODUCTION PRODUCTS COMPANY	MANLIUS	70.91	.00	.00
NYD982183543	PROTOTECH ELECTRONICS INC	FARMINGDALE	40.23	.00	.00
NYD987026127	PT AUTHORITY OF NY & NJ BAYONNE BRG	STATEN ISLAND	20.10	.00	.00
NYD980648554	PT AUTHORITY OF NY & NJ GOETHALS BR	STATEN ISLAND	333.37	.00	.00
NYD981086903	QUAD/GRAPHICS INC	SARATOGA SPRING	23.18	.00	.00
NYD987024213	QUALA SYSTEMS INC	ALBANY	23.25	.00	.00
NYD987024221	QUALA SYSTEMS, INC	TONAWANDA	14.24	.00	.00
NYD082758004	QUALICOAT, INC.	ROCHESTER	23.90	.00	.00
NYD004971719	QUEBECOR PRINTING BUFFALO INC	DEPEW	175.96	.00	.00
NYD982740359	QUEENS LI MEDICAL GROUP	NORTH BABYLON	27.12	.00	.00
NYD982796427	QUEENS MIDTOWN TUNNEL	NEW YORK	28.64	.00	.00
NYD987040318	QUEENSBOROUGH COMMUNITY COLLEGE	BAYSIDE	.16	30.00	.00
NYD982273070	QUICK ROLL LEAF MFG CO	MIDDLETOWN	17.40	.00	.00
NYD000692103	RAD OPERATING CORP THE OCEANSIDE TE	OCEANSIDE	86.42	.00	.00
NYP010001352	RANDALLS ISLAND-NYC DEP	MANHATTAN	35.96	.00	.00
NYD083527713	RECRA ENVIRONMENTAL INC	TONAWANDA	162.10	.00	.00
NYD013518139	REEDS PHOTO SHOP & STUDIO INC	EAST HAMPTON	13.66	.00	.00
NYD001514223	REMCO MAINTENANCE CORPORATION	NEW YORK	17.10	.00	.00
NYD002240638	REMINGTON ARMS COMPANY INC	ILION	47.33	.00	.00
NYD002430742	RENSSELAER POLYTECHNIC INSTITUTE	TROY	34.00	114.00	.00
NYD071586127	REVERE COPPER PRODUCTS INC	ROME	123.84	.00	.00
NYD030485288	REVERE SMELTING & REFINING CORPORAT	MIDDLETOWN	4,076.01	.00	.00
NYD002245967	REYNOLDS METALS COMP	MASSENA	3,807.36	18.00	.00
NYD000809350	REYNOLDS METALS COMPANY-FULTON CAN	FULTON	271.91	.00	.00
NYD986933232	RIP VAN WINKLE BRIDGE	CATSKILL	46.90	.00	.00
NYD986871457	ROCHESTER CITY SCHOOL DISTRICT	ROCHESTER	6.88	960.00	.00
NYD091670018	ROCHESTER DPSYCHIATRIC CENTER	ROCHESTER	9.17	242.00	.00
NYD980537187	ROCHESTER GAS & ELEC CORP	HENRIETTA	40.69	.00	.00
NYD043069996	ROCHESTER GAS AND ELECTRIC CORP	ROCHESTER	65.44	.00	.00
NYD043071141	ROCHESTER GAS AND ELECTRIC CORP	ROCHESTER	77.19	.00	.00
NYD980769830	ROCHESTER PLATING WORKS INC	ROCHESTER	33.90	.00	.00
NYD002220457	ROCHESTER STEEL TREATING WORKS INC	ROCHESTER	15.02	.00	.00
NYD002210565	ROEHLEN ENGRAVING	ROCHESTER	19.60	.00	.00
NYD095578381	ROME CABLE CORP	ROME	51.18	.00	.00
NYD006977086	ROTH BROS SMELTING	EAST SYRACUSE	16.62	.00	.00
NYD002920312	RUCO POLYMER CORP	HICKSVILLE	35.86	.00	.00
NYD987038890	RUDIN MANAGEMENT AS AGENTS/80 PINE	NEW YORK CITY	14.86	.00	.00
NYD052801990	S & S INDUSTRIES INC	BRONX	33.50	.00	.00
NYD981875438	SAGE COMPLEX	SYRACUSE	25.24	.00	.00
NYD000818807	SCHENECTADY INTERNATIONAL INC	SCHENECTADY	22.13	.00	.00
NYD002070118	SCHENECTADY INTERNATIONAL INC	ROTTERDAM JUNCT	1,095.61	.00	.00
NYD002070100	SCHENECTADY INTERNATIONAL, INC	SCHENECTADY	1,037.12	.00	.00
NYD986975761	SCHENECTADY MATERIALS AND PROCESSES	SCHENECTADY	.02	50.00	.00
NYD002204436	SCHWEIZER AIRCRAFT CORP.	BIG FLATS	30.48	.00	.00
NYD042569772	SCOTT AVIATION	LANCASTER	38.51	.00	.00
NYD002066132	SCOTT PAPER COMPANY	FT EDWARD	26.06	.00	.00
NYD056352099	SEMI-ALLOYS COMPANY	MOUNT VERNON	33.33	.00	.00
NY0213820830	SENECA ARMY DEPOT ACTIVITY	ROMULUS	31.15	.00	.00
NYD094411139	SENECA FOODS CORPORATION - CAN PLAN	MARION	34.31	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NYD000632141	SHELL OIL COMPANY	BROOKLYN	47.36	.00	.00
NYD095575429	SHERWOOD-DAVIS & GECK	ORISKANY FALLS	30.39	.00	.00
NYD980769848	SIERRA TECHNOLOGIES INC	CHEEKTOWAGA	15.68	.00	.00
NYD071478044	SIVACO NATIONAL WIRE-NY	TONAWANDA	31.90	.00	.00
NYD002114197	SNYDER TANK CORP.	BUFFALO	14.64	.00	.00
NYD986904191	SOLVENT SAVERS SITE	LINCKLAEN	72.57	.00	.00
NYD001391200	SOMERVILLE TECHNOLOGY GROUP	HUGUENOT	2.45	105.00	.00
NYD002229029	SONOCO FLEXIBLE PACKAGING	FULTON	448.54	.00	.00
NYD099340408	SONOCO PRODUCTS	TONAWANDA	18.73	.00	.00
NYD986904464	SOUTHER GRAPHIC SYSTEMS INC	PHOENIX	73.39	.00	.00
NYD982720914	SPALDING SPORTS WORLDWIDE	GLOVERSVILLE	27.70	.00	.00
NYD002241669	SPECIAL METALS CORP	NEW HARTFORD	129.35	.00	.00
NYD002215838	SPECIALIZED PRINTED FORMS INC	CALEDONIA	31.80	.00	.00
NYD000631960	SPRAYLAT CORP	MT VERNON	537.76	.00	.00
NYD071595474	ST ELIZABETH HOSPITAL	UTICA	91.36	.00	.00
NYD079702452	ST JOHN FISHER COLLEGE	ROCHESTER	.70	1,409.51	.00
NYD073134744	ST JOHNS UNIVERSITY	JAMAICA	3.04	450.00	.00
NYR000014431	ST JOHNSVILLE WASTEWATER PLANT	ST JOHNSVILLE	.03	60.70	.00
NYD013140066	STANB TEXTILE SERVICES INC	ROCHESTER	15.05	.00	.00
NYD054988506	STANDARD MICROSYSTEMS CORP	HAUPPAUGE	14.34	.00	.00
NYD001315266	STANDARD MOTOR PRODUCTS INC	LONG ISLAND CIT	25.79	.00	.00
NYD096925524	STANDARD PRODUCTS CO CAMPBELL PROD	SCHENECTADY	22.88	.00	.00
NYD071486518	STARKS ASSOC INC	BUFFALO	33.78	250.00	.00
NYD071486211	STATE UNIVERSITY COLLEGE AT BUFFALO	BUFFALO	3.69	990.00	.00
NYD980646731	STATE UNIVERSITY OF NEW YORK	ALFRED	17.74	.00	.00
NYD980775936	STATE UNIVERSITY OF NEW YORK AT BUF	AMHERST	53.23	.00	.00
NYD982183527	STATE UNIVERSITY OF NEW YORK AT FAR	FARMINGDALE	1.04	66.72	.00
NYD073669350	STATE UNIVERSITY OF NEW YORK AT GEN	GENESEO	7.56	347.00	.00
NYD071600100	STATE UNIVERSITY OF NY AT BINGHAMTO	BINGHAMTON	2.77	32.00	.00
NYD000829572	STATE UNIVERSITY OF NY AT OSWEGO	OSWEGO	6.65	30.00	.00
NYD040464315	STATE UNIVERSITY OF NY AT STONY BRO	STONY BROOK	34.59	.00	.00
NYD074345315	STATEN ISLAND TERMIANL/GATX TERM CO	STATEN ISLAND	13.39	.00	.00
NYD085502243	STEWART STAMPING CORPORATION	YONKERS	53.70	.00	.00
NYD052780392	STIMPSON CO INC	BAYPORT	44.05	.00	.00
NY3570025897	STRATTON ANGB/109 AIRLIFT WING	SCOTIA	31.29	.00	.00
NYD986971216	STRUCTURAL INDUSTRIES, INC	HICKSVILLE	16.74	.00	.00
NYD065946535	SUFFOLK METAL FINISHING INC	HOLBROOK	20.31	.00	.00
NYD981558570	SULZER METCO (US) INC	HICKSVILLE	30.98	.00	.00
NYD041288689	SUN CHEMICAL	ROCHESTER	14.00	.00	.00
NYD073129793	SUNY AT ALBANY	ALBANY	7.25	620.60	.00
NYR000006890	SUNY ESF	WARRENSBURG	.60	50.00	.00
NYD063053656	SUNY HEALTH SCIENCE CENTER AT SYRAC	SYRACUSE	2.90	70.00	.00
NYD982725111	SUNY PLATTSBURGH	PLATTSBURGH	.39	43.20	.00
NYD002223287	SURFACE FINISH TECH INC	ELMIRA	30.00	.00	.00
NYD055865125	SYRACUSE CHINA COMPANY	SYRACUSE	79.06	.00	.00
NYD982274573	SYRACUSE UNIVERSITY	SYRACUSE	.54	47.00	.00
NYD000799239	SYRACUSE UNIVERSITY (QUAD)	SYRACUSE	7.89	208.00	.00
NYD002234904	SYROCO INC	BALDWINSVILLE	8.20	16,400.00	.00
NYD000228247	T & L AUTOMATICS INC	ROCHESTER	29.66	.00	.00
NYD097649016	TAM CERAMICS INC	NIAGARA FALLS	576.16	.00	.00
NYD041770629	TARKETT INC	VAILS GATE	25.00	.00	.00
NYD049199722	TECHEM	NEW HYDE PARK	101.81	6,554.00	.00
NYD091894899	TEXACO INC-FUELS & LUBES RESEARCH F	GLENHAM	117.52	135.00	.00
NYD986901866	TEXACO SERVICE STATION	SCARSDALE	35.91	.00	.00
NYR000014985	TEXACO SERVICE STATION	YORKTOWN HEIGHT	14.17	.00	.00

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NYD002904076	TEXACO/STAR ENTERPRISE SALES TERMIN	INWOOD	61.89	.00	.00
NYD002106276	TEXTRON REALTY OPERATIONS	WHEATFIELD	22.80	.00	.00
NYD981185101	THAMES PHARMACAL COMPANY INC	RONKONKOMA	110.09	.00	.00
NYD074042292	THE BUFFALO GENERAL HOSPITAL	BUFFALO	13.50	1.50	.00
NYD000688911	THE CARBORUNDUM CO-EKONOL RESINS	NIAGARA FALLS	182.85	.00	.00
NYD046763777	THE CARBORUNDUM COMPANY	FALCONER	13.79	.00	.00
NYD001315209	THE DUPONT MERCK PHARMACEUTICAL CO	GARDEN CITY	31.83	35,480.00	.00
NYD002123495	THE GOODYEAR TIRE & RUBBER COMPANY	NIAGARA FALLS	536.60	1,800.00	.00
NYD002206399	THE GUNLOCKE COMPANY	WAYLAND	46.51	.00	.00
NYD046341400	THE MEARL CORPORATION	BUCHANAN	82.69	.00	.00
NYD068241132	THE NEW YORK HOSPITAL	NEW YORK	12.91	74.00	.00
NYD980763833	THE NOTEWORTH COMPANY	AMSTERDAM	31.00	.00	.00
NYD072817950	THE PRESBYTERIAN HOSPITAL	NEW YORK CITY	141.00	.00	.00
NYD071037113	THE ROCKEFELLER UNIVERSITY	NEW YORK	10.37	339.00	.00
NYD100057447	TIOGA CENTRAL SCHOOL	TIOGA CENTER	.05	105.00	.00
NYD986964849	TISHCON CORPORATION	WESTBURY	77.11	.00	.00
NY0001009869	TOMPKINS COUNTY AIRPORT	ITHACA	3.91	100.00	.00
NYD097644801	TONAWANDA TANK TRANSPORT SERVICE IN	BUFFALO	13.24	.00	.00
NY0000096123	TOSCO PIPELINE COMP - HOLTSVILLE TE	HOLTSVILLE	1,026.23	.00	.00
NYD981484785	TOSHIBA DISPLAY DEVICES INC	HORSEHEADS	1,370.67	.00	.00
NY0000997783	TOUCH OF CLASS ADV & GRAPHICS INC	HAUPPAUGE	19.93	.00	.00
NYR000002485	TOWN OF DEWITT HIGHWAY GARAGE	EAST SYRACUSE	35.33	.00	.00
NYR000014613	TOWN OF ORCHARD PARK	ORCHARD PARK	14.00	.00	.00
NYD041554577	TRANS WORLD AIRLINES INC	JAMAICA	19.20	.00	.00
NYD000918326	TRANSFUEL	MASSENA	49.09	.00	.00
NYD981563521	TREASURE CHEST ADVERTISING COMPANY	SAUGERTIES	18.64	.00	.00
NYD002245264	TRI-CITIES BARRELL-NYS-DEC-SUPERFUN	FENTON	29.19	.00	.00
NYD075243139	TRIBOROUGH BRIDGE	NEW YORK	227.90	.00	.00
NYD002107399	TRICO PRODUCTS CORPORATION	BUFFALO	15.84	.00	.00
NYD002226041	TRIPLE CITIES METAL FINISHING CORP	BINGHAMTON	55.70	.00	.00
NYD981076466	TRW AUTOMOTIVE ELECTRONICS GROUP-AU	AUBURN	18.91	.00	.00
NY4210021792	TSG HC LOCKWOOD US ARMY RESERVE CTR	MALONE	.49	30.00	.00
NYD107399107	TUBE TECH	ROCHESTER	14.58	.00	.00
NYD002113736	TULIP CORPORATION	NIAGARA FALLS	46.85	.00	.00
NY0000981548	TYKO REALTY	FARMINGDALE	16.20	.00	.00
NYD068014711	U S ELECTROPLATING	WEST BABYLON	240.27	.00	.00
NYD001725878	ULANO CORPORATION	BROOKLYN	24.50	.00	.00
NYD980790141	ULTRA CREATIVE CORP	BROOKLYN	222.10	.00	.00
NYD986969301	ULTRALIFE BATTERIES INC	NEWARK	26.26	.00	.00
NYD002046662	UNIFLEX INC	WESTBURY	38.33	.00	.00
NY0001018399	UNION TRANSPORT CORPORATION	JAMAICA	.06	60.00	.00
NYD986900645	UNITED BIOMEDICAL INC	HAUPPAUGE	16.45	.00	.00
NYD006991673	UNITED PARCEL SERVICE	NEW YORK	13.94	.00	.00
NYD982536807	UNITED PRECIOUS METAL REFINING INC.	ALDEN	35.64	.00	.00
NYD030231153	UNITED SILICONE INC	LANCASTER	19.98	.00	.00
NY1210021837	UNITED STATES ARMY RESERVE CTR AMHE	BUFFALO	15.27	.00	.00
NY8470011232	UNITED STATES GENERAL SERV ADMIN	BROOKLYN	21.27	.00	.00
NY8210020915	UNITED STATES MILITARY ACADEMY	WEST POINT	41.27	271.00	.00
NYD002069789	UNIVERSAL PACKAGING CORPORATION	SARATOGA SPRING	67.34	.00	.00
NYD000631994	UNIVERSITY OF ROCHESTER	ROCHESTER	70.22	911.00	.00
NY0000083162	UOP	TARRYTOWN	17.32	335.00	.00
NY5690319889	US COAST GUARD SUPPORT CTR ENV SFTY	GOVERNORS ISLAN	30.22	336.00	.00
NYD980779540	US DEPARTMENT OF ENERGY	WEST VALLEY	78.67	729.85	.00
NY5890008993	US DOE KNOLLS ATOMIC POWER LABORATO	BALLSTON SPA	21.50	.00	.00
NY6890008992	US DOE/KNOLLS ATOMIC POWER LABORATO	NISKAYUNA	14.83	3.50	.00

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NYD002014546	US EPA BARRIER INDUSTRIES	PORT JARVIS	466.67	70.00	.00
NY0000097394	USA INDUSTRIES	BAYSHORE	26.50	.00	.00
NYD045170701	USEPA REGION II POLYMER APPLICATION	TONAWANDA	754.43	.00	.00
NYD987033362	USP&FO-NY	PEEKSKILL	.78	390.00	.00
NYD053719894	UTICA CORPORATION	WHITESBORO	108.55	.00	.00
NYD075814202	UTICA CORPORATION	WHITESBORO	1,387.32	.00	.00
NYD002249613	UTICA METAL PRODUCTS INC	UTICA	84.14	.00	.00
NYD001929611	VALEO ENGINE COOLING-TRUCK DIV	JAMESTOWN	21.16	.00	.00
NY6360010312	VAMC-NORTHPORT	NORTHPORT	2.11	70.00	.00
NYD175773779	VANCHEM INC.	LOCKPORT	311.47	.00	.00
NYD002090991	VAW OF AMERICA INC	ELLENVILLE	361.84	.00	.00
NYD982738635	VERLA INTERNATIONAL LTD	NEW WINDSOR	86.90	.00	.00
NYD982796443	VERRAZANO-NARROWS BRIDGE	NEW YORK	596.76	.00	.00
NY9360010236	VETERANS AFFAIRS MEDICAL CENTER	ALBANY	4.64	149.70	.00
NYD139268023	VILLAGE AUTO BODY	GREENLAWN	20.85	.00	.00
NYD000910695	VILLAGE OF FORT EDWARD	FORT EDWARD	70.00	.00	.00
NYR000007963	WAL-MART RETURN CENTER 9196	JOHNSTOWN	18.49	.00	.00
NYR000004820	WASHINGTON IRVING SCHOOL	TARRYTOWN	.78	1,570.00	.00
NY7213820940	WATERVLIET ARSENAL	WATERVLIET	623.28	40.00	.00
NYD981482839	WATSON METAL PRODUCTS CORP	WAPPINGERS FALL	307.40	.00	.00
NYD006015580	WEBER KNAPP COMPANY PLANT 1	JAMESTOWN	56.38	.00	.00
NYR000000331	WEGMANS FOOD MARKETS-ELMIRA	ELMIRA	140.00	.00	.00
NYD000818823	WELCH ALLYN INC	SKANEATELES FAL	55.50	.00	.00
NYR000007096	WESTCHESTER DEPT OF PUBLIC WORKS	YONKERS	80.07	.00	.00
NYD079678108	WESTINGHOUSE ELECTRIC CORPORATION	HORSEHEADS	1,252.55	.00	.00
NYD048391080	WESTWOOD - SQUIBB PHARMACEUTICALS,	BUFFALO	25.98	.00	.00
NYD002104875	WILLIAMS ADVANCED MATERIALS INC	BUFFALO	37.32	.00	.00
NYD987037421	WILLIAMSBURG BR/NYC DOT	NEW YORK	28.00	.00	.00
NYD986973691	WILLIAMSBURG BRIDGE	BROOKLYN	1,519.60	.00	.00
NYD058650102	WILSON GREATBATCH LTD	CLARENCE	16.99	.00	.00
NYD063638654	WINFIELD INDUSTRIES INC	BUFFALO	29.70	.00	.00
NYD987005477	WINROSS COMPANY, INC.	EAST ROCHESTER	17.42	.00	.00
NYD003907367	WITCO CORP	BROOKLYN	701.52	.00	.00
NYD002215044	WOERNER INDUSTRIES INC	ROCHESTER	1.06	458.72	.00
NYD002061380	WOODBINE PRODUCTS INC.	DEER PARK	38.21	.00	.00
NYD981494644	WORMUTH BROTHERS FOUNDRY INC	ATHENS	53.10	.00	.00
NYD002211324	XEROX CORP	WEBSTER	1,397.70	18.00	.00
NYD986871424	XEROX CORP AMTX	CANANDAIGUA	247.64	.00	.00
NYD041292509	XEROX CORPORATION	HENRIETTA	34.83	.00	.00
NYD981085947	XEROX CORPORATION	BLAUVELT	30.28	.00	.00
NY0000334342	YONKERS DEPT OF PUBLIC WORKS-SERV C	YONKERS	15.03	.00	.00
NYD001526060	ZIERICK MFG CORP	MT KISCO	13.30	.00	.00
NY4572825475	108 ACG - BLDG 442 - HANCOCK FIELD	NORTH SYRACUSE	3.76	2,400.00	.00
NY0000973719	14TH ST STATION / NYCT	NEW YORK	13.40	.00	.00
NYD980646335	207TH ST YARD / NYCI	NEW YORK	52.60	.00	.00
NY0000366542	215 TH ST SIGNAL SHOP	NEW YORK	22.10	.00	.00
NY0000902171	22 THROOP AVE / NYCT	BROOKLYN	79.40	.00	.00
NYD006978795	287 MASPETH AVENUE	BROOKLYN	458.15	.00	.00
NY0000629998	2901 DEWEY AVE NYS DOT	BRONX	46.20	.00	.00
NYD045606480	3M PRINTING & PUBLISHING	ROCHESTER	151.33	225.00	.00
NYD002127124	3M TONAWANDA	TONAWANDA	4.14	1,020.00	.00
NYR000006171	80 W 225TH ST / NYCT	BRONX	27.30	.00	.00
NY0570024273	914TH AIRLIFT WING (AFRES)	NIAGARA FALLS	33.15	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NYD144518081	AAR ENGINE COMPONENT SERVICES	FRANKFORT	12.86	.00	.00
NYD981179146	AASF #1	RONKONKOMA	12.60	.00	.00
NYD001519339	ACCO USA INC	LONG ISLAND CIT	9.36	.00	.00
NYD981484561	ACME STEEL DOOR INC	BROOKLYN	12.39	.00	.00
NYD982738262	ACPC, INC.	MASSENA	1.88	.00	.00
NYD080474588	ADIRONDACK CORRECTIONAL FACILITY NY	RAY BROOK	3.57	.00	.00
NYP000919050	AERO TRANSPORTERS INC	ELLENVILLE	1.24	.00	.00
NYD098220965	AEROCLO CORP	YONKERS	8.96	.00	.00
NYD982535783	AGREVO ENVIRONMENTAL HEALTH ROUSSEL	MIDDLEPORT	8.47	.00	.00
NYD000332767	AGWAY ENERGY PRODUCTS	SODUS	12.55	.00	.00
NYD071605745	AGWAY ENERGY PRODUCTS	LOWVILLE	6.11	.00	.00
NYD135400877	AGWAY ENERGY PRODUCTS	DUNDEE	1.19	.00	.00
NYD980537153	AGWAY ENERGY PRODUCTS	ROCHESTER	2.61	.00	.00
NYD986875300	AGWAY ENERGY PRODUCTS	LIBERTY	3.13	.00	.00
NYD986968097	AGWAY ENERGY PRODUCTS	HEUWELTON	1.58	.00	.00
NYD986980761	AGWAY ENERGY PRODUCTS	NEW BERLIN	6.26	.00	.00
NYD986980787	AGWAY ENERGY PRODUCTS	SHERBURNE	5.36	.00	.00
NYP000921270	AGWAY ENERGY PRODUCTS	RIVERHEAD	3.89	.00	.00
NYD002205607	AKZO NOBEL SALT INC	RETSOF	8.44	.00	.00
NYD002246361	AKZO NOBEL SALT INC	WATKINS GLEN	2.43	.00	.00
NYR000012500	ALARD EQUIPMENT CORP	WILLIAMSON	3.63	.00	.00
NYD986905347	ALBANY COUNTY AIRPORT	ALBANY	1.94	.00	.00
NYD987027646	ALBANY MOLECULAR RESEARCH INC	ALBANY	9.19	.00	.00
NYD071488720	ALBION CORRECTIONAL FACILITY-INDUST	ALBION	12.33	.00	.00
NYD003980216	ALCAN ROLLED PRODUCTS COMPANY	SCRIBA	1.33	.00	.00
NYD987023108	ALEXANDER HAMILTON US CUSTOMHOUSE	NEW YORK CITY	8.70	.00	.00
NYD001328236	ALFA LAVAL	POUGHKEEPSIE	4.96	.00	.00
NYR000007104	ALFREDO LANDSCAPE CORP	ARMONK	1.98	.00	.00
NYD980593107	ALGONQUIN GAS TRANSMISSION COMPANY	STONY POINT	10.67	.00	.00
NY0000063222	ALGONQUIN GAS TRANSMISSION COMPANY	BREWSTER	4.43	.00	.00
NYR000007070	ALL HALLOWS HIGH SCHOOL	BRONX	.49	15.00	.00
NYD002244945	ALLIED SIGNAL INC-SYRACUSE WORKS	SOLVAY	10.35	.00	.00
NY0000018473	ALLWASTE CONTAINER SERVICES	NIAGARA FALLS	2.98	.00	.00
NYD986940856	AMERADA HESS - ALBANY STATION #3220	WATERVLIET	4.26	.00	.00
NYD000707778	AMERADA HESS - MARCY TERMINAL	MARCY	11.80	.00	.00
NYD073674848	AMERADA HESS - ROCHESTER LYELL TERM	ROCHESTER	5.84	.00	.00
NYD010766822	AMERADA HESS - STATION #32214	SYRACUSE	1.15	.00	.00
NYR000006742	AMERADA HESS - STATION #32405	SCHENECTADY	2.75	.00	.00
NY0000936559	AMERADA HESS - STATION #32407	LATHAM	1.25	.00	.00
NY0000270272	AMERADA HESS - STATION 32333	CAMILLUS	2.50	.00	.00
NYD000705889	AMERADA HESS CORPORATION	NEWBURGH	5.00	.00	.00
NYR000015933	AMERADA HESS CORPORATION	ROCHESTER	1.50	.00	.00
NYD987036415	AMERADA HESS CORPORATION STATION 32	WEST GLENS FALL	2.44	.00	.00
NYD981184930	AMERICAN AIRLINES	JAMIACA	4.98	.00	.00
NYD981077712	AMERICAN AIRLINES - LAGUARDIA AIRPO	FLUSHING	3.34	.00	.00
NYD000784462	AMERICAN ALLSAFE COMPANY	TONAWANDA	1.58	.00	.00
NYD078722279	AMERICAN HEALTH FOUNDATION	VALHALLA	6.26	.00	.00
NYD061202768	AMERICAN MUSEUM OF NATURAL HISTORY	NEW YORK	1.36	.00	.00
NYD002114643	AMERICAN PRECISION IND BASCO DIVISI	BUFFALO	1.65	.00	.00
NYD000704429	AMOCO CORPORATION	PELHAM MANOR	1.28	.00	.00
NYD986943587	AMOCO CORPORATION	MINEOLA	2.39	.00	.00
NYD986963585	AMOCO CORPORATION	SOUTH HEMPSTEAD	3.02	.00	.00
NYD002066777	AMSTERDAM PRINTING AND LITHO CORP	AMSTERDAM	10.79	.00	.00
NYD986945582	AMTRAK ERIE YARD / AMTRAK	NEW YORK	11.87	.00	.00
NYD078516895	AMTRAK SUNNYSIDE MAINTENANCE FACILI	LONG ISLAND CIT	9.75	.00	.00

