

Final Functional Equivalent Document

Consolidated Toxic Hot Spots Cleanup Plan



June 1999

New Series No. 7
Division of Water Quality

STATE WATER RESOURCES CONTROL BOARD
CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

STATE WATER RESOURCES CONTROL BOARD

FINAL FUNCTIONAL EQUIVALENT DOCUMENT

CONSOLIDATED TOXIC HOT SPOTS CLEANUP PLAN

June 1999

STATE WATER RESOURCES CONTROL BOARD
RESOLUTION NO. 99 - 065

ADOPTION OF THE
CONSOLIDATED TOXIC HOT SPOTS CLEANUP PLAN

WHEREAS:

1. The Bay Protection and Toxic Cleanup Program (BPTCP) was established by the State Water Resources Control Board (SWRCB) to implement the requirements of Section 13390 et seq. of the Water Code.
2. Water Code Section 13394 requires the SWRCB and the Regional Water Quality Control Boards (RWQCBs) to develop a Consolidated Toxic Hot Spots Cleanup Plan (Consolidated Cleanup Plan).
3. The SWRCB adopted a Water Quality Control Policy for Guidance on the Development of Regional Toxic Hot Spot Cleanup Plans (Guidance Policy) to be used by the RWQCBs in preparing their cleanup plans.
4. Each of the seven coastal Regional Water Quality Control Boards (RWQCBs) used the Guidance Policy in the development of their Regional Toxic Hot Spots Cleanup Plans and has submitted the Plans to the SWRCB.
5. The SWRCB has consolidated the Regional Toxic Hot Spots Cleanup Plans into a Consolidated Cleanup Plan.
6. The SWRCB prepared and circulated a draft Functional Equivalent Document (FED) supporting the proposed Consolidated Cleanup Plan in accordance with provisions of the California Environmental Quality Act and Title 14, California Code of Regulations Section 15251(g).
7. In compliance with Water Code Section 13147, the SWRCB held a public hearing in Sacramento, California, on June 3, 1999 on the Consolidated Cleanup Plan and has carefully considered all testimony and comments received.
8. The SWRCB staff determined that the adoption of the proposed Consolidated Cleanup Plan will not have a significant adverse effect on the environment.
9. The SWRCB staff has prepared a final FED that includes the revised proposed Consolidated Cleanup Plan and has responded to the comments received.

10. The SWRCB consulted with the Department of Fish and Game (DFG) on the potential impacts of the amendments on fish and wildlife resources, including threatened and endangered species. DFG did not find that the Consolidated Cleanup Plan will jeopardize the continued existence of any endangered or threatened species, or result in the destruction or adverse modification of habitat essential to the continued existence of the species.
11. The SWRCB completed a scientific peer review of the draft FED as required by Section 57004 of the Health and Safety Code.
12. As directed at the June 3, 1999 public hearing, SWRCB staff met with representatives of the RWQCBs, DFG and interested parties to discuss specific comments and concerns, and has made minor revisions to the Consolidated Cleanup Plan accordingly.
13. The regulatory provisions of the Water Quality Control Policy do not become effective until the regulatory provisions are approved by the Office of Administrative Law (OAL).

THEREFORE BE IT RESOLVED THAT:

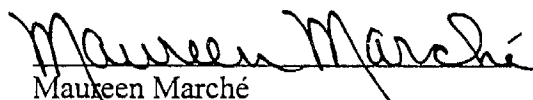
The SWRCB:

1. Approves the Final Functional Equivalent Document: Consolidated Toxic Hot Spots Cleanup Plan.
2. Adopts the Consolidated Toxic Hot Spots Cleanup Plan.
3. Approves the Central Valley RWQCB's request for a variance from the provision of the Guidance Policy in order to address pesticide regulation under the Clean Water Act Section 303(d) Total Maximum Daily Load (TMDL) process. The RWQCB shall report to the SWRCB annually on progress toward completing the TMDLs.
4. Directs the RWQCBs to consult with DFG on compliance with the California Endangered Species Act during the implementation of the Consolidated Cleanup Plan.

5. Authorizes the Executive Director, or his designee, to submit the Consolidated Cleanup Plan to the California Legislature by June 30, 1999 in compliance with Section 13394 of the California Water Code.
6. Authorizes the Executive Director, or his designee, to submit the regulatory provisions of the Consolidated Cleanup Plan to OAL for its approval.

CERTIFICATION

The undersigned, Administrative Assistant to the Board, does hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a meeting of the State Water Resources Control Board held on June 17, 1999.


Maureen Marché
Administrative Assistant to the Board

PREFACE

The State Water Resources Control Board (SWRCB) is required by the California Water Code to develop a Statewide Consolidated Toxic Hot Spots Cleanup Plan by June 30, 1999.

This report is the environmental document supporting the development of the Consolidated Toxic Hot Spots Cleanup Plan (Consolidated Cleanup Plan). This draft Functional Equivalent Document (FED) explores various alternatives, provides options and recommendations, and evaluates the environmental impacts of the Plan.

The Consolidated Cleanup Plan provides a listing of known toxic hot spots in California enclosed bays, estuaries and coastal waters. The Plan also lists actions to address these toxic hot spots, costs of remediation, benefits of remediation and provides findings on funding to implement the Plan. The SWRCB held a public hearing on June 3, 1999 on the draft FED.

This document has three parts: (1) the final FED, (2) Volume I of the proposed Consolidated Cleanup Plan (which contains the consolidated list of toxic hot spots, policy statements and findings), and (3) Volume II of the proposed Consolidated Cleanup Plan (which contains each of the Regional Toxic Hot Spots Cleanup Plans). Volumes I and II of the final Consolidated Cleanup Plan are presented in Appendices A and B, respectively.

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LISTS AND FINDINGS

APPENDIX B: FINAL CONSOLIDATED TOXIC HOT SPOTS CLEANUP PLAN, VOLUME II: REGIONAL CLEANUP PLANS

LIST OF ABBREVIATIONS

ACL	Administrative Civil Liability
AMBAG	Association of Monterey Bay Area Governments
APA	Administrative Procedure Act
BAT	Best available technology economically achievable
BCT	Best conventional pollutant control technology
BIOS	Biologically Integrated Orchard System
BIPS	Biologically Integrated Prune System
BMP	Best management practice
BOD	Biochemical oxygen demand
BPTCP	Bay Protection and Toxic Cleanup Program
CAD	Confined aquatic disposal
CalEPA	California Environmental Protection Agency
CBOD	Carbonaceous biochemical oxygen demand
CCMVCD	Contra Costa Mosquito Vector Control District
CCR	California Code of Regulations
CCSF	City and County of San Francisco
CDF	Confined disposal facility
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CSO	Combined sewer overflow
CWA	Clean Water Act (federal)
cy	cubic yard
CZARA	Coastal Zone Act Reauthorization Amendments
DDT	dichlorodiphenyltrichloroethane
DDE	dichlorodiphenyldichloroethylene
DERP	Defense Environmental Response Program
DFG	Department of Fish and Game
DHS	Department of Health Services
DPR	Department of Pesticide Regulation
DTSC	Department of Toxic Substance Control
EE/CA	Engineering evaluation/cost analysis
EIR	Environmental Impact Report
EPA	U.S. Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
ERL	Effects Range Low
ERM	Effects Range Median
EROD	Ethoxyresorufin O-deethylase
FDA	U.S. Food and Drug Administration

FED	Functional Equivalent Document
FEMA	Federal Emergency Management Agency
FS	Feasibility study
gpd	gallons per day
IR	Installation restoration
kg	kilogram(s)
LACSD	Los Angeles County Sanitation District
LRCS	Leachate removal and containment system
LTMS	Long-Term Management Strategy
MAA	Management Agency Agreement
MEP	Maximum extent practicable
MGD	million gallons per day
mg/kg	milligrams per kilogram (parts per million)
mg/l	milligrams per liter (parts per million)
MOCOCO	Mountain Copper Company
MOU	Memorandum of Understanding
MSD	Minimum significant difference
MS4	Municipal separate storm sewer system
NAS	National Academy of Sciences
NEPA	National Environmental Policy Act
ng/l	nanograms per liter (parts per trillion)
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
NRCS	Natural Resources Conservation Service
OAL	Office of Administrative Law
OEHHA	Office of Environmental Health Hazard Assessment
PAH	Polynuclear Aromatic Hydrocarbon
PCA	Pest control advisor
PCB	Polychlorinated biphenyl
PEP	Process effluent purification
PMP	Pesticide Management Plan
POTW	Publically owned treatment works
PRMP	Pilot Regional monitoring program
PY	Personnel year
RAP	Remedial action workplan
RBI	Relative benthic index
RCD	Resource Conservation District
RMP	Regional monitoring program
RWCF	Regional Wastewater Control Facility
RWQCB	Regional Water Quality Control Board
SAP	Sampling and Analysis Plan
SFEI	San Francisco Estuary Institute