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NYD033490640	ANDIN INTERNATIONAL	NEW YORK	1.39	.00	.00
NY0001039650	ANDREW JACKSON H.S.	CAMBRIA HEIGHTS	1.60	.00	.00
NYD986874568	ARCOM LABS	SYRACUSE	2.30	.00	.00
NYD987036209	ARLINGTON HIGH SCHOOL NORTH CAMPUS	LAGRANGEVILLE	1.49	10.00	.00
NYD981488216	ARTHUR MATNEY CO.,INC.	BROOKLYN	13.05	.00	.00
NYD013233242	ASHFORD CONCRETE, INC.	SPRINGVILLE	9.14	.00	.00
NYD000810937	ASHLAND CHEMICAL CO	RENSSELAER	1.26	.00	.00
NYD000688630	ASHLAND CHEMICAL COMPANY	TONAWANDA	11.59	.00	.00
NYR000005314	ASTRA ARGUS USA	ROCHESTER	3.80	.00	.00
NYD980526560	AT & T CORP	CLARKSVILLE	2.07	.00	.00
NYR000003533	ATALANTA CORPORATION	NEW YORK	2.31	.00	.00
NY0000368423	ATLANTIC AVE MANHOLES	BROOKLYN	4.00	.00	.00
NY0000368381	ATLANTIC AVE MANHOLES/LI RAIL ROAD	BROOKLYN	1.25	.00	.00
NY0000973693	ATLANTIC AVE STA/NYCT	BROOKLYN	8.90	.00	.00
NYR000008441	ATLANTIC MORRIS BROADCASTING	MIDDLETOWN	2.50	.00	.00
NYD000520924	ATLANTIC RESEARCH CORPORATION	NIAGARA FALLS	4.90	.00	.00
NYD981871411	ATLAS COPCO COMPTEC	VOORHEESVILLE	3.54	.00	.00
NYD986942910	AUTOMOTIVE PRECISION MACHINE LTD	HIGHLAND	1.50	.00	.00
NYD063658603	AVERY DENNISON INFORMATION SYSTEMS	BUFFALO	2.29	.00	.00
NYD981080583	AYERST RESEARCH	CHAZY	11.89	.00	.00
NYD085993491	B R DEWITT - CLIFTON SPRINGS	CLIFTON SPRINGS	3.75	.00	.00
NYR000005322	BAHAR CORP	BRENTWOOD	6.26	.00	.00
NYD000098558	BALDWIN PLACE MALL	TOWN OF SOMERS	1.21	.00	.00
NYD176893428	BANKERS TRUST CO.	NEW YORK	3.12	.00	.00
NYR000002261	BARBER WELDING INC	WEEDSPORT	1.54	.00	.00
NYD001328368	BASF CORP	NEW YORK	9.05	.00	.00
NYD987019957	BASTIAN COMPANY INC	GENEVA	5.04	.00	.00
NYD000708230	BAYER CORP BUSINESS GROUP DIAGNOSTI	BLAUVELT	5.17	.00	.00
NYD050275627	BAYER CORP BUSINESS GROUP DIAGNOSTI	TARRYTOWN	5.01	21.00	.00
NYD062506662	BEACON CHEMICAL COMPANY INC	MOUNT VERNON	8.10	.00	.00
NYD987009131	BEECHE SYSTEMS INC	SCOTIA	5.28	.00	.00
NYD000707810	BELLEVUE HOSPITAL CENTER	NEW YORK	11.13	.00	.00
NYD084070192	BELLEVUE MATERNITY HOSPITAL, INC.	NISKAYUNA	.97	5.00	.00
NYR000003327	BELT PKWY/NYC DOT	BROOKLYN	3.80	.00	.00
NYD048146989	BENDER HYGIENIC LABORATORY	ALBANY	.48	6.00	.00
NYD152641270	BETH ISRAEL MEDICAL CTR	NEW YORK	12.79	.00	.00
NYD002209906	BIG FLATS FERTILIZER PLANT	BIG FLATS	1.93	.00	.00
NY0000277244	BOBS ONE HOUR PHOTO	MANHASSET	10.24	.00	.00
NYD058921107	BORG WARNER AUTOMOTIVE MORSE TEC CO	ITHACA	11.65	.00	.00
NYD001556695	BORO KITCHEN CABINETS	RIDGEWOOD	6.02	.00	.00
NY0000933648	BRIDGE CONRAIL OVER RT 17	BARTON	3.25	.00	.00
NY0000933572	BRIDGE PENNA AVE OVER BROAD ST	BARTON	3.25	.00	.00
NY0000933614	BRIDGE PENNA AVE OVER RT 17	BARTON	2.90	.00	.00
NY0000933622	BRIDGE RT 17 OVER CAYUTA CRK	BARTON	4.22	.00	.00
NYD987014818	BRIDGE RT 17C OVER BUTSON CRK	BARTON	4.20	.00	.00
NY0000933556	BRIDGE RT 220 OVER RT 17 & CONRAIL	BARTON	1.63	.00	.00
NY0000933465	BRIDGE RT 38 OVER E BRANCH	RICHFORD	3.30	.00	.00
NY0000933515	BRIDGE RT 38 OVER EAST BRANCH	NEWARK VALLEY	4.22	.00	.00
NY0000933523	BRIDGE RT 38 OVER WADE HOLLOW	NEWARK VALLEY	2.92	.00	.00
NY0000933440	BRIDGE RTE 282 OVER WAPPASENING CRE	BARTON	3.60	.00	.00
NY0000933598	BRIDGES RT 17 OVER CAYUTA CREEK	BARTON	3.00	.00	.00
NY0000933606	BRIDGES RT 17 OVER CONRAIL	BARTON	3.25	.00	.00
NY0000933432	BRIDGES RT 17 OVER CORD 52	NICHOLS	3.25	.00	.00
NYR000006858	BRIGHTON SPAN/NYCT	BROOKLYN	5.80	.00	.00
NYD001502822	BRITISH AIRWAYS	JACKSON HEIGHTS	1.40	.00	.00

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NYD002242543	BRODOCK PRESS INDC	UTICA	12.84	.00	.00
NYD980779672	BRONX PSYCHIATRIC CENTER	BRONX	4.59	.00	.00
NY0000869578	BROOKLYN ARMY TERMINAL - BLDG A	BROOKLYN	7.75	.00	.00
NYD981078058	BROOKLYN NAVY YARD DEVELOPMENT CORP	BROOKLYN	4.19	.00	.00
NYR000015388	BROOKLYN TECHNICAL HIGH SCHOOL	BROOKLYN	1.60	.00	.00
NYR000006007	BROOKLYN UNION	JAMAICA	1.36	.00	.00
NY0000017186	BROOKLYN UNION	BROOKLYN	11.73	.00	.00
NYD980537054	BUCKEYE PIPE LINE COMPANY LP AUBURN	AUBURN	2.23	.00	.00
NYD080335052	BUFFALO COLOR CORPORATION	BUFFALO	2.27	5.00	.00
NYD000631903	BUFFALO FORGE CO	CHEEKTOWAGA	2.27	.00	.00
NYD002102853	BUFFALO METAL FABRICATING CORP	BUFFALO	2.07	.00	.00
NYD986980514	BUFFALO MUNICIPAL HOUSING AUTHORITY	BUFFALO	5.50	.00	.00
NYD987031325	BUFFALO MUNICIPAL HOUSING AUTHORITY	BUFFALO	1.50	.00	.00
NY0000098673	BUFFALO MUNICIPAL HOUSING AUTHORITY	BUFFALO	5.00	.00	.00
NY0001001692	BUFFALO MUNICIPAL HOUSING AUTHORITY	BUFFALO	2.00	.00	.00
NYD002127199	BUFFALO PUMPS INC	N TONAWANDA	1.77	.00	.00
NYD986899714	BUFFALO SERVICENTER	BUFFALO	2.08	.00	.00
NYD097643738	BUFFALO SEWER AUTH WASTEWATER TRTMT	BUFFALO	.01	2.20	.00
NY0001093657	BUFFALO SEWER AUTHORITY SITE	BUFFALO	6.51	.00	.00
NY0000099002	BULOVA FORMER WATCH CASE FACTORY	SAG HARBOR	13.20	.00	.00
NYD982790651	BURNS BROS CONTRACTORS	SYRACUSE	4.46	.00	.00
NYD986974640	BURNS BROS CONTRACTORS	SYRACUSE	1.11	.00	.00
NYD065946642	BURTON INDUSTRIES INC.	NORTH BABYLON	6.10	.00	.00
NYD002111961	BUSH INDUSTRIES INC	LITTLE VALLEY	1.83	.00	.00
NYD981134620	BUSH INDUSTRIES INC	JAMESTOWN	12.92	.00	.00
NYD986947232	BUSINESS EXPRESS INC	LATHAM	2.85	.00	.00
NYD002242303	C A REEVE PAINT CO INC	SYRACUSE	10.60	.00	.00
NYD118786128	C BASIL FORD INC	BUFFALO	2.29	.00	.00
NYD013702410	C.A. BATT CONSTRUCTION CORP	BUFFALO	2.17	.00	.00
NYD063650873	C.H. HEIST CORP.	BUFFALO	2.69	.00	.00
NYD001610849	CADDELL DRY DOCK AND REPAIR CO. INC	STATEN ISLAND	10.20	.00	.00
NYD000818468	CAE-LINK CORP	BINGHAMTON	9.80	.00	.00
NYD980524383	CALLANAN INDUSTRIES INC	SOUTH BETHLEHEM	8.26	.00	.00
NYD004482378	CALSPAN	BUFFALO	3.92	.00	.00
NYD986891356	CAMERA CLICK INC #2	HUNTINGTON	1.81	.00	.00
NYD002242006	CAMILLUS CUTLERY COMP	CAMILLUS	5.13	.00	.00
NYD063784300	CAMO LABORATORIES INC	POUGHKEEPSIE	4.95	.00	.00
NY0000943779	CARABIE CORPORATION	MT VERNON	3.95	.00	.00
NYD986890135	CARBORUNDUM CORP-MICROELECTRONICS-S	SANBORN	6.72	.00	.00
NYD042567297	CARBORUNDUM SPECIALTY GRAPHITE	SANBORN	4.10	.00	.00
NYD010781334	CARGILL INCORPORATED	LANSING	6.12	10.00	.00
NYD002046977	CASTLEREUGH PRESS	FREEPORT	10.50	.00	.00
NYR000007195	CATTARAUGUS COUNTY DPW	HINSDALE	8.00	.00	.00
NYR000007203	CATTARAUGUS COUNTY DPW	PORTVILLE	3.70	.00	.00
NYR000007211	CATTARAUGUS COUNTY DPW	FRANKLINVILLE	11.30	.00	.00
NYR000007153	CAUYGA AVE BRIDGE/CITY OF WATERTOWN	WATERTOWN	3.15	.00	.00
NYD981487168	CCN INTERNATIONAL	GENEVA	5.22	.00	.00
NYD000705905	CENTRAL HUDSON GAS & ELECTRIC CORP	HIGHLAND	2.08	.00	.00
NYD006993695	CENTRAL HUDSON GAS & ELECTRIC CORP	POUGHKEEPSIE	1.64	.00	.00
NYD987017480	CHAMELEON COLOR CARDS LTD	LOCKPORT	3.47	.00	.00
NYD072720162	CHAMPION INTERNATIONAL CORP	WEST NYACK	1.18	.00	.00
NYD051817575	CHAMPION PRODUCTS INC	PERRY	6.77	.00	.00
NYD001482728	CHARLES ROSS & SON COMPANY	HAUPPAUGE	3.92	.00	.00
NYD074039272	CHARM GRAPHICS, INC.	CHEEKTOWAGA	4.60	.00	.00
NYD986950004	CHATHAM CENTRAL SCHOOL DISTRICT	CHATHAM	1.49	.00	.00

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NYD981482672	CHECK-MATE INDUSTRIES INC	WYANDANCH	7.99	.00	.00
NYD986976041	CHELSEA PIERS/NY STATE DEPT OF TRAN	NEW YORK	4.90	.00	.00
NYR000004689	CHEMICAL WASTE MANAGEMENT INC	HARRIMAN	1.46	.00	.00
NYD986947133	CHEMTECH LTD.	ORISKANY	4.60	.00	.00
NYD987017142	CHERRY LANE LITHOGRAPHING CORP	PLAINVIEW	6.73	.00	.00
NYD982534141	CHEVRON USA #204574	HARRISON	2.20	.00	.00
NYD074015744	CHILDRENS HOSPITAL	BUFFALO	1.04	15.00	.00
NYD002205227	CHLORIDE ELECTRO NETWORKS	CALEDONIA	2.54	.00	.00
NYD986965887	CHROMALLOY TURBINE TECHNOLOGIES	MIDDLETOWN	4.81	.00	.00
NYD084069426	CIBRO PETROLEUM PRODUCTS INC	ALBANY	2.75	.00	.00
NYD986950285	CINCINNATUS CENTRAL SCHOOL	CINCINNATUS	1.60	.00	.00
NYD100392992	CIRCLEVILLE MIDDLE SCHOOL	CIRCLEVILLE	2.96	.00	.00
NYT000908558	CITY & SUBURBAN DELIVERY SYSTEMS	LONG ISLAND CIT	1.83	.00	.00
NYD001560580	CITY ENAMELING CORP	YONKERS	4.52	.00	.00
NY0001021898	CITY OF BUFFALO	BUFFALO	3.79	.00	.00
NYD986911568	CITY OF ITHACA DEPT OF PUBLIC WORKS	ITHACA	3.63	.00	.00
NYR000005652	CITY OF NEW YORK DEPARTMENT OF	BROOKLYN	1.62	.00	.00
NYR000007443	CITY OF ROCHESTER	ROCHESTER	2.79	.00	.00
NYR000003277	CITY OF SYRACUSE FIRE STATION #2	SYRACUSE	5.60	.00	.00
NYD980651541	CIVES STEEL COMPANY NORTHERN DIVISI	GOUVERNEUR	6.20	.00	.00
NYD001629682	CLAY PARK LABS INC	BRONX	7.57	.00	.00
NYR000014027	CLAY VOL FIRE DEPARTMENT	CLAY	2.09	.00	.00
NYR000001586	CLEARPLASS CONTAINERS, INC.	PENN YAN	1.47	.00	.00
NYD982790818	CLIFTON PARK	CLIFTON PARK	9.00	.00	.00
NYR000012484	CLINTON COUNTY HIGHWAY DEPARTMENT	MOOERS	1.60	.00	.00
NYR000012492	CLINTON COUNTY HIGHWAY DEPARTMENT	ELLENBURG	1.20	.00	.00
NY0000334375	CLINTON COUNTY HIGHWAY PLATTSBURGH	PLATTSBURGH	1.27	.00	.00
NYD981872278	CNG TRANSMISSION - BORGER COMPRESSO	ITHACA	2.87	.00	.00
NYD982282709	CNG TRANSMISSION - WOODHULL COMPRES	WOODHULL	3.55	.00	.00
NYD987006756	COLOR COMMUNICATIONS INC	BUFFALO	2.63	.00	.00
NYD076691187	COLUMBIA UNIVERSITY NEVIS LABS	IRVINGTON	1.47	.00	.00
NYD981186448	COMSTOCK MICHIGAN FRUIT	OAKFIELD	3.39	.00	.00
NYD000706234	CON EDISON -	BRONX	5.70	.00	.00
NYD981562788	CON EDISON -	NEW YORK	1.90	.00	.00
NYD986872489	CON EDISON -	FLUSHING	4.85	.00	.00
NYD003939766	CON EDISON - ARTHUR KILL GENERATING	STATEN ISLAND	11.62	.00	.00
NYD003939592	CON EDISON - EAST RIVER GENERATING	NEW YORK	2.30	.00	.00
NYD981141252	CON EDISON - ECHO AVENUE SUBSTATION	NEW ROCHELLE	1.60	.00	.00
NYD991304411	CON EDISON - INDIAN POINT GEN STATI	BUCHANAN	3.06	.00	.00
NYD135811503	CON EDISON - RYE SERVICE CENTER	RYE	2.50	.00	.00
NYR000001487	CON EDISON - VERPLANCK HATCHERY	VERPLANCK	1.50	.00	.00
NYP000920017	CON EDISON - YORK AVE & 62ND ST	NEW YORK	3.30	.00	.00
NYD980593636	CON EDISON-ASTORIA SITE	ASTORIA	7.50	.00	.00
NYD981495385	CON EDISON-BRUCKNER BLVD SERVICE CT	NEW YORK	7.60	.00	.00
NYD982272841	CON EDISON-CLEVELAND ST SERVICE CTR	BROOKLYN	1.80	.00	.00
NYD000705939	CON EDISON-EASTVIEW SERVICE CENTER	VALHALLA	2.60	.00	.00
NYD000706259	CON EDISON-WATERSIDE GENERATING STA	NEW YORK	12.40	.00	.00
NYD982529562	CON MED CORP	UTICA	2.34	.00	.00
NYR000004648	CON, COON & FLYNN	TONAWANDA	4.17	.00	.00
NYD003925070	CONCORD ELECTRONICS	NEW YORK	9.32	.00	.00
NY0000990861	CONFORT & COMPANY	LONG ISLAND CIT	1.87	.00	.00
NYD000810978	CONRAIL ROCHESTER CAR SHOP	ROCHESTER	4.60	.00	.00
NYD000691253	CONRAIL SELKIRK ENGINE TERMINAL	SELKIRK	2.00	.00	.00
NYD047677042	CONTEMPORARY CEILINGS INC	LONG ISLAND CIT	11.80	.00	.00
NYD980210397	CONTEMPORARY PACKAGING CORP	PLAINVIEW	9.76	.00	.00

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NEW YORK

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NYD047529979	CORAL COLOR PROCESS LTD	COMMACK	4.80	.00	.00
NYD121029862	CORAL GRAPHIC SERVICES INC	HICKSVILLE	8.50	.00	.00
NYR000001230	CORAL GRAPHIC SERVICES INC	HICKSVILLE	8.70	.00	.00
NY0000074799	CORNELL UNIV - LI HORTICULTURA LAB	RIVERHEAD	5.58	.00	.00
NYD986960573	CORNING CLINICAL LABORATORIES	MASSAPEQUA	13.00	.00	.00
NYD013666821	CORNING INCORPORATED-BIG FLATS PLAN	BIG FLATS	9.37	.00	.00
NYR000007328	CORTLAND JR-SR HIGH SCHOOL	CORTLAND	2.10	.00	.00
NYD055961361	CROSMAN CORPORATION	EAST BLOOMFIELD	9.69	.00	.00
NYP000919027	CROWN ENTERPRIZES	LATHAM	9.60	.00	.00
NY4210022279	CSMS-C & USP & FO WAREHOUSE	ROCHESTER	3.68	.00	.00
NYR000006064	CUMBERLAND FARMS # 3102	SCHENECTADY	2.86	.00	.00
NYR000000224	CUMBERLAND FARMS INC	STATEN ISLAND	9.13	.00	.00
NYD986953164	CUMBERLAND FARMS INC GULF S/S #1203	COMMACK	2.28	.00	.00
NYD074019753	CUMMINS ENGINE CO, INC	LAKEWOOD	10.72	.00	.00
NYR000011544	DAVIDSON PIPE SUPPLY CO INC	BROOKLYN	3.45	.00	.00
NYD986901502	DEDECO INTERNATIONAL INC	LONG EDDY	2.47	.00	.00
NYD000909846	DEFOREST LAKE FILT/UNITED WATER NY	WEST NYACK	4.68	.00	.00
NYD986968139	DELAWARE & HUDSON RAILWAY CO	CLIFTON PARK	1.33	.00	.00
NY0000119537	DELAWARE COUNTY DPW	DELHI	1.94	.00	.00
NYD986884559	DEMING PLATING COMPANY	CUBA	1.50	.00	.00
NYR000002139	DEPT OF CITYWIDE ADMIN SRVCES	NEW YORK	6.11	.00	.00
NYR000008136	DEPT OF CITYWIDE ADMIN SRVCES	NEW YORK	4.42	.00	.00
NYD986963494	DH PROPERTIES	WATERVLIET	7.19	.00	.00
NYD986875219	DORITEX CORP	ALDEN	9.53	.00	.00
NYD052789625	DORNE & MARGOLIN	BOHEMIA	8.45	.00	.00
NYD085999936	DORSCHEL BUICK/TOYOTA	ROCHESTER	7.84	.00	.00
NYD986905628	DORSCHEL OLDSMOBILE	ROCHESTE	2.29	.00	.00
NYD981557796	DOVATRON MANUFACTURING EAST DIVISIO	CONKLIN	5.75	.00	.00
NYD068212695	DREW IND DIV.; DREW WATER SERVICES;	NEW YORK	.74	5.00	.00
NYD981560683	DRI MARK PRODUCTS INC.	PORT WASHINGTON	12.51	.00	.00
NYD986974954	DUN-RITE TOWING, INC.	ELMSFORD	1.67	.00	.00
NYD002101137	DUNKIRK RADIATOR CORPORATION	DUNKIRK	4.58	.00	.00
NYR000014126	DUTCHESS COUNTY DEPARTMENT OF PUB W	POUGHKEEPSIE	1.27	.00	.00
NYD982528010	EAGLE COMTRONICS	LIVERPOOL	5.60	.00	.00
NYD100055086	EAST HAMPTON MIDDLE SCHOOL	EAST HAMPTON	1.88	.00	.00
NY0001039668	EASTERN DISTRICT H.S.	BROOKLYN	3.80	.00	.00
NYD980582969	EASTERN ELECTRIC APPARATUS REPAIR C	YORKVILLE	1.23	.00	.00
NYD002208031	EASTERN METAL OF ELMIRA INC	ELMIRA	12.72	.00	.00
NYD981182926	EASTERN ROCK PRODUCTS INC ORISKANY	ORISKANY FALLS	1.96	.00	.00
NYD980537112	EASTMAN KODAK COMPANY-C PLANT	ROCHESTER	3.27	.00	.00
NYD980789218	EASTMAN KODAK COMPANY-GERBER PLANT	ROCHESTER	12.44	.00	.00
NYD000809335	EASTMAN KODAK COMPANY-HAWKEYE PLANT	ROCHESTER	3.95	.00	.00
NYD980784680	EASTMAN KODAK COMPANY-KODAK OFFICE	ROCHESTER	2.48	.00	.00
NYD018503789	EBENEZER RAILCAR SERV	WEST SENECA	5.13	.00	.00
NYD981086499	EDWARD S GORDON INC	NEW YORK CITY	3.78	.00	.00
NYD001223692	EG&G ROTRON	WOODSTOCK	7.15	.00	.00
NY0000330126	EG&G ROTRON INC	SAUGERTIES	2.20	.00	.00
NYD986974970	ELECTRO ABRASIVES CORP.	LACKAWANNA	2.52	.00	.00
NYD002123933	ELF ATOCHEM NORTH AMERICA	TONAWANDA	6.17	5.00	.00
NYD986887925	ELITE SUEDE & LEATHER CLEANING CO I	BRONX	8.03	.00	.00
NYD986984250	ELL'S & RODS SERVICE CTR	CANISTED	2.29	.00	.00
NYD002049302	ELMONT MANUFACTURING CO INC	HAUPPAUGE	10.61	.00	.00
NYR000013045	EM REALTY MGT CORP	NEW YORK CITY	2.05	.00	.00
NYD982795296	EMPIRE SIGN COMPANY	ROCHESTER	1.37	.00	.00
NYD001480029	EMPIRE STATE CHAIR	HAVERSTRAW	6.24	.00	.00

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NYD061966750	ENTENMANN'S	BAY SHORE	8.69	.00	.00
NYD001212752	EON LABS MANUFACTURING INC	LAURELTON	10.67	.00	.00
NYD982725962	EPNER TECHNOLOGY INC	BROOKLYN	4.10	.00	.00
NYD986992733	ERIE TRAILER REPAIR	TONAWANDA	2.38	.00	.00
NYD002028421	EUTECTIC CORPORATION	FLUSHING	1.42	.00	.00
NY0000379057	EVANS AUTOMOTIVE MACHINE SHOP	AUBURN	3.61	.00	.00
NYP000919787	EVERGREEN & FLUSHING AVE	BROOKLYN	1.40	.00	.00
NYD986906642	EXXON CO USA #30464	SMITHTOWN	2.50	.00	.00
NYD986971778	EXXON CO USA #31208	SCARSDALE	4.00	.00	.00
NYD986949089	EXXON CO USA #32258	MONSEY	8.50	.00	.00
NYD987018512	EXXON CO USA #35488	WESTBURY	3.30	.00	.00
NYD986896264	EXXON CO USA #37072	SPRINGFIELD GAR	7.30	.00	.00
NYD986949279	EXXON CO USA #37078	BROOKLYN	1.70	.00	.00
NYD986949030	EXXON CO USA #37337	BROOKLYN	2.50	.00	.00
NYD986893022	EXXON CO USA #37344	BRONX	1.80	.00	.00
NYD982797664	EXXON CO USA #37447	BRONX	2.50	.00	.00
NYD986928646	EXXON CO USA #37495	SAINT JAMES	1.10	.00	.00
NYD986953255	EXXON CO USA #37741	SYOSSET	8.70	.00	.00
NYD986896868	EXXON CO USA #37823	BRONX	4.60	.00	.00
NYD986955789	EXXON CO USA #38988	BROOKLYN	1.10	.00	.00
NYD000809319	EXXON PELHAM MANOR TERMINAL	PELHAM MANOR	2.56	.00	.00
NYD002109312	F.N. BURT COMPANY INC.	CHEEKTOWAGA	12.10	.00	.00
NY0000474676	FABER & WILKENS AUTO REPAIR INC	BAYSHORE	1.50	.00	.00
NYD079818555	FAIRCHILD REPUBLIC COMPANY	FARMINGDALE	2.06	.00	.00
NYD055057962	FANCHER FURNITURE CO INC	SALAMANCA	12.88	.00	.00
NYD000521856	FARBERWARE	BRONX	11.82	.00	.00
NYR000014498	FDIC AS RECEIVER FOR COMMUNITY NATL	STATEN ISLAND	5.88	.00	.00
NYD987032380	FEINTOOL NEW YORK INC	WHITE PLAINS	7.34	.00	.00
NYD002065860	FIBER GLASS INDUSTRIES INC	AMSTERDAM	5.78	.00	.00
NYD000824474	FILM & PAPER CORPORATION OF AMERICA	JOHNSON CITY	7.33	.00	.00
NYD083536144	FLEX O VIT USA INC	ANGOLA	11.49	.00	.00
NYD986971919	FOAMEX INTERNATIONAL INC	ARCADE	3.59	.00	.00
NYD071474639	FORD MOTOR CO BUFFALO STAMPING	BUFFALO	4.47	.00	.00
NYR000003392	FORMFACTOR INC	ELMSFORD	4.77	10.00	.00
NYD038650495	FORSYTHE COSMETIC GROUP LTD	INWOOD	1.30	.00	.00
NYR000008193	FREEDOM RACEWAY LP	DELEVAN	4.00	.00	.00
NYD986965713	FUJI FILM PROFESSIONAL SERVICE CENT	CORONA PARK	1.63	.00	.00
NYD004986741	FURON-HOOSICK FALLS FACILITY	HOOSICK FALLS	7.46	.00	.00
NYD991291881	FURON-HOOSICK FALLS FACILITY	HOOSICK FALLS	7.73	.00	.00
NYR000002113	GARDEN CITY POLICE DEPARTMENT	GARDEN CITY	4.00	.00	.00
NYD002073781	GARDEN WAY INCORPORATED	TROY	7.20	.00	.00
NYD077499515	GARRETT AVIATION SRVCS	RONKONKOMA	10.70	.00	.00
NYD001493774	GASSER & SONS INC	COMMACK	8.50	.00	.00
NYD980648612	GE COMPANY MOREAU SUPERFUND SITE	SOUTH GLENS FAL	4.20	.00	.00
NYD987031499	GEI INTERNATIONAL INC	E SYRACUSE	10.68	.00	.00
NYD986932911	GEM URETHANE CORP.	AMSTERDAM	8.78	.00	.00
NYD001527688	GENERAL BEARING CORPORATION	WEST NYACK	8.00	.00	.00
NYD067539940	GENERAL ELECTRIC CO	TONAWANDA	1.44	.00	.00
NYD002080075	GENERAL ELECTRIC COMPANY INC	HUDSON FALLS	3.80	.00	.00
NYD981086382	GENERAL ELECTRIC COMPANY-FT MILLER	FT EDWARD	2.16	.00	.00
NYD982730632	GENERAL GALVANIZATING & SUPPLY CO.	BRONX	6.47	.00	.00
NYD012871489	GENERAL MOTORS CORPORATION	MASSENA	6.91	.00	.00
NYD002207256	GENERAL PLATING COMPANY	ROCHESTER	8.80	.00	.00
NYD002207520	GENESEE VALLEY METAL FINISHING	ROCHESTER	5.50	.00	.00
NY0001038462	GENEVA HOUSING AUTHORITY	GENEVA	1.60	.00	.00

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NYR000006809	GENOVESE DRUG STORE #12	OAKDALE	5.36	.00	.00
NYR000011965	GENOVESE DRUG STORE #15	SETAUKET	3.82	.00	.00
NY0000563312	GENOVESE DRUG STORE #44	ROCKY POINT	10.32	.00	.00
NYR000016220	GEOMETRIC CIRCUITS INC	FARMINGDALE	1.89	.00	.00
NYD982796302	GETTY PETROLEUM CORP	ELMONT	2.41	.00	.00
NYD986927648	GETTY PETROLEUM CORP	BALDWIN	9.07	.00	.00
NYD986945707	GETTY PETROLEUM CORP	MINEOLA	2.75	.00	.00
NYD986962272	GETTY PETROLEUM CORP	PELHAM MANOR	2.06	.00	.00
NYD987006590	GETTY PETROLEUM CORP	MANHASSET	1.50	.00	.00
NYR000000240	GETTY PETROLEUM CORP	SMITHTOWN	5.78	.00	.00
NYR000011353	GETTY PETROLEUM CORP	BRONX	2.06	.00	.00
NYR000011379	GETTY PETROLEUM CORP	BRONX	1.86	.00	.00
NYR000011387	GETTY PETROLEUM CORP	WHITE PLAINS	1.86	.00	.00
NYR000012997	GETTY PETROLEUM CORP	DEER PARK	3.30	.00	.00
NYR000014555	GETTY PETROLEUM CORP	BALDWIN	6.59	.00	.00
NYR000016055	GETTY PETROLEUM CORP	BRONX	1.44	.00	.00
NYR000016147	GETTY PETROLEUM CORP	PLEASANT VALLEY	1.69	.00	.00
NY0000563809	GETTY PETROLEUM CORP	ALBERTSON	1.44	.00	.00
NY0000968578	GETTY PETROLEUM CORP	LONG ISLAND CIT	1.24	.00	.00
NY0001013804	GETTY PETROLEUM CORP	WESTBURY	3.03	.00	.00
NY0001013820	GETTY PETROLEUM CORP	WESTBURY	1.86	.00	.00
NY0000188672	GIANI ENTERPRISES	DEER PARK	12.16	.00	.00
NY0000362632	GLASS FACTORY ROAD OVER NINE MILE C	TRENTON	12.80	.00	.00
NYD001340991	GOLDSMITHS	LONG ISLAND CIT	4.40	.00	.00
NYD078705985	GOOD SAMARITAN HOPSITAL	SUFFERN	.16	5.00	.00
NYD149982563	GOODYEAR AUTO SERVICE CENTER # 0435	KENMORE	8.78	.00	.00
NYD137882411	GOODYEAR AUTO SERVICE CENTER #1126	ELMIRA	8.78	.00	.00
NYD986884583	GP:50 NEW YORK LTD	GRAND ISLAND	3.99	.00	.00
NYD101208890	GRANULAR SPECIALTIES	RONKONKOMA	8.00	.00	.00
NYD002111896	GRAPHIC CONTROLS CORPORATION	BUFFALO	9.66	.00	.00
NYD982538969	GREATER BUFFALO INTERNATIONAL AIRPO	CHEEKTOWAGA	8.91	.00	.00
NYD064308455	GREATER DISPLAY INC.	WARWICK	3.60	.00	.00
NYD061200812	GREENSPAN & KUSHLIN ENG. CORP.	NEW YORK	1.83	.00	.00
NYD980755441	GREYHOUND LINES INC	NEW YORK CITY	1.55	.00	.00
NYD982536765	GROVELAND CORRECTIONAL FACILITY	SONYEA	3.46	.00	.00
NYD986964278	GRUMMAN AEROSPACE CORP-EAGLES NEST	BETHPAGE	3.35	.00	.00
NYD096924113	GRUMMAN AEROSPACE CORPORATION	GREAT RIVER	7.91	.00	.00
NY3470010007	GSA	NEW YORK	1.22	.00	.00
NYD002116499	GUARDIAN JAMESTOWN	FALCONER	5.58	.00	.00
NYR000014514	GULF S/S #61721 CUMBERLAND FARMS IN	WESTBURY	2.68	.00	.00
NYD987023959	HALMARK ARCHITECTURAL FINISHING COR	BROOKLYN	3.53	.00	.00
NYD982272239	HAMILTON COLLEGE	CLINTON	1.18	9.34	.00
NYD986883684	HAMMEL HOUSES	ROCKAWAY BEACH	6.65	.00	.00
NYD986897395	HAMPTON PHOTO ARTS INC	BRIDGEHAMPTON	2.75	.00	.00
NY0000622696	HAND BATTERY SITE	S NYACK	5.00	.00	.00
NYD002204063	HARDINGE INC	ELMIRA	3.10	.00	.00
NYD980646111	HARRIS CORPORATION	ROCHESTER	2.43	.00	.00
NY0000149898	HAUPPAUGE DIAGNOSTIC IMAGING	HAUPPAUGE	11.60	.00	.00
NYR000006502	HAWKINSVILLE RD OVER BLACK RIVER	BOONVILLE	12.40	.00	.00
NYD002041242	HAZELTINE CORPORATION	GREENLAWN	9.69	.00	.00
NYR000010504	HEBELER CORPORATION	TONAWANDA	1.12	.00	.00
NYD012556775	HERCULES HEAT TREATING CORP	BROOKLYN	2.04	.00	.00
NYD980641690	HEVI-DUTY ELECTRIC	CORTLAND	1.62	.00	.00
NYD986870582	HILLVIEW RESERVOIR / NYCDEP	YONKERS	2.30	.00	.00
NYD052780145	HISTACOUNT COPRORATION	MELVILLE	7.05	.00	.00

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NYD061947487	HITACHI SEIKI USA INC	CONGERS	4.13	.00	.00
NYD002246668	HOFFMAN AIR & FILTRATION	EAST SYRACUSE	6.33	.00	.00
NYD002091239	HUCK INTERNATIONAL INC	KINGSTON	3.59	.00	.00
NYD980642235	HUDSON DEPOT / NYCT	NEW YORK	4.60	.00	.00
NYD980779490	HUDSON RIVER PSYCHIATRIC CENTER	POUGHKEEPSIE	7.48	.00	.00
NYD986983732	HUDSON SHATZ PAINTING CO INC	NEW YORK	11.20	.00	.00
NYD002230860	HUGHES TRAINING INC	BINGHAMTON	4.67	.00	.00
NYD986905859	HUNT COUNTRY FURNITURE INC	WINGDALE	2.74	.00	.00
NYD987031614	HUNTER COLLEGE CAMPUS SCHOOLS	NEW YORK	1.88	.00	.00
NYD002064087	HUSSMANN CORP	GLOVERSVILLE	5.51	.00	.00
NYD986952299	HYS DOT BRIDGE BIN 1021190	WELLS	9.50	.00	.00
NYD982283053	H2M LABS INC	MELVILLE	11.98	.00	.00
NYD982729311	I L S OFFSET PRINTING INC	CARLE PLACE	4.79	.00	.00
NYD987003563	I-684 OVER RTE 6-NYSDOT	BREWSTER	1.40	.00	.00
NYD002463305	IEC ELECTRONICS CORP	NEWARK	7.95	.00	.00
NYD054978952	ILC DATA DEVICE CORPORATION	BOHEMIA	10.91	.00	.00
NY0000201855	IMPERIAL CONCEPTS DRY CLEANING INC	COMMACK	5.96	.00	.00
NYD065177198	IMPERIAL SCHRADE CORP	ELLENVILLE	2.60	.00	.00
NYD013044508	IMPERIAL WALLCOVERINGS INC	PLATTSBURGH	7.21	.00	.00
NYD114237654	INDEPENDENT CEMENT CORP CATSKILL PL	CATSKILL	1.82	.00	.00
NY0000724435	INDEPENDENT WEB INC	FARMINGDALE	3.00	.00	.00
NYD002240240	INDUSTRIAL ELECTROPLATERS INC	BINGHAMTON	5.46	.00	.00
NYD056301971	INSILCO CORPORATION MOUNT VERNON NY	MOUNT VERNON	9.55	.00	.00
NYD982535098	INSULATING MATERIALS INCORPORATED	SCHENECTADY	3.67	.00	.00
NYD001313410	INTEGRATED IMAGING CENTER	NEW YORK	4.35	.00	.00
NYR000006429	INTERMEDIATE SCHOOL 275	BROOKLYN	1.20	.00	.00
NYD001359694	INTERNATIONAL BUSINESS MACHINES COR	KINGSTON	2.78	.00	.00
NYD130891401	INTERPHARM INC.	PLAINVIEW	2.21	.00	.00
NYD061972188	ISLAND AUTO BODY, INC.	OCEANSIDE	5.11	.00	.00
NYP000922658	ISLAND TRANSPORTATION CORP	MAMARONECK	8.76	.00	.00
NYD067916494	ITEK GRAPHIX	ROCHESTER	12.42	.00	.00
NYD041340159	ITHACA COLLEGE	ITHACA	1.21	10.00	.00
NYD074004508	ITT STANDARD	CHEEKTOWAGA	6.13	.00	.00
NY0000480228	IVOCLAR NORTH AMERICA	BUFFALO	3.52	.00	.00
NYD982718272	J & F CHATSWORTH	LARCHMONT	10.43	.00	.00
NYD001504604	J F JELENKO	ARMONK	3.69	15.00	.00
NYD982792194	J-W OPERATING COMPANY	GOSHEN	5.42	.00	.00
NYD001958305	JAMAICA BUSES INC	JAMAICA	10.12	.00	.00
NYR000002709	JAMAICA MANOR DEVELOPMENT CORP	JAMAICA	4.00	.00	.00
NYD002235471	JAMES RIVER PAPER COMPANY INC	CARTHAGE	3.37	.00	.00
NYD990882425	JAQUITH INDUSTRIES INC	SYRACUSE	2.31	.00	.00
NYD060529708	JARED HOLT CO	ALBANY	4.40	.00	.00
NYD980647838	JASCO INDUSTRIES	CENTRAL ISLIP	5.82	.00	.00
NYR000008375	JB ASSOCIATES	PLAINVIEW	5.70	.00	.00
NY0000884833	JERICHO TPKE-SMITHTOWN VIADUCT	SMITHTOWN	9.60	.00	.00
NYD986869402	JFB LITHO	W BABYLON	9.19	.00	.00
NYR000014993	JOHN BROWNE HIGH SCHOOL	FLUSHING	1.60	.00	.00
NYR000004457	JOHN F KENNEDY TOWERS-TROY HOUSING	TROY	2.83	.00	.00
NYD981491160	JOHN JAY HIGH SCHOOL	CROSS RIVER	.10	15.00	.00
NYD000813428	JONES CHEMICALS INC	CALEDONIA	9.34	.00	.00
NYD068296839	JOS H LOWENSTEIN & SONS INC	BROOKLYN	5.99	.00	.00
NYD981140353	JOSEPH E SEAGRAM & SONS INC	WHITE PLAINS	.76	10.00	.00
NYD054385935	JRLON, INC.	PALMYRA	2.00	.00	.00
NYD013141577	K.J. TRANSPORTATION, INC.	FARMINGTON	1.32	.00	.00
NYD986957660	KARL A HORVATH	BUFFALO	1.20	.00	.00

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NEW YORK

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NYD001210749	KASON INDUSTRIES INC	BINGHAMTON	1.14	.00	.00
NYD002112399	KEY TECH FINISHING INC	BUFFALO	7.70	.00	.00
NYD082272626	KNOWLTON SPECIALTY PAPERS INC	WATERTOWN	11.61	.00	.00
NYD001535103	KOLMAR LABORATORIES	PORT JARVIS	3.71	.00	.00
NYD990890444	KOLMAR LABORATORIES	PORT JERVIS	5.39	.00	.00
NYD120489695	KRAFT FOODS INC	SOUTH EDMESTON	.03	10.00	.00
NY0000665190	KRAMER CHEMICAL FULCO DIV	JOHNSTOWN	2.00	.00	.00
NYD982725699	L D MCCAULEY INC	ORCHARD PARK	11.80	.00	.00
NYD079819090	L I U?SOUTHAMPTON COLLEGE	SOUTHAMPTON	4.13	.00	.00
NYD986899532	LA GUARDIA INTERNATIONAL AIRPORT	FLUSHING	8.34	.00	.00
NYD002206142	LABELON CORPORATION	CANANDAIGUA	11.75	.00	.00
NYD987020344	LABORATORY CORPORATION OF AMERICA	UNIONDALE	10.58	4.17	.00
NYD980648505	LAGUARDIA AIRPORT PT AUTH OF NY/NJ	FLUSHING	1.94	.00	.00
NYR000001115	LAIDLAW TRANSIT	SYRACUSE	1.66	.00	.00
NYD045200201	LAMBERT FABRICATORS INC	BALDWINSVILLE	5.39	.00	.00
NYD092472356	LAPP INSULATOR CO. POLYFACE OPR.	BATAVIA	2.45	.00	.00
NYD055735807	LEHIGH PORTLAND CEMENT COMPANY	CATSKILL	6.82	.00	.00
NYD986886885	LIBERTY BUSINESS FORMS & SYSTEMS IN	PLAINVIEW	2.05	.00	.00
NYD980648133	LILCO - BRENTWOOD OPERATIONS CENTER	BRENTWOOD	8.00	.00	.00
NYD980217384	LILCO - FAR ROCKAWAY POWER STATION	FAR ROCKAWAY	1.82	.00	.00
NYD980648232	LILCO - GLENWOOD GAS PLANT	GLENWOOD LANDIN	6.86	.00	.00
NYD986880045	LILCO - SOUTHAMPTON I.C. SITE	SOUTHAMPTON	1.56	.00	.00
NYD982537110	LILCO-BRIGHTWATERS STORAGE YARD	BRIGHTWATERS	4.90	.00	.00
NYD980648158	LILCO-GREENLAWN OPERATIONS CENTER	GREENLAWN	2.42	.00	.00
NYP000919589	LILCO-MANHOLE	WESTBURY	1.40	.00	.00
NYP000921049	LILCO-MANHOLE	FAR ROCKAWAY	5.60	.00	.00
NYD980648182	LILCO-PATCHOGUE OPERATIONS CENTER	PATCHOGUE	1.11	.00	.00
NYD000706069	LILCO-PT JEFFERSON POWER STATION	PORT JEFFERSON	6.80	.00	.00
NYD980648190	LILCO-RIVERHEAD OPERATIONS CENTER	RIVERHEAD	3.99	.00	.00
NYD980648208	LILCO-ROSLYN OPERATIONS CENTER	ROSLYN HEIGHTS	3.55	.00	.00
NYD000706077	LILCO-SHOREHAM POWER STATION	SHOREHAM	3.17	.00	.00
NYD043075092	LINDBERG HEAT TREATING COMPANY	ROCHESTER	4.02	.00	.00
NY0000204925	LINDEN SHOP/NYCT	BROOKLYN	1.30	.00	.00
NYD085158632	LITTLE RAPIDS CORPORATION POTSDAM M	POTSDAM	1.61	.00	.00
NYD038154464	LNK INTERNATIONAL INC	HAUPPAUGE	11.00	.00	.00
NYD100380120	LONG BEACH SR. HIGH SCHOOL	LIDO BEACH	3.57	.00	.00
NYD064727027	LONG ISLAND JEWISH MEDICAL CENTER	NEW HYDE PARK	11.98	10.00	.00
NY0000884874	LONG ISLAND RAIL RD	STONY BROOK	7.00	.00	.00
NYD095767679	LONG ISLAND UNIVERSITY	BROOKLYN	.00	5.00	.00
NYR000011320	LONG PROPERTIES (RP)	SAUGARTIES	8.14	.00	.00
NY0000204495	LONGWOOD AVENUE BRIDGE/	BRONX	1.67	.00	.00
NYD000522532	LORAL ELECTRONIC SYSTEMS	BRONX	6.82	.00	.00
NYD986996098	LUFFTHANSA GERMAN AIRLINES	NEW YORK	1.10	.00	.00
NYD002115756	LUMINITE PRODUCTS CORP	SALAMANCA	3.62	.00	.00
NYR000001420	LUNN INDUSTRIES INC	GLEN COVE	8.62	.00	.00
NYD986935278	MAACO AUTO PAINTING	HEMPSTEAD	1.61	.00	.00
NYR000013532	MAHOPAC HIGH SCHOOL	MAHOPAC	3.96	.00	.00
NYD088498779	MAJESTIC PACKAGING CO INC	BOHEMIA	9.40	.00	.00
NYD986912558	MAJESTIC PACKAGING CO INC	BOHEMIA	7.50	.00	.00
NYD980664171	MAMARONECK HIGH SCHOOL -	MAMARONECK	8.30	.00	.00
NYD064993389	MANHATTAN EYE EAR & THROAT HOSPITAL	NEW YORK	2.56	.00	.00
NYD982795627	MARINE AIRCRAFT GROUP 49	NEWBURGH	7.26	.00	.00
NYD001487560	MARSEL MIRROR & GLASS PRODUCTS	BROOKLYN	4.10	.00	.00
NYD982739146	MARSELLUS CASKET COMPANY	EAST SYRACUSE	10.70	.00	.00
NYD990763203	MARTIN MARIETTA	DEWITT	9.27	.00	.00

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NYD981559131	MARTIN MARIETTA CORP	BALLSTON SPA	5.87	.00	.00
NYD981482433	MARTIN NEMER VOLKSWAGON CORP	LATHAM	1.85	.00	.00
NYD987000114	MARVEL ENTERTAINMENT GROUP	NEW YORK	9.92	.00	.00
NYD067533950	MCKENICA DIVISION INSILCO CORP	BUFFALO	4.97	.00	.00
NYD002215739	MDT BIOLOGIC COMP	ROCHESTER	1.70	.00	.00
NYD002102317	MEAD-HATCHER INC	BUFFALO	3.88	.00	.00
NY0000081646	MECHTLER'S FOREIGN CAR REPAIR	TONAWANDA	5.09	.00	.00
NYD986904373	MEDCARE TECHNOLOGY	ROCHESTER	2.50	.00	.00
NYD002105757	MENTHOLATUM COMPANY	BUFFALO	1.54	.00	.00
NYD002206639	MERCURY AIRCRAFT INC	HAMMONDSPORT	4.75	.00	.00
NYD981185887	MERCURY AIRCRAFT INC	BATH	3.00	.00	.00
NYD002032779	MERIT ENGRAVING	NEW YORK	7.51	.00	.00
NYD000698365	MERIT OIL OF NEW YORK INC	MASSAPEQUA	2.29	.00	.00
NYD982185472	MERIT OIL OF NEW YORK INC	BROOKLYN	3.51	.00	.00
NYD982185613	MERIT OIL OF NEW YORK INC	BROOKLYN	6.50	.00	.00
NYD982185647	MERIT OIL OF NEW YORK INC	MASSAPEQUA	2.29	.00	.00
NYD982185860	MERIT OIL OF NEW YORK INC	ELMHURST	2.29	.00	.00
NYR000002907	MERKEL DONOHUE	ROCHESTER	8.90	.00	.00
NYD986870103	METAL CONTAINER CORPORATION	NEW WINDSOR	7.01	.00	.00
NYR000007716	METAL IMPROVEMENT COMPANY INC	WEST BABYLON	6.16	.00	.00
NYD986908150	METCALF & EDDY TECHNOLOGIES	RENSSELAER	3.15	.00	.00
NYD000694174	METRO-NORTH RAILROAD	NORTH WHITES PL	6.30	.00	.00
NYD981179773	METRO-NORTH RAILROAD	NEW YORK	5.30	.00	.00
NYD987031671	METRO-NORTH RAILROAD	WHITE PLAINS	6.65	.00	.00
NYR000001644	MID VALLEY OIL AKA XTRA MART #1482	RED HOOK	5.65	.00	.00
NYD075440479	MIDDLETOWN PSYCHIATRIC CTR	MIDDLETOWN	7.66	.00	.00
NYD045649696	MILLBROOK KITCHENS, INC	NASSAU	6.60	.00	.00
NYD002123024	MILWARD ALLOYS INC	LOCKPORT	4.07	.00	.00
NYD981483829	MINRAL SPRINGS WORKS	BUFFALO	6.95	.00	.00
NYD980592851	MOBIL CHEMICAL COMPANY	MACEDON	2.59	.00	.00
NYD002219723	MOBIL OIL	ROCHESTER	12.17	.00	.00
NYD986947430	MOBIL OIL	ANGOLA	1.76	.00	.00
NYD986962371	MOBIL OIL	UTICA	3.29	.00	.00
NYR000001271	MODERN HEATING TREATING & FORGING,	BUFFALO	1.50	.00	.00
NYR000011999	MOHAWK ADIRONDACK & NORTHERN RR	UTICA	1.60	.00	.00
NY0000924209	MONITOR PRODUCTS INC	HAUPPAUGE	5.73	.00	.00
NYD041581026	MONTEFIORE MEDICAL CENTER	NEW YORK	3.37	.00	.00
NYD044127835	MONTGOMERY OVERALL SERVICE INC	MAYBROOK	5.54	.00	.00
NYD980646285	MOOG INC-CONLEY RD	EAST AURORA	2.20	.00	.00
NYD980420780	MOOG INC-PENNSYLVANIA AVE	EAST AURORA	4.10	.00	.00
NYD092469162	MOORE BUSINESS FORMS-MOORE RESEARCH	GRAND ISLAND	2.70	4.00	.00
NYD981178932	MOORE SPECIALTY COATINGS	BUFFALO	6.18	.00	.00
NYD980641625	MORRIS PARK/LONG ISLAND RAIL ROAD	RICHMOND HILL	9.19	.00	.00
NYD981078686	MORTON SALT	SILVER SPRINGS	1.59	.00	.00
NYD012780441	MRC BEARINGS	JAMESTOWN	2.58	.00	.00
NYR000014936	MT SEVERANCE STORE	SCHROON LAKE	1.25	.00	.00
NYD057730764	MULLER MARTINI CORP	HAUPPAUGE	6.00	.00	.00
NYD157711235	MY-SO PRINTING	WESTBURG	1.20	.00	.00
NYP000918615	MYNEX-MANHOLE	BROOKLYN	2.00	.00	.00
NYD982182420	N Y S T A-BUFFALO BRIDGE MAINT	BUFFALO	6.03	.00	.00
NYD980534325	N Y S T A-BUFFALO MAINT	CHEEKTOWAGA	5.09	.00	.00
NYD986936698	N Y S T A-HENRIETTA MAINT	HENRIETTA	1.11	.00	.00
NYD982744104	N Y S THRUWAY AUTHORITY/WATERFORD C	WATERFORD	3.44	.00	.00
NYD987026291	N Y S THRUWAY AUTHORITY/WATERFORD C	WATERFORD	2.80	.00	.00
NYD986961811	N.Y.S. THRUWAY AUTHORITY	WARNERS	4.17	.00	.00

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NYD986969129	N.Y.S. THRUWAY AUTHORITY	VERONA	1.42	.00	.00
NY0000972257	N.Y.S. THRUWAY AUTHORITY	MANLIUS	3.31	.00	.00
NYD002123479	NABISCO BISCUIT COMPANY	NIAGARA FALLS	5.89	.00	.00
NYD002061000	NASSAU CHROMIUM PLATING COMPANY INC	MINEOLA	5.30	.00	.00
NYD119256543	NASSAU COMMUNITY COLLEGE	GARDEN CITY	8.52	.00	.00
NYR000003541	NASSAU COUNTY DEPARTMENT OF PUBLIC	EAST MEADOW	2.90	.00	.00
NYD981085574	NASSAU COUNTY DEPT OF PUBLIC WORKS	WANTAGH	1.61	.00	.00
NYD060318250	NASSAU COUNTY MEDICAL CENTER	EAST MEADOW]	7.90	.00	.00
NYD047699061	NATIONAL DRUM & BARREL CORP	BROOKLYN	2.40	.00	.00
NYD986948016	NATIONAL EQIUPMENT CORPORATION	BRONX	5.61	.00	.00
NYD981177322	NATIONAL FUEL GAS - SHERMAN STATION	SHERMAN	2.97	.00	.00
NYD981177330	NATIONAL FUEL GAS SUPPLY-ZOAR STATI	COLLINS	5.60	.00	.00
NYD986971117	NATIONAL FUEL SUPPLY CORP-CONCORD S	SPRINGVILLE	4.70	.00	.00
NY0000341073	NATIONAL HELICOPTER CORPORATION	FARMINGDALE	1.38	.00	.00
NYD061968558	NATIONAL METAL COATING	DEER PARK	5.50	.00	.00
NYD990690190	NATIONAL RUBBER ADHESIVES INC	LONG ISLAND CIT	4.40	.00	.00
NYD980647564	NATWEST BANK N A	MELVILLE	1.96	.00	.00
NY2210090021	NAVAL & MARINE CORP RESEVE CENTER	BRONX	2.59	.00	.00
NYD980642052	NELSON A TAYLOR CO INC	GLOVERSVILLE	5.64	.00	.00
NYD100382480	NEW ROCHELLE HIGH SCHOOL	NEW ROCHELLE	3.66	.00	.00
NYD981183338	NEW YORK AIR NATIONAL GUARD	NEWBURGH	8.36	.00	.00
NYR000007823	NEW YORK DOWNTOWN HOSPITAL	NEW YORK	1.81	.00	.00
NYD001344886	NEW YORK ENVELOPE CO	LONG ISLAND CIT	11.10	.00	.00
NYD981138480	NEW YORK INSTITUTE OF TECHNOLOGY	OLD WESTBURY	10.00	.00	.00
NYD981495294	NEW YORK LABEL & BOX CORP	BAYSHORE	2.80	.00	.00
NYD981142292	NEW YORK MEDICAL COLLEGE	VALHALLA	3.11	.00	.00
NYD000765065	NEW YORK POWER AUTH/ST LAW FDR PWR	MASSENA	3.98	.00	.00
NYD085743854	NEW YORK POWER AUTHORITY-BLENHEIM G	GILBOA	4.24	.00	.00
NYD982728230	NEW YORK POWER AUTHORITY-CRESCENT	COHOES	1.92	.00	.00
NYD982728248	NEW YORK POWER AUTHORITY-VISCHER FE	REXFORD	1.23	.00	.00
NYD986983351	NEW YORK POWER PARTNERS - RIDGEWOOD	HAUPPAUGE	1.83	.00	.00
NYD986942845	NEW YORK STATE ASSEMBLY	ALBANY	3.30	.00	.00
NYD980535181	NEW YORK STATE D E C	LISBON	11.66	.00	.00
NY0000113068	NEW YORK STATE D.E.C	MADRID	3.76	.00	.00
NYD981133234	NEW YORK STATE D.E.C.	NEW PALTZ	1.76	.00	.00
NYD982184657	NEW YORK STATE D.E.C.	GLOVERSVILLE	1.15	.00	.00
NYD982719189	NEW YORK STATE D.E.C.	OCEANSIDE	1.17	.00	.00
NYD986884039	NEW YORK STATE D.E.C.	MEDFORD	2.85	.00	.00
NYD986992170	NEW YORK STATE D.E.C.	SAG HARBOR	7.65	.00	.00
NYP003631074	NEW YORK STATE D.E.C.	OCEANSIDE	1.61	.00	.00
NYR000005223	NEW YORK STATE D.E.C.	CHAMPLAIN	2.78	.00	.00
NYR000005231	NEW YORK STATE D.E.C.	VESTAL	1.35	.00	.00
NYP000795534	NEW YORK STATE DEC	BRIGHTON	10.01	.00	.00
NYP000918086	NEW YORK STATE DEC	BUFFALO	1.61	.00	.00
NYP000918524	NEW YORK STATE DEC	BINGHAMTON	.02	13.00	.00
NYP000919332	NEW YORK STATE DEC	NEW ROCHELLE	3.15	.00	.00
NYP000920280	NEW YORK STATE DEC	SYRACUSE	12.71	.00	.00
NYP000920561	NEW YORK STATE DEC	BRIDGEPORT	1.27	.00	.00
NYP000920587	NEW YORK STATE DEC	LANCASTER	1.61	.00	.00
NYP000920876	NEW YORK STATE DEC	WARRENSBURG	5.08	.00	.00
NYP000920926	NEW YORK STATE DEC	COXSACKIE	.00	10.00	.00
NYP003601234	NEW YORK STATE DEC	BARTON	2.75	.00	.00
NYP003601887	NEW YORK STATE DEC	BELLPORT	1.67	.00	.00
NYP003601937	NEW YORK STATE DEC	BARTON	5.93	.00	.00
NYP003601952	NEW YORK STATE DEC	SHIRLEY	1.26	.00	.00