SMBRP	Santa Monica Bay Restoration Project
SMW	State Mussel Watch
SOD	Sediment oxygen demand
SRF	State Revolving Fund
SWPPP	Storm water pollution prevention plan
SWRCB	State Water Resources Control Board
TBD	to be determined
THS	Toxic Hot Spot
TIE	Toxicity identification evaluation
TMDL	Total Maximum Daily Load
TSS	Total suspended solids
UPC	Urban Pesticide Committee
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WDR	Waste Discharge Requirement
WMI	Watershed Management Initiative

FINAL FUNCTIONAL EQUIVALENT DOCUMENT
CONSOLIDATED TOXIC HOT SPOTS CLEANUP PLAN

INTRODUCTION

In 1989, the California State Legislature established the Bay Protection and Toxic Cleanup Program (BPTCP). The BPTCP has four major goals: (1) to provide protection of present and future beneficial uses of the bays and estuarine waters of California; (2) identify and characterize toxic hot spots; (3) plan for toxic hot spot cleanup or other remedial or mitigation actions; (4) develop prevention and control strategies for toxic pollutants that will prevent creation of new toxic hot spots or the perpetuation of existing toxic hot spots in the bays and estuaries of the State. Among other things, the BPTCP is required to develop Statewide and Regional Toxic Hot Spots Cleanup Plans and site ranking criteria.

The State Water Resources Control Board (SWRCB) and the Regional Water Quality Control Boards (RWQCBs) have used a three phase process for adoption of the Regional and Consolidated Toxic Hot Spots Cleanup Plans. The three phases are:

1. The SWRCB adopted a policy outlining the toxic hot spot definition, ranking criteria and other factors needed for the consistent development of the BPTCP cleanup plans.

The SWRCB developed formal guidance on the development of toxic hot spot cleanup plans. This document is a Water Quality Control Policy (California Water Code Section 13140, 13142) that contains a specific definition of a toxic hot spot, ranking criteria to assist the SWRCB and the RWQCBs in establishing priorities for addressing toxic hot spots in the plans, and other measures necessary to facilitate the plans' completion. The Policy was accompanied by a functional equivalent document (FED) to help with California Environmental Quality Act (CEQA) and Administrative Procedure Act (APA) compliance and to provide technical justification to withstand peer review (as required by law).

The SWRCB used the procedures for adopting and revising Water Quality Control Plans. The Policy and FED were

adopted by the SWRCB on September 2, 1998. OAL approved the regulatory provisions of the Policy on November 9, 1998.

2. The RWQCBs adopted the Regional Toxic Hot Spots Cleanup Plans (Regional Cleanup Plans).

Each RWQCB first developed proposed Regional Toxic Hot Spots Cleanup Plans in 1997 (RWQCB, 1997a; 1997b; 1997c; 1997d; 1997e; 1997f; 1997g). Subsequent to approval of the Guidance Policy the RWQCBs redeveloped their Cleanup Plans. Each RWQCB has held at least one public hearing or workshop on the revised Regional Cleanup Plan.

The North Coast, Central Coast, Central Valley, Santa Ana and San Diego RWQCBs adopted their Regional Cleanup Plans using the normal procedures for RWQCB action (i.e., the public was given an opportunity to comment on the draft plan, the plan was revised in response to the comments received, and the plan was adopted by the RWQCB).

The San Francisco Bay and Los Angeles RWQCBs did not adopt their Regional Cleanup Plans because they did not have the required number of Board Members to convene a meeting and adopt their cleanup plans. The Executive Officers of these RWQCBs submitted their cleanup plans to the SWRCB after RWQCB public hearings or workshops.

3. The SWRCB will compile and adopt the Consolidated Toxic Hot Spots Cleanup Plan (Consolidated Cleanup Plan).

The SWRCB is now undertaking completion of this phase. The Consolidated Cleanup Plan consists of the consolidated list of toxic hot spots as well as the Water Code-mandated requirements for addressing the toxic hot spots. The SWRCB is required to make specific findings in the Statewide plan (Water Code Section 13394; SWRCB, 1998a).

The SWRCB used the same procedures used for adoption of the Policy in Phase 1 for adoption of the Consolidated Cleanup Plan. The Consolidated Cleanup Plan will be submitted to the Legislature before the regulatory provisions of the Plan are submitted to OAL.

Purpose

The purpose of this Functional Equivalent Document (FED) is to present (1) alternative approaches for developing provisions of the Consolidated Plan, (2) SWRCB staff recommendations for the development of the Consolidated Plan, and (3) an assessment of the potential adverse environmental impacts of the recommended Plan. The topics addressed in the FED include: approaches for consolidating and compiling the Regional Cleanup Plans, remediation of known toxic hot spots, removing locations from the list of known toxic hot spots, guidance on waste discharge requirement reevaluation, and mechanisms to fund implementation of the consolidated plan.