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NYP003602018	NEW YORK STATE DEC	E SYRACUSE	2.51	.00	.00
NYP003630845	NEW YORK STATE DEC	PECONIC	3.60	.00	.00
NYP003630860	NEW YORK STATE DEC	MEDFORD	1.63	.00	.00
NYP003630902	NEW YORK STATE DEC	RONKONKOMA	2.13	.00	.00
NYP003630993	NEW YORK STATE DEC	ISLAND PARK	3.79	.00	.00
NYP003631025	NEW YORK STATE DEC	RIVERHEAD	1.50	.00	.00
NYD987011038	NEW YORK STATE DEPT OF TRANSPORATIO	HOMER	9.40	.00	.00
NYD987011020	NEW YORK STATE DEPT OF TRANSPORTATI	HOMER	10.10	.00	.00
NYD987011053	NEW YORK STATE DEPT OF TRANSPORTATI	HOMER	9.00	.00	.00
NYD987011061	NEW YORK STATE DEPT OF TRANSPORTATI	CORTLANDVILLE	11.50	.00	.00
NY0000988774	NEW YORK STATE DEPT TRANSPORTATION	SOLVAY	8.70	.00	.00
NYR000001933	NEW YORK STATE POLICE	LOCKPORT	1.61	.00	.00
NYR000004283	NEW YORK STATE POLICE	FREDONIA	1.25	.00	.00
NY0001038405	NEW YORK STATE POLICE	ALBANY	7.55	.00	.00
NYD986913812	NEW YORK STATE THRUWAY AUTHORITY	HARRIMAN	4.43	.00	.00
NYD986913820	NEW YORK STATE THRUWAY AUTHORITY	NEWBURGH	3.14	.00	.00
NYD986998458	NEW YORK STATE THRUWAY BRIDGE MP 16	SOUTH NYACK	2.80	.00	.00
NYD000730390	NIAGARA MOHAWK POWER CORP	BUFFALO	5.20	.00	.00
NYD000730432	NIAGARA MOHAWK POWER CORP	LYCOMING	12.92	.00	.00
NYD003909694	NIAGARA MOHAWK POWER CORP	TONAWANDA	5.39	.00	.00
NYD980776892	NIAGARA MOHAWK POWER CORP	GLENS FALLS	5.70	.00	.00
NYD980777478	NIAGARA MOHAWK POWER CORP	GLOVERSVILLE	1.33	.00	.00
NYD980782569	NIAGARA MOHAWK POWER CORP	HANNAWA	8.70	.00	.00
NYD980788483	NIAGARA MOHAWK POWER CORP	POTSDAM	1.46	.00	.00
NYD980788665	NIAGARA MOHAWK POWER CORP	NEW HARTFORD	1.94	.00	.00
NYD982726093	NIAGARA MOHAWK POWER CORP	QUEENSBURY	1.18	.00	.00
NYD986965366	NIAGARA MOHAWK POWER CORP	AMSTERDAM	2.40	.00	.00
NYP000922500	NIAGARA MOHAWK POWER CORP	LAKEPORT	2.92	.00	.00
NYD981181910	NICE-PAK PRODUCTS, INC.	ORANGEBURG	6.06	.00	.00
NYD048357453	NON-FERROUS PROCESSING CORP	BROOKLYN	10.10	.00	.00
NYD986952414	NORTH COUNTRY AUTO RADIATOR INC	QUEENSBURY	2.28	.00	.00
NYD981563588	NORTH EAST WEB PRINTING/THIS WEEK P	FARMINGDALE	7.80	.00	.00
NYD986871382	NORTH ISLAND MINI LAB INC.	EAST SETAULEET	10.28	.00	.00
NYD065968513	NORTH SHORE UNIVERSITY HOSPITAL	PLAINVIEW	1.99	.00	.00
NYD987021490	NORTHERN BLVD / NYCT	QUEENS	1.80	.00	.00
NYD980772156	NORTHLAND A SCOTT FETZER COMPANY	WATERTOWN	9.13	.00	.00
NYD013524186	NORTHPORT FORD INC	EAST NORTHPORT	1.83	.00	.00
NY0000942441	NORTHVILLE INDUSTRIES CORP	LAKE SUCCESS	3.92	.00	.00
NY0000277681	NY RTE 21 OVER CANACADEA CREEK & RR	HORNELL	3.96	.00	.00
NYD980779722	NY STATE DEPT OF TRANSPORTATION	SYRACUSE	2.20	.00	.00
NY0000330134	NY STATE THRUWAY BRIDGE MP NE 11.53	HARRISON	8.20	.00	.00
NY0000942474	NY STATE THRUWAY BRIDGE MP NE 12.01	HARRISON	7.70	.00	.00
NY0000942524	NY STATE THRUWAY BRIDGE MP NE 12.94	RYE	7.70	.00	.00
NYD055959498	NY-KOTE INTERNATIONAL INC	MACEDON	12.60	.00	.00
NYD002235216	NYAB-GENERAL SIGNAL	WATERTOWN	11.25	.00	.00
NYD982529752	NYC DEPARTMENT OF SANIATION	MASPETH	7.92	.00	.00
NYD982182115	NYC DEPARTMENT OF SANITATION	QUEENS	4.05	.00	.00
NYD982528242	NYC DEPARTMENT OF SANITATION	NEW YORK	1.83	.00	.00
NYD986872265	NYC DEPT OF SANITATION BROOKLYN GAR	BROOKLYN	5.26	.00	.00
NYD981184849	NYC DEPT OF SANITATION CENTRAL REP	WOODSIDE	3.00	.00	.00
NYD982725491	NYC DEPT OF SANITATION DIST 13 GARA	BROOKLYN	2.61	.00	.00
NYD980754725	NYC DEPT OF SANITATION EDGEMERE PAR	QUEENS	1.61	.00	.00
NY0000894923	NYCDEP RONDOUT EFFLUENT CHAMBER	NAPANOCH	1.22	.00	.00
NY0000894907	NYCDEP-NEVERSINK RESERVIOR	GRAHAMSVILLE	1.95	.00	.00
NY0000902197	NYCT / WEST 12TH ST	BROOKLYN	7.40	.00	.00

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- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NYD980653885	NYCT/CHEMICAL LABORATORY	BROOKLYN	2.40	.00	.00
NYD980650675	NYCT/EAST 180TH ST YARD	BRONX	4.30	.00	.00
NYR000013003	NYCTA - EAST NY LOOPS	BROOKLYN	5.20	.00	.00
NYD987021177	NYDSOT BIN 1019339	SHIRLEY	9.40	.00	.00
NYD986960987	NYDSOT BIN 1059949	ISLIP TERRACE	11.00	.00	.00
NY0000561134	NYDSOT BIN 1060870	CALVERTON	1.70	.00	.00
NYP000921619	NYNES-MANHOLE	QUEENS	1.20	.00	.00
NYD986946705	NYNEX	FREEPORT	1.42	.00	.00
NYP000919910	NYNEX - MANHOLE	STATEN ISLAND	1.80	.00	.00
NYP000920033	NYNEX - MANHOLE	BROOKLYN	1.20	.00	.00
NYP000920140	NYNEX - MANHOLE	MANHATTAN	1.20	.00	.00
NYP000921304	NYNEX MANHOLE	BROOKLYN	1.20	.00	.00
NYP000795021	NYNEX-MANHOLE	HEMPSTEAD	1.14	.00	.00
NYP000795062	NYNEX-MANHOLE	ROSLYN	4.00	.00	.00
NYP000918342	NYNEX-MANHOLE	BAYSIDE	1.80	.00	.00
NYP000918359	NYNEX-MANHOLE	NEW YORK	2.20	.00	.00
NYP000918367	NYNEX-MANHOLE	QUEENS	1.20	.00	.00
NYP000918383	NYNEX-MANHOLE	QUEENS	1.20	.00	.00
NYP000918441	NYNEX-MANHOLE	HEMPSTEAD	1.71	.00	.00
NYP000918474	NYNEX-MANHOLE	QUEENS	2.20	.00	.00
NYP000918490	NYNEX-MANHOLE	BAYSIDE	1.50	.00	.00
NYP000918698	NYNEX-MANHOLE	BROOKLYN	1.20	.00	.00
NYP000918706	NYNEX-MANHOLE	MANHATTAN	1.20	.00	.00
NYP000918888	NYNEX-MANHOLE	BROOKLYN	1.60	.00	.00
NYP000918979	NYNEX-MANHOLE	JAMAICA	1.71	.00	.00
NYP000919258	NYNEX-MANHOLE	AMITYVILLE	4.76	.00	.00
NYP000919373	NYNEX-MANHOLE	BROOKLYN	2.05	.00	.00
NYP000919407	NYNEX-MANHOLE	BROOKLYN	1.37	.00	.00
NYP000919480	NYNEX-MANHOLE	STATEN ISLAND	1.14	.00	.00
NYP000919563	NYNEX-MANHOLE	BROOKLYN	1.14	.00	.00
NYP000919779	NYNEX-MANHOLE	BROOKLYN	1.20	.00	.00
NYP000919878	NYNEX-MANHOLE	BROOKLYN	1.75	.00	.00
NYP000919902	NYNEX-MANHOLE	BROOKLYN	3.20	.00	.00
NYP000920330	NYNEX-MANHOLE	BROOKLYN	2.00	.00	.00
NYP000920702	NYNEX-MANHOLE	QUEENS	1.40	.00	.00
NYP000920827	NYNEX-MANHOLE	BROOKLYN	1.80	.00	.00
NYP000920967	NYNEX-MANHOLE	MIDDLEPORT	9.96	.00	.00
NYP000920975	NYNEX-MANHOLE	MANHATTAN	1.65	.00	.00
NYP000921189	NYNEX-MANHOLE	NEW YORK	1.20	.00	.00
NYP000921262	NYNEX-MANHOLE	QUEENS	1.60	.00	.00
NYP000921296	NYNEX-MANHOLE	WOODMERE	2.30	.00	.00
NYP000921353	NYNEX-MANHOLE	WATERFORD	1.46	.00	.00
NYP000921361	NYNEX-MANHOLE	BROOKLYN	1.20	.00	.00
NYP000921395	NYNEX-MANHOLE	BROOKLYN	2.00	.00	.00
NYP000921668	NYNEX-MANHOLE	BROOKLYN	3.20	.00	.00
NYP000921759	NYNEX-MANHOLE	FOREST HILLS	2.05	.00	.00
NYP000922013	NYNEX-MANHOLE	QUEENS	1.60	.00	.00
NYP000922062	NYNEX-MANHOLE	BRONX	1.60	.00	.00
NYP000922336	NYNEX-MANHOLE	ALBION	1.20	.00	.00
NYP000922369	NYNEX-MANHOLE	WESTBURY	1.75	.00	.00
NYP000922427	NYNEX-MANHOLE	MANHATTAN	1.20	.00	.00
NYP000922542	NYNEX-MANHOLE	LAKE RONKONKOMA	3.75	.00	.00
NYP000922633	NYNEX-MANHOLE	NIAGARA FALLS	1.78	.00	.00
NYP000922682	NYNEX-MANHOLE	BROOKLYN	1.37	.00	.00
NYP000922732	NYNEX-MANHOLE	GARDEN CITY	1.14	.00	.00

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NYP000922807	NYNEX-MANHOLE	MANHATTAN	1.25	.00	.00
NYP000922971	NYNEX-MANHOLE	PLAINVIEW	1.37	.00	.00
NYP000922997	NYNEX-MANHOLE	BROOKLYN	1.20	.00	.00
NYD986985026	NYNEX-202 DUFFY AVENUE	HICKSVILLE	3.00	.00	.00
NYR000000869	NYS - DOT BIN 1-02813-0	COLLINS	6.30	.00	.00
NYR000000836	NYS - DOT BIN 1-06289-1	ORCHARD PARK	1.80	.00	.00
NYR000000844	NYS - DOT BIN 1-06289-2	ORCHARD PARK	1.80	.00	.00
NYR000000828	NYS - DOT BIN 1-06299-9	WEST SENECA	11.00	.00	.00
NY0000924225	NYS - DOT BIN 1-06499-9	NIAGARA FALLS	3.20	.00	.00
NYR000000745	NYS - DOT BIN 1-07102-2	BOSTON	2.80	.00	.00
NYR000000729	NYS - DOT BIN 1-07109-0	CONCORD	2.80	.00	.00
NY0000475129	NYS ARMORY	HORSEHEADS	2.50	.00	.00
NYD981141096	NYS DEPARTMENT OF TRANSPORTATION	NORTH MERRICK	1.38	.00	.00
NYD982187742	NYS DEPARTMENT OF TRANSPORTATION	HAMBURG	2.29	.00	.00
NYD986909257	NYS DEPARTMENT OF TRANSPORTATION RE	ALBANY	1.30	.00	.00
NYD986909349	NYS DEPARTMENT OF TRANSPORTATION RE	ALBANY	1.70	.00	.00
NYD986969681	NYS DEPARTMENT OF TRANSPORTATION RE	ALBANY	1.20	.00	.00
NYD986969723	NYS DEPARTMENT OF TRANSPORTATION RE	ALBANY	4.40	.00	.00
NYD987024569	NYS DEPARTMENT OF TRANSPORTATION RE	ALBANY	2.70	.00	.00
NYD987024619	NYS DEPARTMENT OF TRANSPORTATION RE	WATERVLIET	4.00	.00	.00
NY0000100990	NYS DEPARTMENT OF TRANSPORTATION RE	ALBANY	11.60	.00	.00
NY0000101014	NYS DEPARTMENT OF TRANSPORTATION RE	ALBANY	2.80	.00	.00
NY0000101121	NYS DEPARTMENT OF TRANSPORTATION RE	WATERVLIET	5.20	.00	.00
NYD986991453	NYS DEPARTMENT OF TRANSPORTATION RE	SCHENECTADY	2.80	.00	.00
NY0000101113	NYS DEPARTMENT OF TRANSPORTATION RE	WATERVLIET	2.40	.00	.00
NYD000831651	NYS DEPT OF HEALTH-WADSWORTH CENTER	ALBANY	7.64	.00	.00
NYD982187783	NYS DOT	CRARYVILLE	4.66	.00	.00
NYD986887222	NYS DOT	TONAWANDA	9.00	.00	.00
NYD986952679	NYS DOT	ALBION	1.20	.00	.00
NY0000491167	NYS DOT	HAMLIN	10.00	.00	.00
NY0000827212	NYS DOT	MEDINA	1.80	.00	.00
NY0000988857	NYS DOT	PALMYRA	1.20	.00	.00
NY0000988865	NYS DOT	PALMYRA	2.80	.00	.00
NY0000988873	NYS DOT	PALMYRA	2.40	.00	.00
NY0000988899	NYS DOT	SPENCERPORT	2.80	.00	.00
NY0000988907	NYS DOT	PITTSFORD	5.20	.00	.00
NY0000988915	NYS DOT	MACEDON	1.20	.00	.00
NYR000003681	NYS DOT BIN #1017340	SCHUYLER FALLS	3.60	.00	.00
NYD000730010	NYS ELECTRIC & GAS	BINGHAMTON	1.73	.00	.00
NYD000730127	NYS ELECTRIC & GAS	ITHACA	1.81	.00	.00
NYD051590255	NYS ELECTRIC & GAS	GENEVA	3.10	.00	.00
NYD074041153	NYS ELECTRIC & GAS	LANCASTER	1.18	.00	.00
NYD980531354	NYS ELECTRIC & GAS	ITHACA	1.82	.00	.00
NYD986875946	NYS ELECTRIC & GAS	BREWSTER	1.58	.00	.00
NYR000013912	NYS ELECTRIC & GAS	WALTON	12.00	.00	.00
NYD986938660	NYS OFFICE OF GENERAL SERVICES	NEW YORK	7.63	.00	.00
NY0001013473	NYS OMRDD CAPITAL DISTRICT DSO	SCHENECTADY	3.70	.00	.00
NYD982186751	NYS THRUWAY AUTHORITY -	MANCHESTER	2.21	.00	.00
NYD986947455	NYS THRUWAY AUTHORITY/ULSTER SERV A	RUBY	2.29	.00	.00
NYD982796732	NYS-DOT BIN 1-01164-0	OLEAN	6.60	.00	.00
NYD987034667	NYS-DOT BIN 1-01169-0	HINSDALE	5.00	.00	.00
NYR000000851	NYS-DOT BIN 1-02448-0	COLLINS	3.50	.00	.00
NY0000563791	NYS-DOT BIN 1-04543-0 RT 305 BRIDGE	PORTVILLE	2.50	.00	.00
NY0001015825	NYS-DOT BIN 1-06266-1	POLAND	1.20	.00	.00
NY0001015833	NYS-DOT BIN 1-06266-2	POLAND	1.20	.00	.00

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NYR000000737	NYS-DOT BIN 1-07102-1	BOSTON	2.10	.00	.00
NYR000000778	NYS-DOT BIN 1-07105-0	BOSTON	1.40	.00	.00
NYR000008557	NYS-DOT D 256365 SITE # 1,	HAMBURG	2.20	.00	.00
NYD987021128	NYSDOT BIN 1018271	LINDENHURST	5.10	.00	.00
NYD987021136	NYSDOT BIN 1018272	LINDENHURST	5.10	.00	.00
NY0000561076	NYSDOT BIN 1019292	PATCHOUGE	7.60	.00	.00
NYD987020963	NYSDOT BIN 1019300	BELLPORT	2.60	.00	.00
NYD987021169	NYSDOT BIN 1019319	BROOKHAVEN	8.50	.00	.00
NYD987020971	NYSDOT BIN 1019340	MASTIC	1.70	.00	.00
NYD987020989	NYSDOT BIN 1019380	CENTER MORICHES	1.70	.00	.00
NYD987021185	NYSDOT BIN 1019390	EAST MORICHES	1.70	.00	.00
NYD987021219	NYSDOT BIN 1019450	HAMPTON BAYS	2.60	.00	.00
NYD987021227	NYSDOT BIN 1056011	WEST ISLIP	7.10	.00	.00
NYD987021235	NYSDOT BIN 1056012	WEST ISLIP	6.40	.00	.00
NY0000561084	NYSDOT BIN 1056130	BAYSHORE	2.60	.00	.00
NY0000561092	NYSDOT BIN 1056140	BAYSHORE	2.60	.00	.00
NY0000561100	NYSDOT BIN 1056150	BAYSHORE	3.40	.00	.00
NYD987021292	NYSDOT BIN 1056350	SPEONK	2.60	.00	.00
NY0000561118	NYSDOT BIN 1058780	WEST ISLIP	4.30	.00	.00
NYD987025624	NYSDOT BIN 1059929	ISLIP TERRACE	1.70	.00	.00
NY0000561126	NYSDOT BIN 1060860	NORTH BABYLON	2.60	.00	.00
NY0000561142	NYSDOT BIN 1064010	NORTH BABYLON	3.40	.00	.00
NYD987021334	NYSDOT BIN 1064140	MEDFORD	3.40	.00	.00
NYD987021342	NYSDOT BIN 1064160	YAPHANK	6.80	.00	.00
NYD987021359	NYSDOT BIN 1064180	YAPHANK	5.10	.00	.00
NYD987021367	NYSDOT BIN 1064191	YAPHANK	6.80	.00	.00
NYD987021375	NYSDOT BIN 1064192	YAPHANK	6.80	.00	.00
NY0000561167	NYSDOT BIN 1064210	MANORVILLE	3.40	.00	.00
NY0000561175	NYSDOT BIN 1064230	MANDAVILLE	2.60	.00	.00
NYD987021383	NYSDOT BIN 1064249	MANORVILLE	8.50	.00	.00
NYD987033982	NYSDOT CONSTRUCTION FIELD OFFICE	LONG ISLAND CIT	12.00	.00	.00
NYR000004614	NYSDOT CONSTRUCTION FIELD OFFICE	STATEN ISLAND	2.70	.00	.00
NY0000055707	NYSDOT CONSTRUCTION FIELD OFFICE	ELMHURST	9.50	.00	.00
NY0000881185	NYSDOT, CONSTUCTION FIELD OFFICE	JAMAICA	3.70	.00	.00
NY0000964585	NYSTA	DUNKIRK	1.70	.00	.00
NYD987006111	OCEAN ARTS INC.	MONTAUK	4.36	.00	.00
NYR000003285	OCEAN S/S	AMITHYVILLE	12.60	.00	.00
NYD092465509	OHMTEK INC	NIAGARA FALLS	12.88	.00	.00
NY0000884825	OLD TOWN ROAD BRIDGE	SETAUKET	4.90	.00	.00
NY0000923458	OLD VAN DUYN HOSPITAL POWERHOUSE	SYRACUSE	1.78	.00	.00
NY0000186999	OLYMPIC-PANORAMA CAR WASH	ROCHESTER	2.17	.00	.00
NYD981185911	OMS #13	BINGHAMTON	2.27	.00	.00
NYR000006775	ONE CENTRAL PARK WEST ASSOC	NEW YORK	10.32	.00	.00
NYD080458862	ONTEROA CENTRAL SCHOOL DISTRICT	BOICEVILLE	2.78	.00	.00
NYD986990133	OPTICAL TECHNOLOGIES CORP	LONG ISLAND CIT	10.93	.00	.00
NYD000706127	ORANGE & ROCKLAND-BOWLINE GENERATIN	WEST HAVERSTRAW	2.58	.00	.00
NYD000706135	ORANGE & ROCKLAND-LOVETT GENERATING	TOMKINS COVE	2.48	.00	.00
NYD000706150	ORANGE & ROCKLAND-MIDDLETOWN OP CTR	MIDDLETOWN	3.02	.00	.00
NYD089754840	ORANGE & ROCKLAND-SPRING VALLEY OP	SPRING VALLEY	7.79	.00	.00
NYR000013144	ORBIT INDUSTRIES LTD	BRONX	2.97	.00	.00
NYD982274474	ORION BUS INDUSTRIES INC	ORISKANY	3.40	.00	.00
NYD986900850	ORLEANS NIAGARA BOCES	SANBORN	1.22	.00	.00
NY0000096131	OSI SPECIALTIES INC	TARRYTOWN	4.48	5.00	.00
NYD042574210	OSM CORPORATION	OLEAN	1.57	.00	.00
NYD982791766	OTISVILLE CORRECTIONAL FACILITY	OTISVILLE	1.25	.00	.00

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NYD986891307	PALL CORPORATION	PORT WASHINGTON	12.03	.00	.00
NYD982540809	PAR PHARMACEUTICAL INC CONGERS FACI	CONGERS	13.15	.00	.00
NYD981488513	PAR PHARMACEUTICAL SPRING VALLEY FA	SPRING VALLEY	12.71	.00	.00
NYD118222140	PARAMOUNT EQUIPMENT INC	RONKONKOMA	4.55	.00	.00
NYD004175550	PARKER HANNIFIN CORPORATION GTFSD	CLYDE	7.29	.00	.00
NYD986925790	PATCLIN CHEMICAL COMPANY INC	YONKERS	4.68	.00	.00
NYD001354349	PAWLING CORPORATION/PRESRAY CORP	PAWLING	7.70	.00	.00
NYD982741696	PCA CERTIFIED CAR CARE	BRENTWOOD	5.05	.00	.00
NYD002123552	PEERLESS-WINSMITH INC	SPRINGVILLE	10.24	.00	.00
NYD980648687	PELHAM YARD / WESCHESTER	BRONX	1.10	.00	.00
NYD096189337	PEPSICO	VALHALLA	11.39	20.00	.00
NYR000006114	PERMANENT IMAGES INC	SCHUYLER	1.17	.00	.00
NYD055955660	PETRO INC	HICKSVILLE	12.60	.00	.00
NYD013128582	PFAUDLER INC	ROCHESTER	10.25	.00	.00
NY0000096321	PHARMLINE INC	FLORIDA	3.20	.00	.00
NYD053724910	PHILIPS BROADBAND NETWORKS INC	MANLIUS	7.09	.00	.00
NYD047931902	PHILIPS LABORATORIES	BRIARCLIFF MANO	2.43	.00	.00
NYD002050383	PICKERING AND COMPANY INCORPORATED	PLAINVIEW	5.60	.00	.00
NYD050273861	PICO ELECTRONICS, INC.	MT VERNON	6.43	.00	.00
NYD068013374	PIPING ROCK BEACH CLUB	MATINECOCK	1.27	.00	.00
NYR000003020	PLAINVIEW FACILITY DEL LABORATORIES	PLAINVIEW	12.10	.00	.00
NYP000921411	PLATTSBURGH HARBOUR MARINA	PLATTSBURGH	5.65	.00	.00
NYD987012689	PORT AUTHORITY OF NY & NJ	NEW YORK	4.16	.00	.00
NYD987026135	PORT AUTHORITY OF NY & NJ	STATEN ISLAND	5.45	.00	.00
NYD981873870	PORT AUTHORITY OF NY & NJ IND PARK	YONKERS	8.25	.00	.00
NYR000005801	PORT JEFFERSON MARINE MAINTENANCE I	EAST SETAUKET	1.38	.00	.00
NYD002228682	POTTER PAINT COMPANY, INC.	CORTLAND	6.99	.00	.00
NYD002123792	PRAXAIR INC	TONAWANDA	5.12	6.00	.00
NYD986908135	PRENDEAULT ASSOCIATES INC	BOHEMIA	11.70	.00	.00
NYD000824409	PRESSWARE PLANT CORNING CONSMR PROD	CORNING	12.45	.00	.00
NYD057722258	PRIDE SOLVENTS & CHEMICAL CO. INC.	WEST BABYLON	12.95	.00	.00
NYD982723173	PRODUCTION PRODUCTS COMPANY	EAST SYRACUSE	8.36	.00	.00
NYD045447398	PROGRAMATIC PLATERS INC	EAST ELMHURST	12.06	.00	.00
NYD986908218	PSM AUTOBODY	QUEENSBURY	4.94	.00	.00
NY0000903401	PUBLIC SCHOOL 2C	BRONX	2.20	.00	.00
NY0000903419	PUBLIC SCHOOL 32	BRONX	1.20	.00	.00
NY0000903450	PUBLIC SCHOOL 41	BRONX	1.20	.00	.00
NYR000003871	PUBLIC SCHOOL 53	BRONX	2.00	.00	.00
NY0000375600	PUBLIC SCHOOL 90	BRONX	1.20	.00	.00
NY0001008994	PUBLIC SCHOOL 98	NEW YORK	1.20	.00	.00
NYD073675514	PUROLATOR PRODUCTS CO	ELMIRA	10.47	.00	.00
NYD055054191	PYRON CORPORATION	NIAGARA FALLS	1.30	.00	.00
NYD002025427	QUALITY HOUSE OF GRAPHICS	LONG ISLAND CIT	4.03	.00	.00
NYR000002915	QUALITY PRINTERS	MARION	12.31	.00	.00
NYD986885614	QUEENS LONG ISLAND MEDICAL GROUP	RONKONKOMA	12.76	.00	.00
NYD981565773	RADIOLOGICAL HEALTH SERVICES PC	SMITHTOWN	8.70	.00	.00
NYD986870913	RALLYE MOTORS INC	ROSLYN	5.20	.00	.00
NYD982278723	RECOGNITIONS SYSTEMS INC	PORT WASHINGTON	1.83	.00	.00
NYD000475137	REGENCY SERVICE CARTS	BROOKLYN	5.02	.00	.00
NYD194873139	REGENERON PHARMACEUTICALS INC	TARRYTOWN	1.58	.00	.00
NYD178219929	REITER & PERKES MD PC	MEDFORD	11.01	.00	.00
NYR000003657	REM OFFICE SERVICES INC	CHEEKTOWAGA	2.64	.00	.00
NYD982726556	REMET CHEMICAL CORPORATION	UTICA	4.87	.00	.00
NYR000006080	REPUBLIC BANK FOR SAVINGS	BROOKLYN	4.00	.00	.00
NYR000015842	RESIDENCE OF M & M FOX	AURELIUS	4.00	.00	.00