This FED does not address issues related to the definition of a toxic hot spot, site ranking criteria and other issues addressed in the guidance policy (SWRCB, 1998a; 1998b). These issues were addressed in the adoption process for the Policy and were used as the foundation for the development of the Regional and Consolidated Cleanup Plans.

Necessity for the Regulatory Provisions of the Consolidated Toxic Hot Spots Cleanup Plan

The SWRCB and the RWQCBs are required to (1) identify and characterize toxic hot spots, (2) plan for the cleanup or other appropriate remedial or mitigating actions at sites, and (3) amend plans and policies to incorporate strategies to prevent the creation of new toxic hot spots and the further pollution of existing toxic hot spots (California Water Code Section 13392). The SWRCB is required to adopt a statewide Consolidated Cleanup Plan (Water Code Section 13394). The Consolidated Cleanup Plan must include: (1) a priority listing of all known toxic hot spots covered by the Plan; (2) a description of each toxic hot spot including a characterization of the pollutants present at the site; (3) an assessment of the most likely source or sources of pollutants; (4) an estimate of the total costs to implement the Cleanup Plan; (5) an estimate of the costs that can be recovered from parties responsible for the discharge of pollutants that have accumulated in sediments; (6) a preliminary assessment of the actions required to remedy or restore a toxic hot spot; (7) a two-year expenditure schedule identifying State funds needed to implement the plan; and (8) findings and recommendations concerning the need for establishment of a toxic hot spots cleanup program.

The regulatory provisions of the Consolidated Cleanup Plan are required to comply with California Water Code Sections 13392 and 13394).

CEQA Compliance

The SWRCB must comply with the requirements of CEQA and the APA when adopting a plan, policy or guideline. CEQA provides that a program of a State regulatory agency is exempt from the requirements for preparing Environmental Impact Reports (EIRs), Negative Declarations, and Initial Studies if certain conditions are met. The process the SWRCB is using to develop the Consolidated Cleanup Plan has received certification from the Resources Agency to be "functionally equivalent" to the CEQA process [Title 14 California Code of Regulations Section 15251(g)]. Therefore, this FED fulfills the requirements of CEQA for preparation of an environmental document.

Agencies qualifying for this exemption must comply with CEQA's goals and policies, evaluate environmental impacts, consider cumulative impacts, consult with other agencies with jurisdiction by law, provide public notice and allow public review, respond to comments on the draft environmental document, adopt CEQA findings, and provide for monitoring of mitigation measures. SWRCB regulations (California Code of Regulations [CCR], Title 23, Chapter 27, Section 3777) require that a document prepared under its certified regulatory programs must include:

1. A brief description of the proposed activity;
2. Reasonable alternatives to the proposed activity; and
3. Mitigation measures to minimize any significant adverse environmental impacts of the proposed activity.

This FED is very similar to the "program" environmental approach that is described in Title 14 CCR (CEQA Guidelines) Section 15168. That section provides that a program environmental impact report "may be prepared on a series of actions that can be characterized as one large project and are related ... (3) In connection with the issuance of rules, regulations, plans, or other general criteria to govern the conduct of a continuing program, or (4) As individual activities carried out under the same authorizing statutory or regulatory authority and having generally similar environmental effects which can be

mitigated in similar ways.” This “program” approach has enabled the SWRCB staff to examine typical effects of remediation and outline mitigation that may be used to lessen or avoid adverse effects.

However, it should be noted that this FED differs from the typical “program” environmental document approach in that it is not intended to provide CEQA compliance for the individual, site-specific remediation projects. Appropriate CEQA compliance is required when site-specific remediation plans are developed.

The environmental impacts that may occur as a result of the remediation alternatives identified in the proposed Consolidated Plan are summarized in an Environmental Checklist and analyzed in the Environmental Impacts section of the FED.

Background

California Water Code, Division 7, Chapter 5.6 established a comprehensive program within the SWRCB to protect the existing and future beneficial uses of California's enclosed bays and estuaries. SB 475 (1989), SB 1845 (1990), AB 41 (1989) and SB 1084 (1993) added Chapter 5.6 [Bay Protection and Toxic Cleanup (Water Code Sections 13390-13396.5)] to Division 7 of the Water Code.

The BPTCP has provided a new focus on the SWRCB and the RWQCBs efforts to control pollution of the State's bays and estuaries by establishing a program to identify toxic hot spots and plan for their cleanup.