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NEW YORK

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- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NY0000229021	REYNOLDS METALS CO-FULTON CAN PLANT	FULTON	12.45	.00	.00
NYD056308315	REYNOLDS METALS COMPANY	MIDDLETOWN	11.67	.00	.00
NYR000002840	RICHFIELD ST BRIDGE OVER STEELE CRE	ILION	5.25	.00	.00
NYD981180888	RIVERSIDE PRINTERS	BUCHANAN	9.60	.00	.00
NYD981080641	ROCHESTER GAS & ELEC CORP - STATION	ROCHESTER	4.80	.00	.00
NYR000006148	ROCHESTER GAS & ELECTRIC CORP	ROCHESTER	1.92	.00	.00
NYD043078385	ROCHESTER GENERAL HOSPITAL	ROCHESTER	5.25	.00	.00
NYD002223642	ROCHESTER INSTITUTE OF TECHNOLOGY	ROCHESTER	2.69	8.00	.00
NYD002220556	ROCHESTER INSTRUMENT SYSTEMS INC	ROCHESTER	9.39	.00	.00
NYD002220523	ROCHESTER METAL ETCHING CO INC	ROCHESTER	1.81	.00	.00
NYR000004812	ROCHESTER TOOL AND MOLD INC	ROCHESTER	3.80	.00	.00
NYD002215622	ROGERS ASSOCIATES MACHINE TOOL CORP	ROCHESTER	2.71	.00	.00
NYD986968279	ROOSEVELT RACEWAY GRANDSTAND	WESTBURY	3.02	.00	.00
NYR000003202	ROSSOMANDO CAR WASH INC	DEWITT	10.83	.00	.00
NYD083534115	ROSWELL PARK CANCER INSTITUTE	BUFFALO	10.28	11.00	.00
NYD003907433	S H S MASPETH LLC	ELMHURST	8.66	.00	.00
NYD981133317	S L AUBURN INC	AUBURN	5.14	.00	.00
NYD980753784	SAFETY KLEEN	AVON	7.32	.00	.00
NYD982743312	SAFETY KLEEN	SYRACUSE	8.42	.00	.00
NYD000708164	SAFETY-KLEEN CORP	CONGERS	3.17	.00	.00
NYD981876923	SAFETY-KLEEN CORP	SOLVAY	5.24	.00	.00
NYD987033248	SALT CITY ENERGY VENTURE LP	SYRACUSE	8.34	.00	.00
NY0000009118	SARATOGA SPRINGS HOUSING AUTHORITY	SARATOGA SPRING	9.00	.00	.00
NYD001039767	SCHC COMPANIES INC	SYRACUSE	6.38	.00	.00
NYD986893352	SCHEIDL MFG CO INC	LINDENHURST	6.66	.00	.00
NYD986978344	SCHENECTADY CITY SCHOOL DISTRICT	SCHENECTADY	2.11	10.00	.00
NYD990764474	SCHLEGEL CORPORATION	ROCHESTER	9.47	.00	.00
NYR000001792	SCOTT'S GARAGE	HENDERSON	1.25	.00	.00
NY0000575662	SE-MAR ELECTRIC CO INC	WEST SENECA	2.69	.00	.00
NYD075782987	SEARLES GRAPHICS INC	EAST PATCHOGUE	5.50	.00	.00
NYD081510224	SEARS UNIT #1264	HICKSVILLE	3.28	.00	.00
NYD981077852	SEARS UNIT #1414	NANUET	1.47	.00	.00
NY0000097469	SEARS UNIT #1924	VALLEY STREAM	1.31	.00	.00
NY0000097485	SEARS UNIT #2764	BRONX	5.42	.00	.00
NY0000066415	SEARS UNIT #8184	MT VERNON	1.67	.00	.00
NYD013226782	SENECA FOODS	GENEVA	4.00	.00	.00
NYD055056410	SENECA PLATERS INC	ELMA	12.64	.00	.00
NYD084086537	SEPCO INDUSTRIES	BROOKLYN	1.44	.00	.00
NYD002418911	SERVO CORPORATION OF AMERICA	HICKSVILLE	4.72	24.00	.00
NYD002206571	SHEPARD NILES INC	MONTOUR FALLS	5.92	.00	.00
NYD000693093	SHERWIN WILLIAMS	JAMESTOWN	11.00	.00	.00
NYD010778843	SHERWIN WILLIAMS	SYRACUSE	4.23	.00	.00
NYD987036324	SHLOMO PIONTKOWSKI MD PC	EAST PATCHOGUE	2.50	.00	.00
NYD058179086	SILAR LABORATORIES INC	SCOTIA	9.90	.00	.00
NYD002064335	SIMMONS MACHINE TOOL CORP	ALBANY	6.94	.00	.00
NYD085203198	SIRMOS	LONG ISLAND CIT	7.11	.00	.00
NYD980567051	SLANTCO MFG CO	WESTBURY	3.61	.00	.00
NYD982727760	SMEDLEY INDUSTRIES INC F/K/A BUDDY	GLOVERSVILLE	4.20	.00	.00
NYD987029550	SMITH BARNEY	BROOKLYN	2.72	.00	.00
NYD002246023	SMITH CORONA CORP	CORTLAND	2.00	.00	.00
NYD981491632	SMITH-CAIRNS FORD	BRONXVILLE	3.63	.00	.00
NYD980761787	SOUTH SHORE HIGH SCHOOL	BROOKLYN	2.30	.00	.00
NYD002209013	SOUTHCO INC	HONEOYE FALLS	10.36	.00	.00
NYD001382860	SPECIALTY INK COMPANY INC	DEER PARK	9.36	.00	.00
NYD041429242	SPELLMAN HIGH VOLTAGE	PLAINVIEW	7.89	.00	.00

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NYD001223452	SPENCE ENGINEERING CO INC	WALDEN	2.13	.00	.00
NY0000362590	SPOOK ROCK GOLF COURSE	SUFFERN	1.17	.00	.00
NYD002255792	ST LAWRENCE UNIVERSITY	CANTON	1.70	.00	.00
NYD043077668	ST MARY'S HOSPITAL	ROCHESTER	.64	23.00	.00
NYD001223338	STAR EXPANSION COMPANY	MOUNTAINVILLE	9.10	.00	.00
NYD986985588	STATE FARM MUTUAL AUTOMOBILE INS CO	MALTA	6.60	.00	.00
NYD077293322	STATE UNIVERSITY OF NEW YORK	POTSDAM	6.98	.00	.00
NYD071475867	STATE UNIVERSITY OF NEW YORK AT BUF	BUFFALO	10.53	.00	.00
NYD980290803	STATE UNIVERSITY OF NY AT BROCKPORT	BROCKPORT	2.25	.00	.00
NYD981483985	STATE UNIVERSITY OF NY CLG AT NEW P	NEW PALTZ	6.83	.00	.00
NYD986886497	STERLING WINTHROP INC-SITE 3	EAST GREENBUSH	8.19	.00	.00
NYD001389261	STEVENS PAINT/INSL-X PRODUCTS CORP	YONKERS	1.40	.00	.00
NYD987016136	STEWART & STEVENSON OPERATIONS, INC	SYRACUSE	5.42	.00	.00
NYD045605888	STONE CONSTRUCTION EQUIPMENT INC	HONEOYE	9.96	.00	.00
NY0000920082	SUFFOLK COUNTY DPW	HAUPPAUGE	3.63	.00	.00
NYD986941078	SUGAR CREEK STORE #46	WAYLAND	3.42	.00	.00
NY0001012848	SUGAR CREEK STORES #306/61	PORTVILLE	3.04	.00	.00
NYD982186827	SUGAR CREEK STORES #48	ROCHESTER	3.11	.00	.00
NYD986936052	SUGAR CREEK STORES #66	RANDOLF	2.08	.00	.00
NYD071598676	SUNY - CORTLAND	CORTLAND	7.24	.00	.00
NYD982272296	SUNY COLLEGE AT FREDONIA	FREDONIA	5.43	.00	.00
NYD981485758	SUNY COLLEGE OF AG. & TECH AT MORRI	MORRISVILLE	2.95	.00	.00
NYD045879038	SUNY ONEONTA	ONEONTA	1.86	.00	.00
NYR000015032	SUSAN WAGNER HIGH SCHOOL	STATEN ISLAND	1.90	.00	.00
NY0000006940	SWEDISH AUTO INC	SYRACUSE	6.88	.00	.00
NYD077344596	SYMBOL TECHNOLOGIES INC	BOHEMIA	6.23	.00	.00
NYR000013888	SYOSSET PROPERTIES ASSOC	SYOSSET	3.53	.00	.00
NYD013771506	SYRACUSE SUPPLY COMPANY	BUFFALO	1.45	.00	.00
NYD982540429	SYRACUSE UNIVERSITY (PHYSICAL PLANT	SYRACUSE	4.17	.00	.00
NYD002227130	SYRTEK INC	LIVERPOOL	3.90	.00	.00
NYD056689201	TAPEMAKER SALES CO	WESTBURY	2.09	.00	.00
NYD987013018	TAPPAN ZEE HIGH SCHOOL	ORANGEBURG	.63	10.00	.00
NYD042023333	TEKNI-PLEX, INC.	BROOKLYN	11.20	.00	.00
NYD043827583	TENNESSEE GAS PIPELINE CO	LAFAYETTE	1.50	.00	.00
NYD987027331	TENNESSEE GAS PIPELINE COMPANY	MINA	9.65	.00	.00
NYR000001321	TEXACO INC-FUELS & LUBES RESEARCH D	GLENHAM	7.20	.00	.00
NYD982793101	TEXACO SERVICE STATION	RONKONKOMA	2.98	.00	.00
NYD041555665	THE BROOKLYN HOSPITAL CENTER	BROOKLYN	4.96	.00	.00
NYD981482896	THE CAMERA SHOP	SMITHTOWN	8.61	.00	.00
NYD981482904	THE CAMERA SHOP	MANHASSET	7.80	.00	.00
NYD152305645	THE CAMERA SHOP INC 1 HOUR CO-82	COMMACK	9.74	.00	.00
NYD041512104	THE CARBIDE/GRAPHITE GROUP INC	NIAGARA FALLS	1.47	.00	.00
NY0000280867	THE CHASE MANHATTAN BANK	NEW YORK	2.85	.00	.00
NYD981487226	THE CITY COLLEGE OF NEW YORK	NEW YORK	1.25	.00	.00
NYD986889863	THE COCA COLE BOTTLING COMP OF NY I	ELMSFORD	7.55	.00	.00
NYD080457955	THE COLLOEGE OF SAINT ROSE	ALBANY	.12	3.00	.00
NY0000082628	THE COLOR SHOP INC	MECHANICVILLE	2.29	.00	.00
NYD982743494	THE COLOR WHEEL, INC.	NEW YORK	4.82	.00	.00
NYD986926830	THE DAILY GAZETTE CO	SCHENECTADY	5.60	.00	.00
NYD987028131	THE ELECTROSYNTHESIS COMPANY INC	LANCASTER	1.35	.00	.00
NYD059644484	THE GENESEE HOSPITAL	ROCHESTER	9.68	.00	.00
NYR000000414	THE NATIONAL BANK OF GENEVA	PENN YAN	1.15	.00	.00
NYD981483332	THE PORT AUTHORITY OF NY & NJ	NEW YORK	2.87	.00	.00
NYD029290194	THE RAYMOND CORP	EAST SYRACUSE	4.89	.00	.00
NYD002233856	THE RAYMOND CORPORATION	GREENE	8.87	.00	.00

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NYD986913523	THE SHERWIN-WILLIAMS CO	ROCHESTER	13.02	.00	.00
NYD986999787	THE TAYLOR KIDS INC	ROCHESTER	1.46	.00	.00
NYD001317320	THE ULLMAN COMPANY	HAUPPAUGE	1.43	.00	.00
NYD981878374	THE WHEATLEY SCHOOL	OLD WESTBURY	.18	5.00	.00
NYD174569657	THOMPSON AIRCRAFT TIRE	HAUPPAUGE	8.10	.00	.00
NYR000015743	THREE SPACKENKILL RD CORP	POUGHKEEPSIE	2.00	.00	.00
NYR000002360	TIFFANY ST IRON SHOP	BRONX	1.80	.00	.00
NYD002046027	TIFFEN MANUFACTURING CORPORATION	HAUPPAUGE	5.05	.00	.00
NYD980774582	TIMES SQUARE STAGE LIGHTING	STONY POINT	1.15	.00	.00
NYD044477784	TODD PRODUCTS CORP	BRENTWOOD	7.88	.00	.00
NYD986932457	TONAWANDA FORGE	TONAWANDA	3.09	.00	.00
NYD000910182	TOWN OF ELMA WATER DEPT	ELMA	1.83	.00	.00
NYR000012112	TOWN OF WELLSVILLE VETERAN'S BRIDGE	WELLSVILLE	3.75	.00	.00
NY0001013556	TOY FACTORY INC	AMITYVILLE	2.55	.00	.00
NYD001533082	TRAULSEN & CO INC	COLLEGE POINT	1.17	.00	.00
NYD000813386	TRICO PRODUCTS CORPORATION PLANT II	BUFFALO	9.62	.00	.00
NYD982737983	TRM COPY CENTER	ELMSFORD	9.07	.00	.00
NYD986982635	TUMBLE FORMS INC	DOLGEVILLE	4.70	.00	.00
NY0000923540	TURNER BELLOWS INC	ROCHESTER	2.51	.00	.00
NYD002042471	U S TAPE COMPANY	PATCHOGUE	2.20	.00	.00
NYD981142342	UNC ACCESSORY SERVICES	BAY SHORE	10.86	.00	.00
NYD071088082	UNI DISTRIBUTION CORPORATION	GLOVERSVILLE	2.71	.00	.00
NY0000806984	UNION BUSINESS CENTRE	CHEEKTOWAGA	8.85	.00	.00
NYD986940880	UNITED PARCEL SERVICE (STATEN ISLAN	STATEN ISLAND	1.85	.00	.00
NYD986929321	UNITED REBUILDERS INC	MT VERNON	1.25	.00	.00
NYD986950632	UNITED REFINING CO OF PA	SHERRILL	3.59	.00	.00
NYD986955045	UNITED REFINING CO OF PA	DUNKIRK	1.60	.00	.00
NYD986907848	UNITED REFINING CO OF PA KWIK FILL	LAKEWOOD	2.51	.00	.00
NYD986950483	UNITED REFINING CO OF PA KWIK FILL	LIMA	1.41	.00	.00
NYD986908648	UNITED REFINING CO OF PA KWIK FILL	FULTON	2.25	.00	.00
NYD986955136	UNITED REFINING CO OF PA RED APPLE	KENMORE	1.24	.00	.00
NYD986950343	UNITED REFINING CO. OF PA	PERRY	1.24	.00	.00
NYD986943819	UNITED REFINING COOR PA KWIK FILL A	ROCHESTER	2.49	.00	.00
NY2213720897	UNITED STATES ARMY	FLUSHING	12.51	.00	.00
NY4470090107	UNITED STATES POSTAL SERVICE	NEW YORK	5.38	.00	.00
NYD986892990	UNITED STATES POSTAL SERVICE MORGAN	NEW YORK	12.52	.00	.00
NYD054017355	UNIVERSAL MEDICAL INSTRUMENT CORP	BALLSTON SPA	3.32	.00	.00
NYD002212348	UPSTATE LITHO	ROCHESTER	3.22	.00	.00
NY3960009923	US ARMY CORPS OF ENGINEERS	BUFFALO	2.66	.00	.00
NYD990774200	US CHROME CORPORATION OF NY	BATAVIA	8.11	.00	.00
NY5120010710	USDA/AGRICULTURAL RESEARCH SERVICE	ORIENT POINT	4.54	8.00	.00
NY4360010249	V A HOSPITAL/BROOKLYN	BROOKLYN	3.24	.00	.00
NYD002075802	VALMET SANDY HILL INC	HUDSON FALLS	4.70	.00	.00
NYD061302634	VAN WATERS & ROGERS INC	GUILDERLAND CEN	1.66	.00	.00
NYR000011650	VAUGHAN COSMETICS	AMITYVILLE	3.48	.00	.00
NYD101279529	VICTORY SPECIALTY PACKAGING INC	VICTORY MILLS	8.10	.00	.00
NYR000007450	VILLAGE OF OSSINING	VILLAGE OF OSSI	10.50	.00	.00
NYD072369515	VINCENT BARBERA INC	MINEOLA	4.31	.00	.00
NYD982277774	VOLKERT PRECISION TECHOLOGIES INC	QUEENS VILLAGE	3.05	.00	.00
NYD060544418	W ALTON JONES CELL SCIENCE CENTER	LAKE PLACID	1.28	.00	.00
NY0000915165	WALKER & WHYTE INC	LONG ISLAND CIT	2.27	.00	.00
NYP000918557	WALL ST & BRONX ST	NEW YORK	4.50	.00	.00
NYD980642334	WALNUT DEPOT / NYCT	BRONX	12.90	.00	.00
NYR000006163	WARNER LAMBERT, INC.	WESTBURY	7.15	.00	.00
NYD981185838	WARWICK WOOD WORK REFURNISHING	MIDDLETOWN	13.10	.00	.00

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NYD001367481	WASHINGTON MILLS ELECTRO MINERALS C	NIAGARA FALLS	1.26	.00	.00
NYD002110062	WASTE STREAM TECHNOLOGY INC	BUFFALO	4.20	.00	.00
NYD071474712	WCA HOSPITAL	JAMESTOWN	10.08	.00	.00
NYR000011031	WEGMANS FOOD MARKETS INC	ROCHESTER	1.26	.00	.00
NYD001250059	WEISS INSTRUMENTS INC	WEST BABYLON	1.11	.00	.00
NY0000264705	WESTBURY UNION NFREE SCHOOL DISTRIC	OLD WESTBURY	.01	21.17	.00
NYD002076214	WHITE MOP WRINGER COMPANY	FULTONVILLE	5.37	.00	.00
NYD002234433	WILCOX PRESS INC	ITHACA	8.42	.00	.00
NYR000001842	WILLIAM LEGAZ	LINDENHURST	2.61	.00	.00
NYD981134711	WILSON ELECTROPLATING INC	BINGHAMTON	3.30	.00	.00
NYD986890531	WINTHROP-UNIVERSITY HOSP PROF BLDG	MINEOLA	.00	4.00	.00
NYR000015776	WKBW TV GRANITE BROADCASTING	BUFFALO	1.88	.00	.00
NY0000362640	WOODHULL STREET OVER WOODHULL CREEK	FORESTPORT	9.60	.00	.00
NYD980654057	WRIGHT COMPONENTS INC	PHELPS	1.85	.00	.00
NYR000010421	WRUN INC	ORISKANY	2.09	.00	.00
NYD980642284	YUKON DEPOT / NYCT	STATEN ISLAND	8.00	.00	.00
NYD013596556	ZOTOS INTERNATIONAL, INC.	GENEVA	8.67	1.00	.00
NYD986962728	00E5J SARFATI MOSHE	BROOKLYN	1.32	.00	.00
NYD000701698	0007-3221 SUNOCO SERVICE STATION	FREEPORT	1.20	.00	.00
NYD000699389	0007-3924 SUNOCO SERVICE STATION-A	HUNTINGTON	5.20	.00	.00
NYD986903805	0007-5606 SUNOCO SERVICE STATION	BRONX	1.20	.00	.00
NYD000707596	0013-8552 SUNOCO SERVICE STATION	LONG ISLAND CIT	2.30	.00	.00
NYD000703827	0015-2603 SUNOCO SERVICE STATION	ST JAMES	1.60	.00	.00
NYD980646624	0019-9364 NEWBURGH TERMINAL	NEW WINDSOR	7.11	.00	.00
NYD013326442	0050-3185 MOHAWK VALLEY OIL TERMINA	MARCY	2.32	.00	.00
NYT370010530	0093-4216 BUFFALO TERMINAL	TONAWANDA	5.17	.00	.00
NYD045604022	0358-1519 ROCHESTER TERMINAL	ROCHESTER	2.72	.00	.00
NYD986897932	0363-1264 ATLANTIC SERVICE STATION	ALBANY	1.46	.00	.00
NYD986929826	0363-2254 ATLANTIC SERVICE STATION	ROME	13.14	.00	.00
NYD986929818	0363-4045 ATLANTIC SERVICE STATION	ONEIDA	1.67	.00	.00
NYD986935518	0363-9127 ATLANTIC SERVICE STATION	ITHACA	3.34	.00	.00
NYD986929727	0363-9507 ATLANTIC SERVICE STATION	GENEVA	1.18	.00	.00
NYD986935419	0363-9838 ATLANTIC SERVICE STATION	DEWITT	2.08	.00	.00
NYD986935435	0364-0109 ATLANTIC SERVICE STATION	SYRACUSE	1.56	.00	.00
NYD986944288	0364-0232 ATLANTIC SERVICE STATION	SYRACUSE	5.60	.00	.00
NYD986897726	0364-0851 ATLANTIC SERVICE STATION	SYRACUSE	1.36	.00	.00
NYD986929842	0364-1222 ATLANTIC SERVICE STATION	UTICA	3.96	.00	.00
NYD986897734	0364-1990 ATLANTIC SERVICE STATION	BALDWINSVILLE	1.17	.00	.00
NY2572824249	106 RESCUE WING	WESTHAMPTON BEA	4.26	.00	.00
NYR000007682	109 INDUSTRAIL CO LLC	LINDENHURST	1.38	.00	.00
NYD980642276	126TH ST DEPOT/NYCT	NEW YORK	4.40	.00	.00
NYD987007093	129TH ST STUVAGE AREA / NYCT	QUEENS	3.60	.00	.00
NY3570025475	174 FW HANCOCK FIELD-ANGB	SYRACUSE	6.35	.00	.00
NYR000001313	275/285 MT READ REALTY	ROCHESTER	1.78	.00	.00
NYR000003996	424 REALTY CORP	WADING RIVER	1.15	.00	.00
NYD987038346	55 BROAD STREET COMPANY	NEW YORK CITY	6.06	.00	.00
NYR000007781	8501 FLATLANDS AVE REALTY CO	BROOKLYN	1.14	.00	.00

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- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NYD986930949	ADELPHI UNIVERSITY	GARDEN CITY	.00	.00	.00
NYD080470750	ADIRONDACK COMMUNITY COLLEGE	QUEENSBURY	.01	1.00	.00
NYD986988335	AGWAY INCORPORATED	E SYRACUSE	.25	.00	.00
NYP000920629	ARCADE PROPERTIES	ARCADE	.00	.00	.00
NYD049253719	ASHLAND CHEMICAL CO	BINGHAMTON	.00	.00	.00
NYD987039716	ASHLAND PETROLEUM COMP	TONAWANDA	.16	.00	.00
NYR000007526	ASSOCIATION OF RETARDED CITIZENS	UTICA	.00	.00	.00
NYD987035870	ATLANTIC COAST AIRLINES	NEW WINDSOR	.83	.00	.00
NYD064308240	BICC UTILITY CABLE CO	YONKERS	.65	.00	.00
NYD002069557	BLUE CIRCLE CEMENT	RAVENA	.00	.00	.00
NYD986928042	BRIDGES RT 17 OVER RAILROAD	WAVERLY	.00	.00	.00
NYD986999563	BROAD CHANNEL SUBSTATION/NYCT	QUEENS	.00	.00	.00
NYR000003137	BROOKLYN UNION	BROOKLYN	.00	.00	.00
NY0000885939	BROOKLYN UNION	STATEN ISLAND	.73	.00	.00
NYD986995876	BUFFALO MUNICIPAL HOUSING AUTHORITY	BUFFALO	.00	.00	.00
NY0000475095	BUFFALO PAPERBOARD CORPORATION	LOCKPORT	.00	.00	.00
NYD127325405	CENTRAL HUDSON GAS & ELECTRIC CORP	NEWBURGH	.81	.00	.00
NYD082785429	CHEMICAL POLLUTION CONTROL INC	BAY SHORE	.00	.00	.00
NY0001037316	CHEMUNG COUNTY FAIRGROUNDS	HORSEHEADS	.00	.00	.00
NYD095584470	CITY OF CORTLAND	CORTLAND	.00	.00	.00
NYD980535116	CITY OF ROCHESTER POLICE & FIRE ACA	ROCHESTER	.32	.00	.00
NYD981872351	CNG TRANSMISSION CORP	NEW HARTFORD	.70	.00	.00
NYD002207132	COATING TECHNOLOGY, INC.	ROCHESTER	.25	.00	.00
NYD002105534	COLUMBUS MCKINNON CORPORATION	TONAWANDA	.54	.00	.00
NYD981566862	CON EDISON	NEW YORK	.00	.00	.00
NYD982272106	CON EDISON	NEW YORK	.00	.00	.00
NYD982272114	CON EDISON	NEW YORK	.00	.00	.00
NYD982279572	CON EDISON	NEW YORK	.00	.00	.00
NYD982279598	CON EDISON	NEW YORK	.00	.00	.00
NYD982281180	CON EDISON	NEW YORK	.00	.00	.00
NYD982281198	CON EDISON	NEW YORK	.00	.00	.00
NYD982535551	CON EDISON -	NEW YORK	.30	.00	.00
NYR000013946	CON EDISON - FOX HILLS SUBSTATION	STATEN ISLAND	.00	.00	.00
NYP000918839	CON EDISON - LEONARD STREET SUBSTAT	NEW YORK	.00	.00	.00
NYD982739831	CON EDISON - NEPTUNE AVENUE	BROOKLYN	.80	.00	.00
NYD982280331	CON EDISON - PIER 40	NEW YORK	.00	.00	.00
NYD982280349	CON EDISON - PIER 62	NEW YORK	.00	.00	.00
NY0000247403	CON EDISON - SPRAIN BROOK SUBSTATIO	YONKERS	.00	.00	.00
NYR000002501	CON EDISON - 110TH ST SUB	NEW YORK	.00	.00	.00
NYP000920488	CON EDISON - 21ST ST & 41ST AVE	LONG ISLAND CIT	.00	.00	.00
NYR000012518	CON EDISON - 66 BARCLAY ST	NEW YORK	.00	.00	.00
NYD046195541	CON EDISON-NORTH FIRST STREET TERMI	BROOKLYN	.00	.00	.00
NYD075431353	CON EDISON-YONKERS SERVICE CENTER	YONKERS	.10	.00	.00
NYD002106763	CONAGRA	BUFFALO	1.07	.00	.00
NYD980756019	DELAWARE COUNTY ELECTRIC COOPERATIV	DELHI	.00	.00	.00
NY8690536208	DOT FAA WEST SAYVILLE IFST	WEST SAYVILLE	.23	.00	.00
NYD986908739	ED LOYA'S AUTO PARTS & SALVAGE CORP	BALLSTON SPA	.24	.00	.00
NYD980764492	ENDICOTT MUNICIPAL LIGHT DEPT	ENDICOTT	.00	.00	.00
NYD980761191	ENVIRONMENTAL PRODUCTS & SERVICES I	SYRACUSE	.01	.00	.00
NYD000692228	ESAB/L-TECT WELDING FLUX PLANT	NIAGARA FALLS	.65	.00	.00
NY0000954057	ESTATE OF SAMUEL O WHITE	NARROWSBURG	1.02	.00	.00
NYD002227643	FRAZIER INDUSTRIAL CO.	WATERLOO	.00	.00	.00
NYD986980233	FULCIRCLE BALLAST RECYCLERS INC	BRONX	.00	.00	.00
NYD155934755	GE CORPORATE COMPUTER SERVICES	SCHENECTADY	.00	.00	.00
NY0000025544	GENERAL ELECTRIC - BAKERS FALLS	HUDSON FALLS	.00	.00	.00

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NEW YORK

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO CANNOT BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- LESS THAN 1.1 TONS RCRA HAZARDOUS WASTE, AND
- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NYD080462757	GREAT MEADOW CORRECTIONAL FACILITY	COMSTOCK	.00	.00	.00
NYR000013391	GUION PLACE HOUSING CO INC	NEW ROCHELLE	.00	.00	.00
NYP000922666	HORSE SHOE ROAD	MILLBROOK	.00	.00	.00
NY0000465435	HUNTS POINT COOP MARKET	BRONX	.00	.00	.00
NYD982535221	INSITUFORM - METROPOLITAN	STATEN ISLAND	.52	.00	.00
NYD002240760	INTERNATIONAL PAPER COMPANY-OSWEGO	OSWEGO	.12	.00	.00
NYD981566342	JAMESTOWN BOARD OF PUBLIC UTILITIES	JAMESTOWN	.00	.00	.00
NYR000014977	JANSEN AVENUE SUBSTATION	KINGSTON	.00	.00	.00
NY0000994210	KIRYAS JOEL VILLAGE OF WATER TANK	MONROE	.00	.00	.00
NYD987000395	LASALLE DIVISION DEL LABORATORIES I	LITTLE FALLS	.00	.00	.00
NYD095586376	LCP CHEMICALS	SOLVAY	.00	.00	.00
NYD986889715	LILCO - AMAGANSETT SUBSTATION	AMAGANSETT	.00	.00	.00
NYD986889723	LILCO - BRIDGEHAMPTON SUBSTATION	SAG HARBOR	.00	.00	.00
NYD986889640	LILCO - EAST GARDEN CITY SUBSTATION	EAST GARDEN CIT	.00	.00	.00
NYD986889574	LILCO-GREENLAWN SUBSTATION	GREENLAWN	.00	.00	.00
NYD981181894	LILCO-LAKE SUCCESS SUBSTATION	LAKE SUCCESS	.00	.00	.00
NYP000920942	LILCO-OAKWOOD SUBSTATION	HUNTINGTON	.00	.00	.00
NYR000001339	LILCO-TIANA SUBSTATION	HAMPTON BAYS	.00	.00	.00
NYD986889426	LILCO-VALLEY STREAM SUBSTATION	VALLEY STREAM	.00	.00	.00
NYD072711054	LINCOLN HALL	LINCOLNDALE	.00	.00	.00
NYD002084572	MACINTYRE DEVELOPMENT/KRONOS INC	TAHAWUS	.00	.00	.00
NYD982185761	MERIT OIL OF NEW YORK INC	BROOKLYN	.60	.00	.00
NYD986890143	METAULLICS SYSTEMS CO LP	SANBORN	.15	.00	.00
NYR000005256	MIFAC HACHASED	BROOKLYN	.08	.00	.00
NYD107878688	MOUNT ALVERNO CTR	WARWICK	.00	.00	.00
NYD002239440	N AMERICAN OPER GEN MOTORS CORP	SYRACUSE	.00	.00	.00
NYD089107528	NATIONAL RAILROAD PASSENGER CORP	RENSSELAER	.00	.00	.00
NYD982538530	NATIONAL SEMICONDUCTOR CORP	LATHAM	.00	.00	.00
NYD980646319	NAVUNSEAWARCEN DET SENECA LAKE NY	DRESDEN	.55	.00	.00
NYD045662921	NDL ORGANIZATION	PEEKSKILL	.00	.00	.00
NYR000000265	NEW VICI INC	HAMMONDSPORT	.00	.00	.00
NYP003601994	NEW YORK STATE DEC	ELDRED	.00	.00	.00
NYP003602042	NEW YORK STATE DEC	QUEENSBURY	.00	.00	.00
NYP003602067	NEW YORK STATE DEC	TICONDEROGA	.00	.00	.00
NYD000692939	NIAGARA MOHAWK POWER CORP	LYCOMING	.00	.00	.00
NYD000730457	NIAGARA MOHAWK POWER CORP	GLENMONT	.69	.00	.00
NYD980664221	NIAGARA MOHAWK POWER CORP	ROME	.00	.00	.00
NYD980778872	NIAGARA MOHAWK POWER CORP	COLBLESKILL	.00	.00	.00
NYD980779078	NIAGARA MOHAWK POWER CORP	MOREAU	.00	.00	.00
NYD980779110	NIAGARA MOHAWK POWER CORP	POTTERSVILLE	.00	.00	.00
NYD980782049	NIAGARA MOHAWK POWER CORP	HONEOYE FALLS	.00	.00	.00
NYD980782064	NIAGARA MOHAWK POWER CORP	ALBION	.00	.00	.00
NYD980782627	NIAGARA MOHAWK POWER CORP	TONAWANDA	.00	.00	.00
NYD980783310	NIAGARA MOHAWK POWER CORP	WHEATFIELD	.00	.00	.00
NYD980783369	NIAGARA MOHAWK POWER CORP	TONAWANDA	.00	.00	.00
NYD980783443	NIAGARA MOHAWK POWER CORP	SALINA	.00	.00	.00
NYD980783476	NIAGARA MOHAWK POWER CORP	TONAWANDA	.00	.00	.00
NYD980783583	NIAGARA MOHAWK POWER CORP	YORK	.00	.00	.00
NYD980788681	NIAGARA MOHAWK POWER CORP	FULTON	.74	.00	.00
NYD980788715	NIAGARA MOHAWK POWER CORP	WHITEHALL	.00	.00	.00
NYD981076821	NIAGARA MOHAWK POWER CORP	MENANDS	.00	.00	.00
NYD981076847	NIAGARA MOHAWK POWER CORP	COHOES	.00	.00	.00
NYD981484074	NIAGARA MOHAWK POWER CORP	BUFFALO	.00	.00	.00
NYD981488737	NIAGARA MOHAWK POWER CORP	CUBA	.00	.00	.00
NYD981872963	NIAGARA MOHAWK POWER CORP	PROSPECT	.00	.00	.00

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NEW YORK

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NYD981872971	NIAGARA MOHAWK POWER CORP	UTICA	.23	.00	.00
NYD981873011	NIAGARA MOHAWK POWER CORP	NEW HARTFORD	.00	.00	.00
NYD981873037	NIAGARA MOHAWK POWER CORP	BARNEVELD	.00	.00	.00
NYD981873409	NIAGARA MOHAWK POWER CORP	FRANKFORT	.00	.00	.00
NYD981873441	NIAGARA MOHAWK POWER CORP	LEE CENTER	.00	.00	.00
NYD982280612	NIAGARA MOHAWK POWER CORP	CHERRY VALLEY	.00	.00	.00
NYD987026416	NIAGARA MOHAWK POWER CORP	BUFFALO	.00	.00	.00
NYD987040672	NIAGARA MOHAWK POWER CORP	GLENS FALLS	.30	.00	.00
NYP000921288	NIAGARA MOHAWK POWER CORP	WESTMORELAND	.00	.00	.00
NY0000024679	NIAGARA MOHAWK POWER CORP	CLAY	.00	.00	.00
NY0000024695	NIAGARA MOHAWK POWER CORP	ALBANY	.00	.00	.00
NY0000024711	NIAGARA MOHAWK POWER CORP	MARCY	.00	.00	.00
NY0000024729	NIAGARA MOHAWK POWER CORP	SCHENECTADY	.00	.00	.00
NY0000024745	NIAGARA MOHAWK POWER CORP	SCHOHARIE	.00	.00	.00
NYD982740243	NORTHEAST ANALYTICAL INC	SCHENECTADY	.00	.00	.00
NYR000013375	NORTHTOWN, INC.	AMHERST	.46	.00	.00
NYD981178981	NYCTA / CORONA YARD	FLUSHING	.40	.00	.00
NYP000921338	NYNEX-MANHOLE	BROOKLYN	.00	.00	.00
NYD981076144	NYNEX: 11 WARDS LANE	MENANDS	.00	.00	.00
NYD000729855	NYS ELECTRIC & GAS	LOCKPORT	.28	.00	.00
NYD000729913	NYS ELECTRIC & GAS	CHATHAM	.00	.00	.00
NYD000730184	NYS ELECTRIC & GAS	ARKPORT	.53	.00	.00
NYD000730234	NYS ELECTRIC & GAS	NORWICH	.52	.00	.00
NYD000730473	NYS ELECTRIC & GAS	BAINBRIDGE	.53	.00	.00
NYD013001904	NYS ELECTRIC & GAS	ONEONTA	.37	.00	.00
NYD045606548	NYS ELECTRIC & GAS	HORSEHEADS	.99	.00	.00
NYD080460595	NYS ELECTRIC & GAS	LIBERTY	.50	.00	.00
NYD980763700	NYS ELECTRIC & GAS	PLATTSBURGH	.50	.00	.00
NYD095578720	NYS FAIR	SYRACUSE	.00	.00	.00
NYD986885440	OCCIDENTAL CHEMICAL	NORTH TONAWANDA	.50	.00	.00
NYD000706143	ORANGE & ROCKLAND-BLOOMING GROVE OP	MONROE	.21	.00	.00
NYD980756027	OTSEGO ELECTRIC COPPERATIVE INC	HARTWICK	.00	.00	.00
NYD067910943	PENN YAN MUNICIPAL BOARD	PENN YAN	.00	.00	.00
NYR000003830	PUBLIC SCHOOL 153	NEW YORK	.20	.00	.00
NYD980642243	QUEENS VILLAGE DEPOT / NYCT	QUEENS VILLAGE	.40	.00	.00
NYR000001123	RHP PROPERTIES INC	ELMIRA	.00	.00	.00
NYR000013060	RINALDI TRUCKING	NANUET	.00	.00	.00
NYR000007831	ROCHESTER & SOUTHERN RAILROAD	WARSAW	.87	.00	.00
NYD099328890	ROCHESTER GAS & ELEC CORP FILMORE O	FILMORE	.08	.00	.00
NYD000818781	ROCHESTER GAS & ELECTRIC CORP BROOK	ROCHESTER	.46	.00	.00
NYD000708172	SAFETY KLEEN	THORNWOOD	.00	.00	.00
NYD981556541	SAFETY KLEEN	LACKAWANNA	.00	.00	.00
NYD986872869	SAFETY KLEEN	COHOES	.00	.00	.00
NYD980785760	SAFETY KLEEN CORP	WOODSIDE	.00	.00	.00
NYD000708198	SAFETY-KLEEN CORP	NORTH AMITYVILL	.00	.00	.00
NYD987031366	SCHENECTADY INDUSTRIAL CORP	SCHENECTADY	.00	.00	.00
NYD080481351	SIENA COLLEGE	LOUDONVILLE	.81	.00	.00
NYD002104404	SPAULDING COMPOSITES COMPANY INC	TONAWANDA	.00	.00	.00
NYD982534885	SUNY AT ONEONTA	ONEONTA	.26	.00	.00
NYD060546181	SUNY PLATTSBURGH	PLATTSBURGH	.37	.00	.00
NYD986930451	SYRACUSE FIRE TRAINING CENTER	SYRACUSE	.00	.00	.00
NYD986899912	TCI INC	HUDSON	.00	.00	.00
NYD000767764	TENNESSEE GAS PIPELINE CO	NASSAU	.85	.00	.00
NYD000829564	TENNESSEE GAS PIPELINE COMPANY	EDEN	.00	.00	.00
NYD084006238	TENSOLITE CO	BUCHANAN	.00	.00	.00

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NEW YORK

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- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NYR000000695	TOPS MARKETS	FAIRPORT	.00	.00	.00
NY2690315906	U.S. COAST GUARD STATION	WELLESLEY ISLAN	.00	.00	.00
NY1180000134	UNITED STATES POSTAL SERVICE JAF BL	NEW YORK	.25	.00	.00
NYD071602064	UTICA COLLEGE	UTICA	.26	.00	.00
NYD980296636	VAN RAALTE KNITTING MILL	SARATOGA SPRING	.00	.00	.00
NYD980574396	VICTOR INSULATORS INC	VICTOR	.00	.00	.00
NYD981085608	VILLAGE OF FREEPORT	FREEPORT	.00	.00	.00
NYD980769863	VLG OF TUPPER LAKE MUNICIPAL ELEC D	TUPPER LAKE	.00	.00	.00
NY0001039783	VOLCKENING INC	BROOKLYN	.00	.00	.00

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NORTH CAROLINA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NCD003154010	A.B. CARTER,INC.	GASTONIA	18.92	.00	.00
NCD091254532	A.G. INDUSTRIES INC.	FOREST CITY	18.87	.00	.00
NCD089904536	A.O. SMITH ELECTRICAL PRODUCTS CORP	MEBANE	111.75	.00	.00
NCD050411800	ABBOTT LABORATORIES	LAURNINBURG	50.78	.00	.00
NCD002571438	ABC INDUSTRIES, INC.	CHARLOTTE,	19.36	.00	.00
NCD981021413	ACCUDYNE, INC.	RALEIGH	94,539.41	.00	.00
NCD045924339	ACME UNITED CORPORATION	FREMONT	29.31	.00	.00
NCD986166338	ADVANCED ENVIROMENTAL TECHNOLOGY CO	CREEDMOOR	1,400.40	4,770.00	.00
NCD030511976	AEROQUIP CORPORATION 1035	MOORESVILLE	14.80	.00	.00
NCD067199851	AGROEVO USA COMPANY	PIKEVILLE	7.39	80.00	.00
NCD006390561	AKZO NOBEL COATING INC.	HIGH POINT	446.73	.00	.00
NCD991278300	AKZO NOBEL COATING INC.	HIGH POINT	171.24	.00	.00
NCD986175776	ALBEMARLE HOSPITAL	ELIZABETH CITY	15.28	.00	.00
NCD986229375	ALCATEL FIBER OPTIC MFG. PLANT	CLAREMONT	53.06	.00	.00
NCD005002894	ALCATEL NETWORK SYSTEMS INC.	CLINTON	18.15	.00	.00
NCD980838478	ALLIEDSIGNAL AEROSPACE	ROCKY MOUNT	96.24	.00	.00
NCD053488409	ALLIEDSIGNAL INC.	MONCURE	43.08	.00	.00
NCD986232395	ALLWASTE CONTAINER SERVICES	CHARLOTTE	57.04	.00	.00
NCD980841753	ALTEC INDUSTRIES, INC.	CREEDMOOR	16.27	.00	.00
NCD000792770	AMERADA HESS CORP.	GREENSBORO	152.20	.00	.00
NCD000792788	AMERADA HESS CORP.	WILMINGTON	56.24	.00	.00
NCD093345387	AMERADA HESS CORP.	PAW CREEK	107.94	.00	.00
NCD986186542	AMERADA HESS CORP.	SELMA	165.72	.00	.00
NCD000622654	AMERICAN DREW PLANT #14	NORTH WILKESBOR	43.12	.00	.00
NCD000622746	AMERICAN DREW PLANT 12	NORTH WILKESBOR	43.77	.00	.00
NCD000622720	AMERICAN DREW PLANT 13	NORTH WILKESBOR	74.85	.00	.00
NCD049774979	AMERICAN NATIONAL CAN	ASHEVILLE	184.18	.00	.00
NCD980844674	AMERIMARK BUILDING PRODUCTS	ROXBORO	58.84	.00	.00
NCD000615872	AMP CORPORATION	GASTONIA	51.40	.00	.00
NCD000202549	AMP INCORPORATED	COLFAX	15.90	.00	.00
NCD041230418	AMP INCORPORATED	WINSTON-SALEM	96.31	.00	.00
NCO000202523	AMP INCORPORATED	GREENSBORO	78.16	.00	.00
NCD980605729	APLIX, INC.	CHARLOTTE	15.66	.00	.00
NCD037149663	APPLIED ANALYTICAL, INC	WILMINGTON	19.79	.00	.00
NCD054282025	ASHEVILLE METAL FINISHING	ASHEVILLE	109.00	.00	.00
NCD061263315	ASHLAND CHEMICAL COMPANY	CHARLOTTE	27.51	.00	.00
NCD982134181	ASMO NORTH CAROLINA, INC.	STATESVILLE	81.91	.00	.00
NCD003213907	AT&T NETWORK SYSTEM	WINSTON-SALEM	17.34	.00	.00
NCD003219904	ATHENS FURNITURE	STATESVILLE	18.29	.00	.00
NCD072003635	ATHOL CORPORATION	BUNTER	147.84	.00	.00
NCD003195161	AVX CORPORATION	RALEIGH	136.59	.00	.00
NCD982085789	B & H PANEL	ASHEBORO	33.04	.00	.00
NCD003162542	BADIN WORKS/ALUMINUM COMPANY OF AME	BADIN	1,954.49	.00	.00
NCD003445939	BAKER FURNITURE	ANDREWS	17.74	.00	.00
NCD003152519	BALL GLASS CONTAINER CORP	ASHEVILLE	51.97	.00	.00
NCD053528170	BALL-FOSTER GLASS CONTAINER CO.	HENDERSON	41.50	.00	.00
NCD084170570	BALL-FOSTER GLASS CONTAINER CO.	WILSON	77.21	.00	.00
NCD049997786	BASF CORPORATION	MORGANTON	1,283.93	.00	.00
NCD000276154	BASSETT FURNITURE IND. OF STATESVIL	STATESVILLE	17.29	.00	.00
NCD067181818	BAYER CORPORATION	CLAYTON	536.95	.00	.00
NCD003200383	BEAZER EAST, INC.	MORRISVILLE	48.37	.00	.00
NCD024617524	BELDING CORTICELLI THREAD CO.	HENDERSONVILLE	69.29	.00	.00
NCD000829127	BERNHARDT FURNITURE CO PLT 3	LENIOR	28.23	.00	.00
NCD003158979	BERNHARDT FURNITURE CO PLT2	LENOIR	23.84	.00	.00
NCD000829119	BERNHARDT FURNITURE CO. PLT 7	LENOIR	20.93	.00	.00

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NORTH CAROLINA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NCD001936699	BERNHARDT FURNITURE CO. PTL 1	LENOIR	37.77	.00	.00
NCD986182582	BF GOODRICH	GASTONIA	31.20	.00	.00
NCD041467267	BLACK & DECKER, INC.	FAYETTEVILLE	13.32	.00	.00
NCD194078838	BLUE RIDGE METALS CORPORATION	FLETCHER	125.84	.00	.00
NCR000001586	BOB BARKER CO, INC.	FUQUAY-VARINA	14.82	.00	.00
NCD000320515	BRASS CRAFT THOMAS, INC	THOMASVILLE	86.62	.00	.00
NCD067191262	BRIDGESTONE/FIRESTONE	WILSON	33.16	.00	.00
NCR000000521	BRISTOL COMPRESSORS-SPARTA INC.	SPARTA	114.45	.00	.00
NCD991278466	BROYHILL FURNITURE INDS (MILLER HIL	LENOIR	196.71	.00	.00
NCD003162336	BROYHILL FURNITURE INDS INC(VA STRE	LENOIR	181.64	.00	.00
NCD000277293	BROYHILL FURNITURE INDS, INC.	CONOVER	279.12	.00	.00
NCD083682229	BROYHILL FURNITURE INDS, INC.	RUTHERFORD	71.12	.00	.00
NCD083682583	BROYHILL FURNITURE INDS, INC.	NEWTON	61.23	.00	.00
NCD991278342	BROYHILL FURNITURE INDS, INC.	LENOIR	57.08	.00	.00
NC0000878231	BTR SEALING SSTEMS N.C., OPERATIONS	REIDSVILE,	30.00	.00	.00
NCD079059192	BUCKEYE FIRE EQUIPMENT COMPANY	KINGS MTN.	29.47	.00	.00
NCD981024730	BURNS AEROSPACE CORP.	WINSTON-SALEM	87.99	.00	.00
NCD091572073	C T SPECIALITES CORP.	LELAND	129.54	.00	.00
NCD982116006	CAIRN STUDIOS LTD.	MOORESVILLE	23.30	.00	.00
NCD097728000	CAMPBELL SOUP COMPANY	MAXTON	16.92	.00	.00
NCD006996342	CAROLINA FREIGHT CARRIERS, INC.	CHERRYVILLE	28.20	240.01	.00
NCD047285598	CAROLINA SOLVENTS, INC.	HICKORY	146.75	.00	.00
NCD086330412	CATERPILLAR, INC.	CLAYTON	28.60	.00	.00
NCD003221868	CENTURY FUNITURE, IND.	HICKORY	49.05	.00	.00
NCD003470812	CENTURY FURNITURE IND., PLANT #3	HICKORY	32.96	.00	.00
NCD003522026	CENTURY FURNITURE IND., PLANT #9	HICKORY	17.46	.00	.00
NCD049769144	CHAIRCRAFT	HICKORY	16.64	.00	.00
NCD982083420	CHAMPION PRODUCTS, INC	DUNN	25.05	.00	.00
NCD980844898	CHANNEL MASTER	SMITHFIELD	51.45	.00	.00
NCD079047148	CHEMICAL COATINGS, INC.	HUDSON	46.70	.00	.00
NCD048467427	CHEMICAL SPECIALTIES, INC.	HARRISBURG	816.59	206,558.00	.00
NCR000002626	CHEROKEE ENVIROMNETAL GROUP	FAYETTEVILLE	64.93	.00	.00
NCR000003533	CHEROKEE ENVIRONMENTAL GROUP	FAYETTEVILLE	14.60	.00	.00
NCD097716625	CHESEBROUGH-POND'S USA	RAEFORD	60.49	.00	.00
NCD061801361	CIBA GEIGY CORPORATION	GREENSBORO	26.33	9,702.00	.00
NCD990867152	CIBA-GEIGY CORPORATION TEXTILE PROD	CHARLOTTE	87.45	.00	.00
NCD001810365	CLARIANT CORPORATION	CHARLOTTE	451.33	.00	.00
NCD003445756	CM FURNITRUE, INC.	MAIDEN	23.94	.00	.00
NCD003191079	COASTAL LUMBER COMPANY	WELDON	2,125.71	.00	.00
NCD003157377	COATS AMERICAN-SEVIER FINISHING PLT	MARION	21.40	.00	.00
NCD000623074	COLONIAL PIPELINE COMPANY	PAW CREEK	208.16	.00	.00
NCD057038168	COLONIAL PIPELINE COMPANY	GREENSBORO	1,253.03	.00	.00
NCD003233756	COMPONENT CONCEPTS, INC.	THOMASVILLE	29.23	.00	.00
NC0000016451	COMPU CHEM ENVIRONMENTAL CORP	RTP	64.92	.00	.00
NCD000823146	CONE MILLS OLYMPIC PRODUCTS	GREENSBORO	26.72	.00	.00
NCD000616581	CONOCO INC.	GREENSBORO	138.73	.00	.00
NCD000616599	CONOCO INC.	PAW CREEK	81.40	.00	.00
NCD000616607	CONOCO INC.	SELMA	87.78	.00	.00
NCD056463573	CONSOLIDATED DIESEL COMPANY	WHITAKERS	109.76	.00	.00
NCD003162500	CONSOLIDATED ENGRAVERS	CHARLOTTE	41.29	.00	.00
NCD051331999	CONSOLIDATED METCO INC-CASHIERS PLA	CASHIERS	17.73	.00	.00
NCD042892067	COOPER INDUSTRIES, INC./ LUFKIN DIV	APEX	65.37	.00	.00
NCD991278706	COPELAND CORPORATION	SHELBY	20.41	.00	.00
NCD003938586	CORINING INCORPORATED	WILMINGTON	43.30	.00	.00
NCD067422758	COUNCILL CRAFTSMEN	DENTON	15.11	.00	.00

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NORTH CAROLINA

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NCD006556963	CR INDUSTRIES	GASTONIA	13.77	.00	.00
NCD982091092	CRANE RESISTOFLEX COMPANY	MARION	19.81	.00	.00
NCD067200949	CROFT METALS INC.	LUMBER BRIDGE	6,582.03	.00	.00
NCD021389358	CROWM CORK & SEAL CO., INC.	ARDEN	34.61	.00	.00
NCD000770032	CROWN CENTRAL PETROLEUM CORP.	SELMAN	237.48	.00	.00
NCD044447639	CRWON CENTRAL PETROLEUM CORP.	CHARLOTTE	158.85	.00	.00
NCD098770746	CURTISS-WRIGHT FLIGHT SYSTEMS	SHELBY	14.94	.00	.00
NCD093338598	CUTLER-HAMMER	ARDEN	27.48	.00	.00
NCD085083004	DANAHER TOOL GROUP	GASTONIA	47,344.77	.00	.00
NCD986166361	DAY INTERNATIONAL	ARDEN	208.96	.00	.00
NCD982122210	DEERE-HITACHI CONSTRUCTION	KERNERSVILLE	20.71	.00	.00
NCD049773245	DETREX CORPORATION	CHARLOTTE	164.18	.00	.00
NCD003224037	DML, FOREST CITY TOOL DIVISION	HICKORY	22.77	.00	.00
NCD079070702	DOTSON METAL FINISHING INC.	ASHEVILLE	68.50	.00	.00
NCD003213030	DOUGLAS BATTERY MFG. COMPANY	WINSTON-SALEM	344.41	.00	.00
NCD003221546	DOW CORNING CORPORATION	GREENSBORO	174.55	.00	.00
NCD051329167	DREXEL HERITAGE FURNISH INC. PLT 43	HILDEBRAN	31.76	.00	.00
NCD991278037	DREXEL HERITAGE PLT 1	DREXEL	42.67	.00	.00
NCD097368294	DREXEL HERITAGE PLT 2	MARION	41.28	.00	.00
NCD003171691	DREXEL HERITAGE PLT 3/5	MORGANTON	98.64	.00	.00
NCD991279068	DREXEL HERITAGE PLT 6	MORGANTON	44.20	.00	.00
NCD003154804	DUFF-NORTON COMPANY, INC.	CHARLOTTE	14.15	.00	.00
NCD108706029	DUKE POWER	HUNTERSVILLE	13.72	.00	.00
NCD000813519	DUKE UNIVERSITY/MEDICAL CENTER	DURHAM	39.22	.00	.00
NCD047369046	DUPONT EI DE NEMOURS	LELAND	13.60	.00	.00
NCD980843866	DUPONT ELECTRONICS	RTP	335.68	.00	.00
NCD000609776	DUPONT REFINISH SERVICE CENTER	CHARLOTTE	34.53	.00	.00
NCD003173358	DURABLE WOOD PRESERVERS, INC.	CHARLOTTE	94.07	.00	.00
NCD000648402	DURACELL USA	LEXINGTON	33.90	.00	.00
NCD047368642	E.I. DUPONT DE NEMOURS & CO.	DUART	371.75	.00	.00
NCD045924487	EASCO ALUMINUM	WINTON	521.19	.00	.00
NCD024462327	EAST COAST CONTAINER	MATTHEWS	205.70	.00	.00
NCD004520136	EATON CORPORATION	ROXBORO	110.70	.00	.00
NCD045923059	EATON CORPORATION	LAURINBURG	171.57	.00	.00
NCD980842132	ECOFLO, INC.	GREENSBORO	3,442.15	.00	.00
NCD003166675	ECUSTA DIVISION	PISGAH FOREST	199.22	.00	.00
NCD095118212	EMPIRE INDUSTRIES PLANT #1	TARBORO	155.71	.00	.00
NCD982140329	ENGINEERED CONTROLS INTERNATIONAL,	WHITSETT	30.10	.00	.00
NCD991302498	ENGINEERED CONTROLS INTERNATIONAL,	ELON COLLEGE	2,703.11	.00	.00
NCD986231637	ERITECH INC.	ADBERDEEN	53.41	.00	.00
NCD981473127	ERSHIGS, INC.	WILSON	63.65	.00	.00
NCD986171171	ETHAN ALLEN INC.	SPRUCE PINE	34.84	.00	.00
NCD074509233	ETHAN ALLEN INC. PINE VALLEY DIV.	OLD FORT	50.73	.00	.00
NCD000822957	EVEREADY BATTERY COMPANY INC.	ASHEBORO	17.05	.00	.00
NCD003184249	EVEREADY BATTERY FACILITY	GREENVILLE	233.00	.00	.00
NCD991278276	FAIRFIELD CHAIR CO. PLT2	LENOIR	21.71	.00	.00
NCD062566047	FASCO CONTROLS CORPORATION	SHELBY	54.66	.00	.00
NCD067178707	FAWN INDUSTRIES	MIDDLESEX	202.23	.00	.00
NCD091568279	FEDERAL PAPER BOARD CO. INC.	DURHAM	49.37	.00	.00
NCD072022726	FEDERAL PAPER BOARD CO(CARTON PLANT	WILMINGTON	91.22	.00	.00
NCD003154960	FLEMING LABORATORIES, INC.	CHARLOTTE	61.00	.00	.00
NCD093340487	FLORIDA STEEL CORPORATION	CHARLOTTE	4,494.67	.00	.00
NCD003170784	FLORIDA STEEL DRUM COMPANY	HARRISBURG	57.32	.00	.00
NCD980840383	FLOWLINE DIVISION	WHITEVILLE	79.31	.00	.00
NCD000771964	FMC CORP LITHUM DIV. CHEMICAL PLANT	BESSEMER CITY	462.00	200.00	.00

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NORTH CAROLINA

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NCD986166429	FMC CORPORATION	BESSEMER CITY	493.32	.00	.00
NCD085080182	FOAMEX INTERNATIONAL, INC	CORNELIUS	25.60	.00	.00
NC0000055061	FORTRON INDUSTRIES	WILMINGTON	323.10	.00	.00
NCD056750003	FOUNTAIN POWERBOATS INC.	WASHINGTON	75.37	.00	.00
NCD991277732	FOUR SEASON ENVIRONMENTAL, INC	GREENSBORO	16.59	.00	.00
NCD091245498	FREIGHTLINE CORPOIRATION	MOUNT HOLLY	1,010.55	.00	.00
NCD018652339	FREIGHTLINER CORP	CLEVELAND	1,802.49	.00	.00
NCD091245431	FREIGHTLINER CORPORATION	GASTONIA	98.18	.00	.00
NCD003198967	GEL-CAROLINA PRODUCTS PLANT	GOLDSBORO	25.51	.00	.00
NCD057037194	GENERAL ELECTRIC CO.	MEBANE	116.99	.00	.00
NCD079044426	GENERAL ELECTRIC CO.	EAST FLAT ROCK	100.85	.00	.00
NCD003237948	GENERAL ELECTRIC COMPANY	HICKORY	22.29	.00	.00
NCD050409150	GENERAL ELECTRIC WILMINGTON, NC	WILMINGTON	180.53	.00	.00
NCD986197655	GENERAL MARBLE COMPANY	LINCOLNTON	58.00	.00	.00
NCD095463881	GENERAL STEEL DRUM CORP	CHARLOTTE	47.57	.00	.00
NCD093137636	GENERAL WOOD PRESERVING COMPANY, IN	LELAND	534.37	.00	.00
NCD001115245	GILBARCO INC.	GREENSBORO	19.95	.00	.00
NCD085443240	GKN, A.I.	SANFORD	112.94	.00	.00
NCD065655599	GLAXO WELLCOME	RTP	145.12	.00	.00
NCD047373766	GLAXO WELLCOME INC.	GREENVILLE	6,653.76	.00	.00
NCD101740215	GLAXO WELLCOME INC.	ZEBULON	48.04	.00	.00
NCD052547635	GLAXO WELLCOME INC. - SOUTH CAMPUS	RESEARCH TRIANG	74.22	.00	.00
NCR000003467	GLEN ROYALL MILL APARTMENTS	WAKE FOREST	28.66	.00	.00
NCD051330280	GLOBE MANUFACTURING CO.	GASTONIA	18.79	.00	.00
NCD003156510	GM NAMEPLATE-ACME DIVISION	MONROE	18.45	.00	.00
NCD003191582	GOLDEN BELT MANUFACTURING	DURHAM	54.10	.00	.00
NCD044387538	GRADY-WHITE BOATS INC.	GREENVILLE	139.60	.00	.00
NCD982092041	GRAPHIC PACKAGING FLEXIBLE	CHARLOTTE	306.40	.00	.00
NCD982120388	GREENSBORO AUTO AUCTION	GREENSBORO	21.75	.00	.00
NCD981922362	GREIF BROS. CORPORATION	BLADENBORO	17.67	.00	.00
NCD053491221	GUARDSMAN PRODUCT, INC	HIGH POINT	434.20	.00	.00
NCD062674338	HACKNEY & SON INC.	WASHINGTON	33.01	.00	.00
NCD003229358	HAMILTON BEACH/PROCTOR-SILEX, INC.	MOUNT AIRY	116.82	.00	.00
NCD003159084	HAMMARY FURNITURE CO.	LENOIR	15.29	.00	.00
NCD003448453	HAMMARY FURNITURE CO.	GRANITE FALLS	49.68	.00	.00
NCD045924065	HATTERAS YACHTS	NEW BERN	81.44	.00	.00
NCD061793253	HATTERAS YACHTS	HIGH POINT	44.87	.00	.00
NCD980483275	HELENA CHEMICAL CO.	ENFIELD	1,013.20	2,026,400.00	.00
NCD062567623	HENKEL CORP	CHARLOTTE	349.14	.00	.00
NCD024817827	HENREDON FURNITURE INDUSTRIES INC.	SPRUCE PINE	78.34	.00	.00
NCD003163888	HENREDON FURNITURE INDUSTRIES, INC	MORGANTON	135.22	.00	.00
NCD121700777	HERITAGE ENVIRONMENTAL SERVICES, IN	CHARLOTTE	2,010.72	.00	.00
NCD982164121	HI TECH CIRCUITS INC.	WILKSBORO	91.51	.00	.00
NCD044440642	HICKORY CHAIR CO.	HICKORY	25.50	.00	.00
NCD980840177	HICKORY CHAIR CO. WOOD PROD.	CONOVER	22.13	.00	.00
NCD003217536	HICKORY WHITE	HICKORY	42.66	.00	.00
NCD980600597	HIGH POINT CHEMICAL CORP.	HIGH POINT	56.17	15.00	.00
NCD003216397	HIGHLAND INDUSTRIES	KERNERSVILLE	190.26	.00	.00
NCD000616763	HK RESEARCH CORP.	HICKORY	114.53	.00	.00
NCD000608117	HOECHST CELANESE	CHARLOTTE	22.92	580.00	.00
NCD003446721	HOECHST CELANESE CORPORATION	EARL	39.01	.00	.00
NCD041043811	HOECHST CELANESE CORPORATION	SALISBURY	88.72	.00	.00
NCD085074821	HOECHST CELANESE CORPORATION SOU-TE	MOUNT HOLLY	375.51	10.00	.00
NCD990734055	HOECHST CELANESE POLYESTER	WILMINGTON	305.49	.00	.00
NCD981927320	HOLT MANUFACTURING CO.	BURLINGTON	18.25	.00	.00

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- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NCD991278631	HOLTRACHEM MFG., CO., L.L.C.	RIEGELWOOD	137.64	.00	.00
NCD091249417	HOMELITE-SUBSIDIARY OF DEERE, INC.	GASTONIA	884.45	.00	.00
NCD980840466	HONDA POWER EQUIPMENT MFG., INC.	SWEPSONVILLE	85.76	.00	.00
NCD048401087	HOOKER FURNITURE CORP.	PLEASANT GARDEN	44.80	.00	.00
NCD053488359	HOOKER FURNITURE CORP.	KERNERSVILLE	40.11	.00	.00
NCD003215696	HUNT MANUFACTURING CO.	STATESVILLE	36.19	.00	.00
NCD041463761	IBM CORPORATION	RTP	51.50	.00	.00
NCD982094278	IBM CORPORATION	RTP	32.90	.00	.00
NCD000623165	IBM CORPRATION	CHARLOTTE	39.76	.00	.00
NCD986177061	IEA INC	CARY	45.18	.00	.00
NCD045646924	ILCO UNICAN CORP.	ROCKY MOUNT	91.26	.00	.00
NCD024895864	ILCO UNICAN CORPORATION	WINSTON-SALEM	16.08	.00	.00
NCD059141184	IMPACT FURINTURE CO.	HILDEBRAN	29.62	.00	.00
NCD980841951	INCO ALLOYS	NEWTON	51.87	.00	.00
NCD057927857	INDUSTRIAL ELEC. CO. INC.	GASTONIA	35.93	.00	.00
NCD003186004	INTERNATIONAL PAPER	RALEIGH	49.26	.00	.00
NCD040027898	INTERPANE GLASS CO.	CLINTON	47.25	.00	.00
NCD986171189	ITT AUTOMOTIVE	ASHEVILLE	69.36	.00	.00
NCD087336335	IXL FURNITURE CO	ELIZABETH CITY	31.26	.00	.00
NCD986215465	JMC (USA) INC.	RESEARCH TRIANG	55.86	.00	.00
NCD001876549	JOHN BOYLE & CO., INC.	STATESVILLE	21.20	.00	.00
NCD000770487	JOHNSON CONTROLS BATTERY GROUP, INC	KERNERSVILE	18.15	.00	.00
NCD980844369	JORDAN GRAPHICS, INC.	CHARLOTTE	103.95	.00	.00
NCD083673681	KEARFOTT GUIDANCE & NAVIGATION CORP	BLACK MOUNTAIN	24.83	.00	.00
NCD048958615	KELLY SPRING FIELD TIRE, CO.	FAYETTEVILLE	62.70	.00	.00
NCD038547519	KEMET ELECTRONICS CORP.	SHELBY	385.47	.00	.00
NCD986189611	KENTEC INCORPORATED	GRIFTON	63.30	.00	.00
NCD003217726	KEWAUNEE SCIENTIFIC CORP.	STATESVILLE	25.69	.00	.00
NCD980839369	KEYSTONE POWDERED METAL CO.	CHERRYVILLE	37.39	.00	.00
NCD982109027	KINCAID FUNITURE COMPANY	HUDSON	32.09	.00	.00
NCD051324093	KINCAID FURNITURE COMPANY	HUDSON	78.82	.00	.00
NCD982114373	KONICA MANUFACTURING	WHITSETT	679.12	130.00	.00
NCD048183768	LABCORP OF AMERICA	BURLINGTON	16.16	1,753.00	.00
NCD002388965	LACKAWANNA LEATHER COMPANY	CONOVER	28.60	.00	.00
NCD000648451	LAIDLAW ENVIROMENTAL SERVICES (TS),	REIDSVILLE	4,711.71	3,434,774.96	.00
NCD079049409	LANE UPHOLSTERY PLANT #14	CONOVER	36.86	.00	.00
NCD066303728	LEA INDUSTRIES	WAYNESVILLE	58.10	.00	.00
NCD982077570	LENOX CHINA	OXFORD	47.41	.00	.00
NCD986186369	LENOX CHINA	KINSTON	115.52	.00	.00
NCD003220902	LEXINGTON FURNITURE IND	LEXINGTON	27.60	.00	.00
NCD981863897	LEXINGTON FURNITURE IND PLANT NO 3	LEXINGTON	14.60	.00	.00
NCD003226651	LEXINGTON FURNITURE IND PLANT NO.1	LEXINGTION	42.80	.00	.00
NCD067431700	LEXINGTON FURNITURE IND.	LEXINGTON	22.65	.00	.00
NCD991279076	LEXINGTON FURNITURE IND. PLANT NO.	LEXINGTON	33.92	.00	.00
NCD003231321	LEXINGTON FURNITURE IND. PLANT NO.1	LEXINGTON	19.78	.00	.00
NCD003523214	LEXNGTON FURNITURE IND.	LEXINGTON	23.20	.00	.00
NCD003232030	LILLY IDUSTRIES INC.	HIGH POINT	784.55	.00	.00
NCD000616334	LILLY INDUSTRIES, INC.	THOMASVILLE	13.86	.00	.00
NCD044438406	LITTON SYSTEMS CLIFTON PRECISION	MURPHY	44.69	.00	.00
NCD003224334	LORILLARD TOBACCO CO.	GREENSBORO	17.21	.00	.00
NCD055167324	M-B INDUSTRIES INC.	ROSMAN	15.65	.00	.00
NCD986230225	MACO, INC.	SHELBY	15.46	.00	.00
NCD060299880	MAGNETI MARELLI USA INC.	SANFORD	163.71	.00	.00
NCD062552989	MALLARD CREEK POLYMERS, INC.	CHARLOTTE	65.02	.00	.00
NCD042091975	MALLINCKRODT CHEMICAL, INC	RALEIGH	2,915.34	.00	.00

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- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NCD982090383	MANNINGTON WOOD FLOORS	HIGH POINT	17.23	.00	.00
NCD000735902	MARATHON OIL COMPANY	PAW CREEK	419.93	.00	.00
NCD003233111	MARSH FURNITURE COMPANY	HIGH POINT	87.07	.00	.00
NC0000016485	MAST BROTHERS TANK CLEANING, INC.	CHARLOTTE	13.82	.00	.00
NC8170022570	MCAS	JACKSONVILLE	43.57	.00	.00
NC1170027261	MCAS CHERRY POINT	CHERRY POINT	1,459.90	.00	.00
NCD097728091	MEASUREMENTS GROUP, INC.	WENDELL	52.49	.00	.00
NCR000003459	MEHERRIN AGRICULTURE & CHEMICAL	AHOSKIE	7.83	15,670.00	.00
NCD075575191	MESTEK INCORPORATED	FARMVILLE	15.15	.00	.00
NCD981026909	METALS AMERICA	SHELBY	18.10	.00	.00
NCD003215621	MILLER DESK, INC.	HIGH POINT	47.85	.00	.00
NCD980845044	MITSUBISHI SEMICONDUCTOR	DURHAM	74.28	.00	.00
NCD067427922	MOEN INCORPORATED	SANFORD	506.35	.00	.00
NCD980602445	MOEN INCORPORATED	NEWBERN	74.40	.00	.00
NCD185374899	MOLDED FIBER GLASS COMPANIES	MORGANTON	14.32	.00	.00
NCD071572036	MORFLEX INCORPORATED	GREENSBORO	80.09	.00	.00
NCD980559660	MOTOROLA	RTP	48.22	.00	.00
NCD981920580	N.C. DOT MARINE MAINT. FACILITY	MANNS HARBOR	15.02	.00	.00
NCD000623116	NATIONAL STARCH AND CHEMICAL COMPAN	SALISBURY	2,782.69	.00	.00
NCD058830050	NATIONAL/MT.AIRY FURN. CO.	MT. AIRY	25.14	.00	.00
NC2750890004	NATL. INST. OF ENVR. HEALTH SCI.	RESEARCH TRIANG	14.36	16.00	.00
NCD095465035	NEPTCO INCORPORATED	LENOIR	95.31	.00	.00
NCD986172476	NOBLE OIL SERVICE, INC.	SANFORD	204.07	.00	.00
NCD982086555	NORTH AMERICAN ROTO ENGRAVER	WINSTON-SALEM	452.21	.00	.00
NCD986230233	NORTH CAROLINA CENTRAL UNIVERSITY	DURHAM	1.57	376.00	.00
NCD000830737	NORTH CAROLINA STATE UNIVERSITY	RALEIGH	175.88	660.00	.00
NCD986228344	NORTH CAROLINA STATE UNIVERSITY	RALEIGH	.48	86.50	.00
NCD000831057	NORTHERN TELECOM, INC.	RESEARCH TRIANG	31.22	.00	.00
NCD000052563	NWC, INC	HICKORY	262.48	.00	.00
NCD057454670	OCCIDENTAL CHEMICAL CORPORATION	CASTLE HAYNE	135.88	.00	.00
NCD981003197	OMC ANDREWS	ANDREWS	19.28	.00	.00
NCD101773992	OMC BURNSVILLE	BURNSVILLE	134.74	.00	.00
NCD986182368	PAC-FAB INC.	SANFORD	20.25	.00	.00
NCD981025406	PAXAR-PRINTED LABEL GRP.	LENOIR	38.20	.00	.00
NCD986172526	PESTICIDE DISPOSAL AREA MAGNOLIA LA	SELMA	540.86	.00	.00
NCD002972966	PHELPS DODGE MAGNET WIRE CO.	LAURINBURG	199.90	.00	.00
NCD057932675	PHILLIPS PIPE LINE COMPANY	PAW CREEK	103.50	.00	.00
NCD000645929	PHILLIPS PIPELINE COMPANY	SELMA	180.49	.00	.00
NCD000615617	PIEDMONT AVIATION SERVICES, INC.	WINSTON-SALEM	5.58	200.00	.00
NCD003215779	PIEDMONT CHEMICAL IND. INC.	HIGH POINT	52.60	.00	.00
NCD116001280	PIEDMONT COVERTING	LEXINGTON	159.00	.00	.00
NCD001493931	PILLING WECK	RTP	18.19	.00	.00
NCD986188134	PISGAH LABS, INC.	PISGAH FOREST	41.84	.00	.00
NCD093787307	PLANTATION PIPE LINE	GREENSBORO	255.92	.00	.00
NCD003224235	PLASTIC PACKAGING, INC.	HICKORY	265.10	.00	.00
NCD981028210	PLASTICS MFG. INC. MOLDING D.	HARRISBURG	65.15	.00	.00
NCD003156940	PNEUMAFIL CORP./CR HARRIS PLANT	CHARLOTTE	34.24	.00	.00
NCD986189595	POLYGRAM MANUFACTURING/DIST.CENTER.	GROVER	38.55	.00	.00
NCD986166544	PRAXIS BIOLOGICS, INC.	SANFORD	29.32	35.00	.00
NCD980729248	PREFORMED LINE PRODUCTS CO.	ALBEMARLE	39.18	.00	.00
NCD066304627	PREMIUM COATINGS INC.	CONOVER	51.62	.00	.00
NCD030504062	PRINTPACK ENTERPRISES, INC.	HENDERSONVILLE	60.25	.00	.00
NCD000616441	PROCTER & GAMBLE MFG. CO.	BROWN SUMMIT	41.92	64.00	.00
NCD003237963	PROCTER & GAMBLE MFG. CO.	GREENSBORO	43.87	94.00	.00
NCD980843049	PRODELIN CORPORATION	CATAWBA	21.91	.00	.00

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NORTH CAROLINA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NCD045917176	PUROLATOR PRODUCTS	FAYETTEVILLE	22.44	.00	.00
NCD986229110	QUALA SYSTEMS INC.	GREENSBORO	14.38	.00	.00
NCD084173830	QUALITY FOREST PRODUCTS, INC.	ENFIELD	244.57	.00	.00
NCD044514602	R J REYNOLDS TOBBCCO CO	WINSTON-SALEM	45.49	.00	.00
NCD981859549	R J REYNOODS TOBACCO CO G41	WINSTON-SALEM	32.25	.00	.00
NCD991279118	R R DONNELLEY PRINTING CO.	NEWTON	60.49	.00	.00
NCD109141424	RADIAN INTERNATIONAL LLC	MORRISVILLE	2.47	60.00	.00
NCD091245969	RADIATOR SPECIALTY COMPANY	MATTHEWS	29.67	.00	.00
NCD981017320	RAUCH INDUSTRIES	GASTONIA	185.11	.00	.00
NCD083673616	REEVES INTERNATIONAL	RUTHERFORD	165.51	.00	.00
NCD986194272	REICHHOLD CHEMICALS, INC.	DURHAM	16.95	.00	.00
NCD004868105	RESEARCH TRIANGLE INSTITUTE	RESEARCH TRINGL	29.07	.00	.00
NCD980729875	REVLON	OXFORD	102.98	.00	.00
NCD099224164	REX-ROSENLEW INTERNATIONAL, INC.	THOMASVILLE	38.60	.00	.00
NCD041747775	REXAM FLEXIBLE PACKAGING	GREENSBORO	135.42	.00	.00
NCD041048448	REXAM, INC.	MATTHEWS	633.44	.00	.00
NCD089914311	REYNOLDS METALS COMPANY	REIDSVILLE	14.96	.00	.00
NCD980600274	RHONE POULENC AG COMPANY	RESEARCH TRIANG	65.58	11,117.00	.00
NCD042091215	RJ REYNOLDS TOBACCO	WINSTON-SALEM	92.61	.00	.00
NCD981745342	RJ REYNOLDS TOBACCO CO.	WINSTON-SALEM	8.02	1,570.00	.00
NCD067441394	RJ REYNOLDS TOBACCO CO.-604	WINSTON-SALEM	460.88	.00	.00
NCR000003509	S & W MOTORLINES PROPERTY	GREENSBORO	14.00	.00	.00
NCD991278680	SADOLIN PAINT PRODUCTS	WINSTON-SALEM	306.11	.00	.00
NCD057450090	SAFELITE GLASS CORP	ENFIELD	1,645.21	.00	.00
NCD077840148	SAFETY-KLEEN CORP	ARCHDALE	62.37	.00	.00
NCD079060059	SAFETY-KLEEN CORP	CHARLOTTE	30.14	.00	.00
NCD000776740	SAFETY-KLEEN CORP.	RALEIGH	24.24	.00	.00
NCD000623140	SAFT AMERICA, INC	VALDESE	21.61	.00	.00
NCD065300519	SCHLAGE LOCK COMPANY	ROCKY MOUNT	14.78	.00	.00
NCD095458709	SCHRADER AUTOMOTIVE INC.	MONROE	36.26	.00	.00
NCD002591014	SCHRADER BELLOWS	WAKE FOREST	1,424.63	.00	.00
NCD981025950	SCHWITZER	ASHEVILLE	21.59	.00	.00
NCD074503129	SEALRIGHT/VENTURE PACKAGING, INC.	CHARLOTTE	147.18	.00	.00
NCD003214319	SHERWIN-WILLIAMS DIVERSIFIED BRANDS	GREENSBORO	302.29	.00	.00
NCD003217437	SHURTAPE TECHOLOGIES, INC.	HICKORY	63.92	.00	.00
NCD981922602	SIECOR CORPORATION	HICKORY	57.78	.00	.00
NCD062568035	SINGER FURNITURE CO.	LENOIR	113.75	.00	.00
NCD072012354	SINGER FURNITURE COMPANY	CHOCOWINITY	54.61	.00	.00
NCD042272526	SM COMPANY	ASHEVILLE	33.59	.00	.00
NCD986189785	SMT, INC,	RALEIGH	22.58	.00	.00
NCD986228146	SOLECTRON TECHNOLOGY, INC.	CHARLOTTE	19.62	.00	.00
NCD000616391	SONOCO ENGRAPH	CHARLOTTE	68.95	.00	.00
NCD982131476	SONOPRESS INC.	WEAVERVILLE	24.10	.00	.00
NCD047372503	SOUTHCHEM INC.	DURHAM	23.37	.00	.00
NCD000609974	SOUTHEAST TERMINAL	GREENSBORO	83.86	.00	.00
NCD000609982	SOUTHEAST TERMINAL	CHARLOTTE	24.19	.00	.00
NCD081427023	SOUTHERN FURNITURE COMPANY	CATAWBA	23.52	.00	.00
NCD981473564	SOUTHERN GRAPHIC SYSTEMS	WILMINGINTON	153.57	.00	.00
NCD986191781	SOUTHERN STATES GALVANIZING	ABERDEEN	563.99	.00	.00
NCD003152501	SOUTHREN ENGINEERING COMPANY	CHARLOTTE	509.00	.00	.00
NCD003951878	SQUARE D COMPANY	ASHEVILLE	166.32	.00	.00
NCD067203752	SQUARE D COMPANY	KNIGHTDALE	38.27	.00	.00
NCD101773000	SQUARE D COMPANY	MONROE	78.85	.00	.00
NCD980845366	STABILUS	GASTONIA	36.51	.00	.00
NCD084167444	STANADYNE AUTOMOTIVE CORP.	JACKSONVILLE	25.86	.00	.00

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NORTH CAROLINA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NCD981932031	STANDARD PACKAGING AND PRINTING	MT. GILEAD	67.82	.00	.00
NCD003216413	STANLEY FURNITURE CO.	LEXINGTON	43.78	.00	.00
NCD024770125	STANLEY FURNITURE CO.	ROBBINSVILLE	18.19	.00	.00
NCD000623199	STAR ENTERPRISE	FAYETTEVILLE	59.38	.00	.00
NCD980799142	STAT INC.	HUDSON	59.11	.00	.00
NCD062572391	STEELCASE,INC	FLETCHER	145.23	.00	.00
NCD049773666	STORK SCREENS AMERICA	CHARLOTTE	32,721.58	.00	.00
NCD053487765	STRATFORD METAL FINISHING	WINSTON -SALEM	17.99	.00	.00
NCD990868168	SUN CHEMICAL CORPORATION	CHARLOTTE	497.37	.00	.00
NCD003459336	SURTRONICS, INC.	RALEIGH	156.27	.00	.00
NCD077828358	T.I. INDUSTRIES/INDIANA MOULDING	LEXINGTON	120.30	.00	.00
NCD127257673	TAKEDA CHEMICAL PRODUCTS USA, INC.	WILMINGTON	515.08	.00	.00
NCD986185536	TALON INC.	STANLEY	34.04	.00	.00
NCD001924745	TARHEEL ARMY MISSILE PLANT	BURLINGTON	16.35	.00	.00
NCD982077802	TARHEEL WOOD TREATING CO. INC.	MORRISVILLE	1,022.23	.00	.00
NCD105797922	TECHNIBILT, LTD	NEWTON	148.23	.00	.00
NCD086872082	TECHNOGRAPHICS PRINTWORLD	MONROE	568.24	.00	.00
NCD086326741	TEXACO / STAR ENTERPRISE SALES TERM	APEX	58.63	.00	.00
NCD044380798	THE BOLING COMPANY	MOUNT OLIVE	135.95	.00	.00
NCD982117079	THE COLOR WORKS INC	RUTHERFORDTON	22.10	.00	.00
NCD986204493	THE COLORWORKS INC.	GREENSBORO	59.16	.00	.00
NCD003465101	THE HASTINGS COMPANY	KING	20.50	.00	.00
NCD071561864	THE SHERWIN-WILLIAMS COMPANY	GREENSBORO	1,900.56	.00	.00
NCD037152683	THE STANDARD PRODUCT CO	ROCKY MOUNT	26.32	.00	.00
NCD041415019	THE VALSPAR CORPORATION	HIGH POINT	937.63	.00	.00
NCD003233970	THOMAS BUILT BUSES INC.	HIGH POINT	74.59	.00	.00
NCD003159894	THOMASVILLE FURNITURE	WEST JEFFERSON	22.90	.00	.00
NCD003219714	THOMASVILLE FURNITURE IND	WINSTON-SALEM	37.88	.00	.00
NCD054290770	THOMASVILLE FURNITURE IND	LENOIR	44.57	.00	.00
NCD044517167	THOMASVILLE FURNITURE IND PLT D	THOMASVILLE	16.47	.00	.00
NCD044517043	THOMASVILLE FURNITURE IND. PLT. B	THOMASVILLE	16.11	.00	.00
NCD000828863	THOMASVILLE FURNITURE IND.PLT.A	THOMASVILLE	17.65	.00	.00
NCD003219615	THOMASVILLE FURNITURE PLANT C	THOMASVILLE	66.59	.00	.00
NCD096164629	THOMSON CROWN WOOD PRODUCTS	MOCKSVILLE	98.10	.00	.00
NCD051331395	THONET INDUSTRIES	STATESVILLE	16.99	.00	.00
NCD003157930	THREADS USA	GASTONIA	21.29	.00	.00
NCD986186351	TIMCO	GREENSBORO	31.45	.00	.00
NCD072028251	TORPEDO WIRE & STRIP INC.	ROCKY MOUNT	208.00	.00	.00
NCD982156879	TRIANGLE LABORATORIES	DURHAM	32.28	415.00	.00
NC6170022580	U. S. MARINE CORPS BASE	CAMP LEJEUNE	774.25	1,524.00	.00
NCD067185744	U.S. ASSEMBLIES RALEIGH	RALEIGH	17.23	.00	.00
NCR000003558	UNC CHAPEL HILL LAUNDRY BLD.	CHAPEL HILL	204.14	.00	.00
NCD982093783	UNC HAZARDOUS MATERIALS FACILITY	CHAPEL HILL	13.87	.00	.00
NCD061795696	UNITEX CHEMICAL CORP.	GREENSBORO	67.43	.00	.00
NCR000003483	UNIVERSITY OF NORTH CAROLINA-CHAPEL	CHAPEL HILL	204.14	.00	.00
NCD980799498	US AIR	GREENSBORO	22.53	.00	.00
NC6570024475	US AIR FORCE- POPE	POPE AFB	52.36	.00	.00
NC7570024474	USAF SEYMOUR JOHNSON, AFB	SEYMOUR JOHSON	53.45	.00	.00
NCD006997795	USAIR, INC.	WINSTON-SALEM	3,704.24	.00	.00
NCD986227957	USAIR, INC.	CHARLOTTE	25.13	.00	.00
NC2690308232	USCG SUPPORT CENTER	ELIZABETH CITY	52.47	40.00	.00
NCD089903983	VAN WATERS AND ROGERS, INC.	GREENSBORO	18.29	.00	.00
NCD003464765	VAUGHAN-BASSETT FURNITURE CO.	ELKIN	21.32	.00	.00
NCD041466251	VEEDER-ROOT COMPANY OF NC	ELIZABETHTOWN	8,359.38	.00	.00
NCD060306727	W. C. RICHARDS COMPANY	ABERDEEN	19.00	.00	.00

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NORTH CAROLINA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS WHO MUST BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NCD003236841	WARLICK PAINT COMPANY INC.	STATESVILLE	39.96	.00	.00
NCD097363527	WATTS REGULATOR	SPINDALE	614.24	.00	.00
NCD039102959	WAUKESHA ELECTRIC SYSTEM	GOLDSBORO	16.57	.00	.00
NCD044513695	WESTERN ROTO ENGRAVERS, INC	GREENSBORO	57.84	.00	.00
NCD079054680	WESTINGHOUSE ELECTRIC CORPORATION	CHARLOTTE	27.94	490.00	.00
NC0000187112	WOOD PROTECTION PRODUCTS, INC	CHARLOTTE	14.87	29,731.00	.00
NCD024766719	WRIGHT CORPORATION	RIEGELWOOD	87.78	.00	.00
NC8210020121	XVIII AIRBORNE CORPS AND FORT BRAGG	FORT BRAGG	459.99	600.00	.00
NCD000616516	YALE SECURITY INC.	MONROE	35.22	.00	.00
NCD002560159	ZENECA SPECIALITY INKS	WINSTON-SALEM	48.37	.00	.00

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NORTH CAROLINA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NCD099233686	AAR POWERBOSS, INC.	ABERDEEN	8.83	.00	.00
NC0000876300	ABB POWER T & D CO., INC.	RALEIGH	12.10	.00	.00
NCD003195963	ABB POWER T&D COMPANY, INC.	RALEIGH	1.70	.00	.00
NCD990733180	ABBOTT LABORATORIES	ROCKY MOUNT	3.58	.00	.00
NCD051327963	AEROQUIP CORPORATION	FOREST CITY	12.32	.00	.00
NCR000001545	AIR PRODUCTS & CHEMICALS INC.	GREENSBORO	2.78	.00	.00
NCD981014996	AMP INCORPORATED	GREENSBORO	7.95	.00	.00
NCD982165995	APPLIED ANALYTIACAL, INC.	WILMINGTON	12.16	.00	.00
NCD024599011	ASHLAND CHEMICAL, INC.	GREENSBORO	8.82	.00	.00
NCD986194330	AT & T CUSTOM MANUFACTURING SER	WHITSETT	12.23	.00	.00
NCD062548995	BALCRANK PRODUCTS	WEAVERVILLE	5.25	.00	.00
NCD052813250	BASF CORP.	ENKA	12.23	.00	.00
NCD003149705	BASF CORPORATION	CHARLOTTE	3.41	.00	.00
NCD139687974	BASF CORPORATION	RTP	8.59	.00	.00
NCD000829101	BERNHARDT FURNITURE CO	LENOIR	4.34	.00	.00
NCD003189024	BORDEN CHEMICAL	FAYETTEVILLE	2.57	.00	.00
NCR000003111	BORDEN WORLDWIDE	MORGANTON	4.62	.00	.00
NCD075559526	BP OIL COMPANY	SELMA	1.69	.00	.00
NCD000623082	BRISTOL MYERS PRODUCTS	MORRISVILLE	7.93	.00	.00
NCR000003574	BURRIS MACHINE CO.	HICKORY	2.20	.00	.00
NCD981856396	C.T BOWERS CENTER	RALEIGH	12.02	.00	.00
NCD003152642	CAROLINA SOLITE CORPORATION	NORWOOD	1.42	.00	.00
NCD062550082	CARPENTER CO.	CONOVER	4.59	.00	.00
NCD003148889	CHAMPION INTERNATIONAL CORP.	CANTON	9.70	.00	.00
NCD981863228	CHELSEA LABS. INC.	MONROE	10.14	21.00	.00
NCD000609727	CITGO PETROLEUM CORP.	SELMA	3.00	.00	.00
NCD008923914	CITY CHERVOLET CO	CHARLOTTE	7.49	.00	.00
NCD986168797	CLARK SCHWEBEL	STATESVILLE	11.00	.00	.00
NCD986178127	CLEVELAND REGIONAL MEDICAL CENTER	SHELBY	12.75	.00	.00
NCD980728901	CLEVELAND TWIST DRILL	ASHEBORO	11.38	.00	.00
NCD003154903	COCHRANE FURNITURE COMPANY, INC	LINCOLNTON	10.39	.00	.00
NCD107868812	CONBRACO INDUSTRIES INC.	MATTHEWS	9.25	.00	.00
NCD043679349	CONTINENTAL GENERAL TIRE INC.	CHARLOTTE	8.94	.00	.00
NCD003232477	COPLAND FABRICS, INC	BURLINGTON	2.37	.00	.00
NCD980559645	COUNCILL BUSINESS FURNITURE	DENTON	3.36	.00	.00
NCD986166205	COUNCILL CRAFTSMAN PLT2	DENTON	7.01	.00	.00
NCD043714245	COVINGTON DETROIT DIESEL	GREENSBORO	1.20	.00	.00
NCD083680025	CR INDUSTRIES	FRANKLIN	4.57	.00	.00
NCD003150539	CRANSTON PRINT WORKS CO.	FLETCHER	1.25	.00	.00
NCD046135992	CUTLER HAMMER INCORPORATED	FAYETTEVILLE	5.06	.00	.00
NCD148724891	DANA CORPORATION (A.P.D.)	HARRISBURG	4.17	.00	.00
NCR000003475	DAVE STEEL COMPANY INC.	ASHEVILLE	11.75	.00	.00
NCD049842255	DIVERSIFIED TECHNOLOGIES INC.	JAMESTOWN	11.55	.00	.00
NCR000002477	DOPACO, INC.	KINSTON	13.19	.00	.00
NCD981020258	DREXEL HERITAGE PLT 33	MORGANTON	11.54	.00	.00
NCD981861438	DUKE POWER COMPANY TODDVILLE STORE	CHARLOTTE	7.77	.00	.00
NCD003190386	E I DUPONT DE NEMOURS CO.	KINSTON	6.99	.00	.00
NCD986194421	EQUIPMENT AND SUPPLY, INC.	MONROE	12.97	.00	.00
NCD986171197	EXCEL ELECTRONICS, INC	CHARLOTTE	3.80	.00	.00
NCD986187029	EXIDE ELECTRONICS	LELAND	5.96	.00	.00
NCD072021074	EXXON CHEMICAL COMPANY	WILMINGTON	2.67	.00	.00
NCD056478506	EXXON TERMINAL #4116	CHARLOTTE	1.10	.00	.00
NCD000825505	EXXON TERMINAL #4327	SELMA	1.43	.00	.00
NCD003150562	FIRESTONE FIBERS AND TEXTILES CO.	GASTONIA	2.21	7.00	.00
NCD083678631	FLINT INK	CHARLOTTE	4.50	.00	.00

Note: Please refer to the introduction for an explanation of this list.

NORTH CAROLINA

REPORTED RCRA LARGE QUANTITY GENERATORS (LQG) GROUPED BY RCRA GENERATION QUANTITIES

GENERATORS FOR WHOM FEDERAL LQG STATUS CANNOT BE DETERMINED BASED ON THEIR REPORTED GENERATION OF

- AT LEAST 1.1 BUT LESS THAN 13.2 TONS RCRA HAZARDOUS WASTE, OR
- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NCD986191674	FRIT CAR, INC.	BRIDGETON	3.70	.00	.00
NCD982117384	GLAXO WELLCOME INC. - IMPERIAL CENT	MORRISVILLE	11.72	.00	.00
NCD986232619	GREER LABORATORIES	LENOIR	12.14	.00	.00
NCD991278284	HARRI NUCLEAR PLANT	NEW HILL	1.17	.00	.00
NCD003233137	HAWORTH INCORPORATED	HIGH POINT	5.81	.00	.00
NCD986171130	HERMAN MILLER INC.	SANFORD	11.79	.00	.00
NC0000930727	IBM CORPORATION	CHARLOTTE	11.31	.00	.00
NCD980803274	IMPACT FURNITURE CO.	HILDEBRAN	11.84	.00	.00
NCD041414772	INGERSOLL-RAND	MOCKSVILLE	12.50	.00	.00
NCD083680090	INTERNATIONAL RESISTIVE CO., INC.	BOONE	5.22	.00	.00
NCD000653576	KRC ROLLS	SALISBURY	4.91	.00	.00
NCD049841232	LEESONA DIV. TRAFALGAR HOUSE, INC.	BURLINGTON	1.37	.00	.00
NCD991277799	LEXINGTON FURNITURE IND.	MOCKSVILLE	6.00	.00	.00
NCD991278813	LEXINGTON FURNITURE IND.	HILDEBRAN	10.35	.00	.00
NCD986166601	MAYFLOWER VEHICLE SYSTEMS	KINGS MOUNTAIN	6.93	.00	.00
NCD986182616	MAYVILLE METAL PRODUCTS	CREEDMOOR	2.93	.00	.00
NCD980798839	MERCK MANUFACTURING DIVISION	WILSON	5.00	.00	.00
NCD003907508	MORGANITE INCORPORATED	DUNN	3.73	.00	.00
NCD991298480	NAMEPLATE-DIV. OF THE FRED B. JOHNS	HILLSBOROUGH	5.79	.00	.00
NCD991277856	NC DEPARTMENT OF AGRICULTURE	RALEIGH	2.96	.00	.00
NCD981923378	NC DEPT OF TRANS. EQUIP. DEPOT,	RALEIGH	12.22	.00	.00
NCR000001792	NORFOLK SOUTHERN RAILWAY CO.	RALEIGH	3.07	.00	.00
NCR000003566	NORTH CAROLINA DOT (DAVIDSON CO)	LEXINGTON	3.21	.00	.00
NCD000773655	OLDOVER CORPORATION	NORWOOD	6.91	.00	.00
NCD061792362	OWENS BROCKWAY	LEXINGTON	11.76	.00	.00
NCD051823680	PAKTANK CORPORATION	WILMINGTON	5.22	.00	.00
NCD039137823	PHILIP MORRIS USA	CONCORD	8.53	.00	.00
NCD041466806	PHILLIPS PLATING CO. INC.	BRIDGETON	4.21	.00	.00
NCD981932791	PLASTICS MFG INC.	CONCORD	11.07	.00	.00
NCD980559983	PPG INDUSTRIES INC. WORKS 52	SHELBY	7.82	.00	.00
NCD981472905	PROGRESSIVE FURNITURE, INC.	CLAREMONT	8.28	.00	.00
NCD986229045	QUALA SYSTEM, INC.	WILMINGTON	1.90	.00	.00
NCR000001255	REXAM RELEASE	EDEN	4.69	.00	.00
NCD980846935	SAFETY KLEEN CORP	ST PAUL	11.97	.00	.00
NCD986171882	SCHINDLER ELEVATOR CORP.	CLINTON	9.69	.00	.00
NCR000001446	SEARS UNIT #2225	GOLDSBORO	2.27	.00	.00
NCD139362693	SHAMROCK CORPORATION	GREENSBORO	3.31	.00	.00
NC0000108886	SIECOR	WINSTON-SALEM	6.64	.00	.00
NCD000604322	SINGER FURNITURE CO. PLT 33	LENOIR	4.17	.00	.00
NCD980802664	SOUTHERN FURITURE CO P#2	CONOVER	3.30	.00	.00
NCR000003491	STALLINGS FIELD	KINSTON	8.41	.00	.00
NCD091567065	STANADYNE AUTOMOTIVE CORP.	WASHINGTON	12.06	.00	.00
NCD003233228	STONEVILLE FURNITURE CO.	STONEVILLE	9.20	.00	.00
NCD053530895	SUPREME MURPHY TRUCK BODIES	WILSON	13.12	.00	.00
NCD986181857	SYNTHETICS FINISHING	HICKORY	1.50	.00	.00
NCD096165121	TEXACO/STAR ENTERPRISE SALES TERMIN	GREENSBORO	13.06	.00	.00
NCD003147485	THE NEW CHEROKEE CORP	SPINDALE	2.50	.00	.00
NCR000000638	THE TEXWIPE COMPANY	KERNERSVILLE	2.07	.00	.00
NCD021392048	THE TORRINGTON CO.	RUTHERFORD	1.61	.00	.00
NCD095468849	THE TRANE COMPANY	CHARLOTTE	6.25	.00	.00
NCD980844427	TREASURE CHEST ADVERTISING CO.	CHARLOTTE	7.02	.00	.00
NCD980515308	UNC CHAPEL HILL	CHAPEL HILL	7.42	6.17	.00
NCD980600894	UNC CHARLOTTE	CHARLOTTE	3.88	17.00	.00
NCD055133029	UNIVERSAL FOREST PRODUCTS, INC.	ELIZABETH CITY	1.25	.00	.00
NCR000003525	US ASSEMBLIES RTP, INC.	MORRISVILLE	1.25	.00	.00

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NORTH CAROLINA

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- AT LEAST 2.2 BUT LESS THAN 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NCD009623430	VAMPLY, INC	CHARLOTTE	1.46	.00	.00
NCD990745242	VERMONT AMERICAN CORP.	LINCOLNTON	2.68	.00	.00
NCD033999764	WALTER KIDDLE AEROSPACE, INC.	WILSON	7.59	.00	.00
NCD981869167	WAVERLY MILLS, INC	E. LAURINBURG	1.12	.00	.00
NCD003199882	WEYERHAEUSER	PLYMOUTH	9.54	.00	.00
NCD991278540	WEYERHAEUSER CO. WOOD PRODUCTS	PLYMOUTH	2.55	.00	.00
NCR000000760	WNC SCHOOL FOR THE DEAF	MORGANTON	2.45	.00	.00
NCD003471158	WORTH CHEMICAL CORPORATION	GREENSBORO	6.39	.00	.00
NCD980843122	ZENECA SPECIALTY INKS	WINSTON-SALEM	3.60	.00	.00

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NORTH CAROLINA

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GENERATORS WHO CANNOT BE A FEDERAL LQG BASED ON THEIR REPORTED GENERATION OF

- LESS THAN 1.1 TONS RCRA HAZARDOUS WASTE, AND
- LESS THAN 2.2 POUNDS RCRA ACUTE HAZARDOUS WASTE, AND
- 220 POUNDS OR LESS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NCD071562656	AMOCO PETROLEUM PRODUCTS	GREENSBORO	.96	.00	.00
NCD088560032	ASHLAND CHEMICAL CO.	RALEIGH	.20	.00	.00
NCD025423856	BATTLEGROUND CLEANERS	GREENSBORO	.98	.00	.00
NCD071566681	CHEMCENTRAL GREENSBORO	JAMESTOWN	.40	.00	.00
NCD003186178	COASTAL CHEMICAL CORP	GREENVILLE	.00	.00	.00
NCD991278946	DREXEL HERITAGE PLT 76	MORGANTON	.99	.00	.00
NCD000825547	EXXON TERMINAL # 4187	GREENSBORO	.15	.00	.00
NCD982095051	GAGE CAROLINA METALS INC.	DURHAM	.23	.00	.00
NCR000000414	MATLACK INC.	CHARLOTTE	.94	.00	.00
NCD101734598	MELLCO, INC	ROANOKE RAPIDS	.73	.00	.00
NCR000003541	NORTH CAROLINA DOT (PENDER)	BURGAW	.00	.00	.00
NCD986187458	PITT COUNTY SCHOOLS-AYDEN DUMP	AYDEN	.00	.00	.00
NCD986215572	RENTAL UNIFORM	WILSON	.00	.00	.00
NCD091258756	REYNOLDS METALS CO.	SALISBURY	.23	.00	.00
NCD046362117	ROADWAY EXPRESS, INC.	KERNERSVILLE	1.04	.00	.00
NC0000926428	SNIDER TIRE INC.	GREENSBORO	.93	.00	.00
NCD053010732	SOUTH BOULEVARD PROPERTIES	CHARLOTTE	.00	.00	.00
NC5690308262	USCG BASE FORT MACON	ATLANTIC BEACH	1.08	.00	.00

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NORTH DAKOTA

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- AT LEAST 26.4 POUNDS RCRA ACUTE HAZARDOUS WASTE, OR
- MORE THAN 220 POUNDS OF ACUTE SPILL CLEANUP MATERIAL

EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NDD006175467	AMOCO OIL COMPANY - MANDAN REFINERY	MANDAN	518,495.81	.00	.00
NDD000690594	DAKOTA GASIFICATION COMPANY	BEULAH	72.06	.00	.00
NDD031852478	FARSTAD OIL INC.	MINOT	18.99	.00	.00
NDD986271310	GALVANIZERS INC	WEST FARGO	314.85	.00	.00
ND3571924759	GRAND FORKS AIR FORCE BASE ND	GRAND FORKS AFB	34.48	.00	.00
NDD167721265	HEALTH CARE INCINERATORS	FARGO	79.38	.00	.00
NDD051439743	INDUSTRIAL PLATING CORPORATION	WAHPETON	19.24	.00	.00
NDD053426565	LUCAS AEROSPACE CARGO SYSTEMS	JAMESTOWN	44.00	.00	.00
ND4571924758	MINOT AIR FORCE BASE	MINOT AFB	198.20	1.00	.00
NDD980957070	SAFETY-KLEEN - BISMARCK	BISMARCK	313.44	.00	.00
NDD000716738	SAFETY-KLEEN CORP - FARGO	FARGO	457.64	.00	.00
NDD099790818	TURTLE MOUNTAIN MANUFACTURING	BELSOURT	20.32	.00	.00
NDD982591794	WASTE RECOVERY SERVICES INC.	BELFIELD	72.89	.00	.00
NDD031875719	WIL-RICH	WAHPETON	32.19	.00	.00
NDD084497775	3M DATA STORAGE PRODUCTS	WAHPETON	40.42	.00	.00

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EPA ID	GENERATOR NAME	LOCATION CITY	RCRA TONS GENERATED	RCRA ACUTE LBS GENERATED	ACUTE SPILL LBS GENERATED
NDD990872590	CASE CORPORATION	FARGO	11.88	.00	.00

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	Hydrologic Descriptor	Waterbody	Segment / Area [B]	Pollutant / Stressor	Extent of Impairment [C]	Year Listed
1	San Joaquin Hills HSA (901.11) [D]	Pacific Ocean Shoreline	Cameo Cove at Irvine Cove Dr. - Riviera Way	Bacterial Indicators[E]	0.6 miles	1998
			at Heisler Park - North			
2	Laguna Beach HSA (901.12)	Pacific Ocean Shoreline	at Main Laguna Beach	Bacterial Indicators[E]	1.8 miles	1998
			Laguna Beach at Ocean Avenue			
			Laguna Beach at Laguna Avenue			
			Laguna Beach at Cleo Street			
			Arch Cove at Bluebird Canyon Road			
			Laguna Beach at Dumond Drive			
3	Aliso HSA (901.13)	Aliso Creek	See Footnote F	Bacterial Indicators[E]	lower 1 mile (see Footnote F)	1998
			See Footnote F	Phosphorus, Toxicity	See Footnote F	2002
4	Aliso HSA (901.13)	Pacific Ocean Shoreline	Laguna Beach at Lagunita Place / Blue Lagoon Place	Bacterial Indicators[E]	0.7 miles	1998
			at Aliso Beach			
5	Aliso HSA (901.13)	Aliso Creek	at creek mouth	Bacterial Indicators[E]	0.3 acres	1998
6	Dana Point HSA (901.14)	Pacific Ocean Shoreline	Aliso Beach at West Street	Bacterial Indicators[E]	1.88 miles	1998
			Aliso Beach at Table Rock Drive			
			1000 Steps Beach at Pacific Coast Hwy at Hospital (9th Ave)			
			at Salt Creek (large outlet)			
			Salt Creek Beach at Salt Creek service road			
			Salt Creek Beach at Dana Strand Road			
7	Dana Point HSA (901.14)	Dana Point Harbor	at Baby Beach	Bacterial Indicators[E]	0.4 miles	2002
8	Mission Viejo HA (901.20)	San Juan Creek	at creek mouth	Bacterial Indicators[E]	6.3 acres	1998
9	Lower San Juan HSA (901.27)	San Juan Creek		Bacterial Indicators[E]	1 mile	1998
10	Lower San Juan HSA (901.27)	Pacific Ocean Shoreline	at North Beach Creek	Bacterial Indicators[E]	1.2 miles	1998
			at San Juan Creek (large outlet)			
			at Capistrano Beach			
			South Capistrano Beach at Beach Road			2002
11	San Clemente HA (901.30)	Pacific Ocean Shoreline	at Poche Beach (large outlet)	Bacterial Indicators[E]	3.7 miles	1998
			Ole Hanson Beach Club Beach at Pico Drain			
			San Clemente City Beach at El Portal St. Stairs			
			San Clemente City Beach at Mariposa St.			
			San Clemente City Beach at Linda Lane			
			San Clemente City Beach at South Linda Lane			

			San Clemente City Beach at Lifeguard Headquarters			
			Under San Clemente Municipal Pier			
			San Clemente City Beach at Trafalgar Canyon (Trafalgar Ln.)			
			San Clemente State Beach at Riviera Beach			
			San Clemente State Beach at Cypress Shores			
12	Prima Deshecha HSA (901.31)	Prima Deshecha Creek	lower portion	Phosphorus, Turbidity	lower 1 mile	2002
13	Segunda Deshecha HSA (901.32)	Segunda Deshecha Creek	lower portion	Phosphorus, Turbidity	lower 1 mile	2002
14	Lower Ysidora HSA (902.11)	Santa Margarita Lagoon		Eutrophic	1 acres	1998
15	De Luz HA (902.20)	Rainbow Creek	should be in 905.22 (lwr) and 905.23 (upper)	Nitrogen, Phosphorus	5 miles	1998
16	Gavilan HSA (902.22)	Santa Margarita River, Upper	upper portion	Phosphorus	17.5 miles	2002
17	Gavilan HSA (902.22)	Sandia Creek	lower 1.5 miles	Total Dissolved Solids	lower 1.5 mile	2002
18	Wolf HSA (902.52)	Murrieta Creek		Phosphorus	12 miles	2002
19	San Luis Rey HU (903.00)	Pacific Ocean Shoreline	at San Luis Rey River Mouth	Bacterial Indicators[E]	0.5 miles	1998
20	Mission HSA (903.11)	Lake Guajome		Eutrophic	33 acres	1998
21	Mission HSA (903.11)	San Luis Rey River	lower portion	Chloride	lower 13 miles	2002
				Total Dissolved Solids	lower 17 miles	2002
22	Loma Alta HA (904.10)	Pacific Ocean Shoreline	at Loma Alta Creek Mouth	Bacterial Indicators[E]	1.1 mile	1998
23	Loma Alta HA (904.10)	Loma Alta Slough		Bacterial Indicators[E]	8 acres	1998
				Eutrophic		
24	Buena Vista Creek HA (904.20)	Pacific Ocean Shoreline	at Buena Vista Creek	Bacterial Indicators[E]	1.2 miles	1998
			Carlsbad City Beach at Carlsbad Village Drive			
			Carlsbad State Beach at Pine Avenue			
25	El Salto HSA (904.21)	Buena Vista Lagoon		Bacterial Indicators[E]	202 acres	1998
				Sedimentation / Siltation	202 acres	1998
				Nutrients	150 acres	1998

26	Los Monos HSA (904.31)	Agua Hedionda Lagoon		Bacterial Indicators[E]	6.8 acres	1998
				Sedimentation / Siltation		
27	Los Monos HSA (904.31)	Agua Hedionda Creek	lower portion	Total Dissolved Solids	lower 7 miles	2002
28	San Marcos HA (904.50)	Pacific Ocean Shoreline	at Moonlight State Beach	Bacterial Indicators[E]	0.4 miles	1998
29	Escondido Creek HA (904.60)	Pacific Ocean Shoreline	at San Elijo Lagoon	Bacterial Indicators[E]	0.44 miles	1998
30	San Elijo HSA (904.61)	San Elijo Lagoon		Bacterial Indicators[E]	150 acres	1998
				Eutrophic	330 acres	
				Sedimentation / Siltation	150 acres	
31	San Dieguito HU (905.00)	Pacific Ocean Shoreline	at San Dieguito Lagoon Mouth	Bacterial Indicators[E]	0.86 miles	1998
32	Del Dios HSA (905.21 and 905.22)	Green Valley Creek		Sulfate	1 mile	2002
33	Del Dios HSA (905.21)	Hodges Reservoir	Entire Reservoir	Color	Entire Reservoir (1104 acres)	2002
				Nitrogen		
				Phosphorus		
				Total Dissolved Solids		
34	Felicita HSA (905.23)	Felicita Creek		Total Dissolved Solids	lower 0.92 miles	2002
35	Felicita HSA (905.23)	Kit Carson Creek	should in 905.21 HSA	Total Dissolved Solids	1 mile	2002
36	Highland HSA (905.32)	Cloverdale Creek		Phosphorus	1.2 miles	2002
				Total Dissolved Solids		
37	Sutherland HSA (905.53)	Sutherland Reservoir	Entire Reservoir	Color	Entire Reservoir	2002
38	Miramar Reservoir HA (906.10)	Los Penasquitos Lagoon	Entire Lagoon	Sedimentation / Siltation	469 acres	1998
39	Miramar Reservoir HA (906.10)	Pacific Ocean Shoreline	Torrey Pines State Beach at Del Mar (Anderson Canyon)	Bacterial Indicators[E]	0.4 miles	2002
40	Scripps HA (906.30)	Pacific Ocean Shoreline	La Jolla Shores Beach at El Paseo Grande	Bacterial Indicators[E]	3.9 miles	1998
			La Jolla Shores Beach at Caminito Del Oro			
			La Jolla Shores Beach at Vallecitos			
			La Jolla Shores Beach at Ave de la Playa			

			at Casa Beach, Children's Pool			
			South Casa Beach at Coast Blvd.			
			Whispering Sands Beach at Ravina St.			
			Windansea Beach at Vista de la Playa			
			Windansea Beach at Bonair St.			
			Windansea Beach at Playa del Norte			
			Windansea Beach at Palomar Ave.			
			at Tourmaline Surf Park			
			Pacific Beach at Grand Ave.			
41	Miramar HA (906.40)	Mission Bay Shoreline	along the entire bay	Bacterial Indicators[E]	1540 acres	1998
			Rose and Tecolote Creek Mouths[H]	Eutrophic	0.5 acre	1998
			Rose and Tecolote Creek Mouths[H]	Lead	0.5 acre	1998
42	Tecolote HA (906.50)	Tecolote Creek		Bacterial Indicators[E]	6.6 miles	1998
				Cadmium		
				Copper		
				Lead		
				Toxicity		
				Zinc		
43	Mission San Diego HSA (907.11)	Famosa Slough & Channel		Eutrophic	32 acres	1998
44	San Diego HU (907.11)	Pacific Ocean Shoreline	at San Diego River Mouth (aka Dog Beach)	Bacterial Indicators[E]	0.37 miles	1998
45	Santee HSA (907.12)	Forrester Creek		Fecal Coliform	lower 1 mile	2002
				pH	upper 3 miles	2002
				Total Dissolved Solids	lower 1 mile	2002
46	Mission San Diego HSA (907.11) & Santee HSA (907.12)	San Diego River, Lower		Fecal Coliform	lower 6 miles	2002
				Oxygen (dissolved)	lower 20 miles	2002
				Phosphorus		
				Total Dissolved Solids		
47	Chollas HSA (908.22)	Chollas Creek		Bacterial Indicators[E]	1.2 miles	1998
				Cadmium		
				Copper		
				Lead		
				Diazinon		
				Zinc		
48	Pueblo San Diego HU 908.00, Sweetwater HU	San Diego Bay Shoreline Point Loma HA	near Sub Base	Degraded Benthic Comm.	16 acres	1998

909.00 and Coronado HU (910.00)	(908.10)		Sediment Toxicity		
		in Shelter Island Yacht Basin	Copper (dissolved)	153 acres	1998
		at Shelter Island Shoreline Park	Bacterial Indicators[E]	0.4 miles	2002
	San Diego Bay Shoreline Lindbergh HSA (908.21)	vicinity of B Street and Broadway Piers [J]	Degraded Benthic Comm.	10 acres	1998
			Sediment Toxicity		
			Bacterial Indicators[E]	0.4 miles	1998
		Downtown Anchorage (near Grape St.)	Degraded Benthic Comm.	7.4 acres	1998
			Sediment Toxicity		
		at G Street	Bacterial Indicators[E]	0.4 miles	1998
	San Diego Bay Shoreline Chollas HSA (908.22)	near Coronado Bridge (includes area near Crosby Street Park)	Degraded Benthic Comm.	37 acres	1998
			Sediment Toxicity		
		near Chollas Creek	Degraded Benthic Comm.	15 acres	1998
			Sediment Toxicity		
		near Switzer Creek	Chlordane	See Footnote K	2002
			Lindane		
			PAHs		
		between Sampson and 28th Streets *Should be listed for Sed Tox and Benthic Community Effects	Copper	55 acres	2002
			Mercury		
			PAHs		
			PCBs		
			Zinc		
	San Diego Bay Shoreline El Toyan HSA (908.31)	at 32nd St. Naval Station	Degraded Benthic Comm.	103 acres	1998
			Sediment Toxicity		
	San Diego Bay Shoreline Paradise HSA (908.32)	at 7th St. Channel	Degraded Benthic Comm.	9 acres	1998
			Sediment Toxicity		
		at 24th St. Marine Terminal	Degraded Benthic Comm.	10 acres	1998
			Sediment Toxicity		

	San Diego Bay Shoreline Telegraph HSA (909.11&909.12)	at Chula Vista Marina	Bacterial Indicators[E]	0.4 miles	1998
	San Diego Bay Shoreline Coronado HA (910.10)	at Tidelands Park	Bacterial Indicators[E]	0.4 miles	2002
49 Tijuana HU (911.00) 911.11	Pacific Ocean Shoreline	from the border, extending north along the shore	Bacterial Indicators[E]	3.2 miles	1998
50 Tijuana HU (911.00) 911.41	Pine Valley Creek, Upper	lower portion	Enterococci	lower 2.9 miles	2002
51 San Ysidora HSA (911.11)	Tijuana River		Bacterial Indicators[E]	5.8 miles	1998
			Dissolved Oxygen, low		
			Eutrophic		
			Pesticides		
			Solids		
			Synthetic Organics		
			Trace Elements		
			Trash		
52 San Ysidora HSA (911.11)	Tijuana River Estuary		Bacterial Indicators[E]	150 acres	1998
			Eutrophic	1 acre	1998
			Lead		
			Nickel		
			Pesticides		
			Thallium		
			Trash		
			Oxygen (dissolved)	Entire Estuary	2002

[A] The 1998 List has been corrected as described in the text, pgs 17-18.

[B] The 1998 list, as adopted by the Regional Board, contained specific locations of impairment. These specific locations were omitted from the list as adopted by the USEPA. In 2002, it is recommended that these specific locations be included to better illustrate the location of impairment.

[C] In 1998, unless more information was available, the extent of impairment was assumed to be 0.1 miles for each shoreline impairment due to bacteria. The extents of impairment have been increased to 0.4 miles. Extents of impairment that were greater than 0.4 miles in 1998 were not changed. Rationale is described in Appendix B, pgs B69-

[D] This location was previously listed as "Pacific Ocean, Laguna Beach HSA"

[E] In 1998, Bacterial Indicators implies that impairment was due to either total coliform, fecal coliform, or both. In 2002, impairment may have also been caused by enterococci.

[F] The entire reach (7.2 miles) is listed for enterococci, *E. coli*, fecal coliform and toxicity. Additionally, Aliso Hills Channel, English Canyon Creek, Dairy Fork Creek, Sulphur Creek and Wood Canyon Creek are also listed for enterococci and *E. coli*. The lower 4 miles of Aliso Creek is listed for phosphorus.

[H] These locations and extents of impairment are approximated from interpretation of the 1996 Section 303(d) Report.

[J] This location was previously known as "San Diego Bay, at Downtown Piers."

[K] Area at the end of Switzer Creek, bound by piers on the north and south side of the outlet, extending to the edge of the piers.