Program Activities

The BPTCP is a comprehensive effort by the SWRCB and RWQCBs to programmatically link standards development, environmental monitoring, water quality control planning, and site cleanup planning. The Program includes six primary activities:

1. Development and amendment of the California Enclosed Bays and Estuaries Plan. This plan should contain the State's water quality objectives for enclosed bays and estuaries, and implementation measures for these objectives.
2. Development and implementation of regional monitoring programs designed to identify toxic hot spots. These monitoring programs include analysis for a variety of

chemicals, toxicity tests, measurements of biological communities, and various special studies to support the Program.

3. Development of a consolidated database that contains information pertinent to describing and managing toxic hot spots.
4. Development of narrative and numeric sediment quality objectives for the protection of California enclosed bays and estuaries.
5. Preparation of criteria to rank toxic hot spots that are based on the severity of water and sediment quality impacts.
6. Development of Regional and Statewide Consolidated Cleanup Plans that include identification and priority ranking of toxic hot spots, identification of pollutant sources, identification of actions already initiated, strategies for preventing formation of new toxic hot spots, and cost estimates for recommended remedial actions.

Toxic Hot Spot Identification

The Water Code defines toxic hot spots as locations in enclosed bays, estuaries, or the ocean where pollutants have accumulated in the water or sediment to levels which (1) may pose a hazard to aquatic life, wildlife, fisheries, or human health, or (2) may impact beneficial uses, or (3) exceed SWRCB or RWQCB-adopted water quality or sediment quality objectives.

To identify toxic hot spots, water bodies of interest have been assessed on both a regional and site-specific basis. Regional assessments require evaluating whether water quality objectives are attained and beneficial uses are supported throughout the water body. In the past, the State Mussel Watch program, independent RWQCB studies, and other studies were used extensively to evaluate beneficial use impacts in many California enclosed bays and estuaries. The BPTCP efforts continue this work by focusing on measures of effects (such as toxicity) with the associated pollutants.

Generally, where sites were not well characterized, regional monitoring programs have been implemented. This monitoring activity has been performed by the Department of Fish and Game

(DFG) under contract with the SWRCB. The consolidated statewide database required by the Water Code was planned to eventually include all data generated by the regional monitoring programs. All data collected as part of the BPTCP monitoring efforts are available on the BPTCP web page. The web page address is: <http://www.swrcb.ca.gov/bptcp/bptcp.html>.

A specific definition of candidate and known toxic hot spots was adopted by the SWRCB in September, 1998 (SWRCB, 1998a). This specific definition has been used by the RWQCBs in developing their lists of candidate toxic hot spots.

Ranking Criteria

The Water Code (Section 13393.5) requires the SWRCB to develop criteria for ranking toxic hot spots. The ranking criteria must consider the pertinent factors relating to public health and environmental quality. The factors include three considerations: (1) potential hazards to public health, (2) toxic hazards to fish, shellfish, and wildlife, and (3) the extent to which the deferral of a remedial action will result, or is likely to result, in a significant increase in environmental damage, health risks, or cleanup costs.

Ranking criteria were adopted by the SWRCB in September, 1998 (SWRCB, 1998a). These ranking criteria have been used by the RWQCBs in ranking their lists of candidate toxic hot spots.

Sediment Quality Objectives

State law defines sediment quality objectives as "that level of a constituent in sediment which is established with an adequate margin of safety, for the reasonable protection of beneficial uses of water or prevention of nuisances" (Water Code Section 13391.5). Water Code Section 13393 further defines sediment quality objectives as: "...objectives...based on scientific information, including but not limited to chemical monitoring, bioassays or established modeling procedures." The Water Code requires "adequate protection for the most sensitive aquatic organisms." Sediment quality objectives can be either numerical values based on scientifically defensible methods or narrative descriptions implemented through toxicity testing or other methods.

Toxic Hot Spot Cleanup Plans

The Water Code requires that each RWQCB must complete a toxic hot spots cleanup plan and the SWRCB must prepare a Statewide Consolidated Cleanup Plan.

Each cleanup plan must include: (1) a priority listing of all known toxic hot spots covered by the plan; (2) a description of each toxic hot spot including a characterization of the pollutants present at the site; (3) an assessment of the most likely source or sources of pollutants; (4) an estimate of the total costs to implement the cleanup plan; (5) an estimate of the costs that can be recovered from parties responsible for the discharge of pollutants that have accumulated in sediments; (6) a preliminary assessment of the actions required to remedy or restore a toxic hot spot; and (7) a two-year expenditure schedule identifying State funds needed to implement the plan.

Within 120 days from the ranking of a toxic hot spot in the consolidated cleanup plan, each RWQCB is required to begin reevaluating waste discharge requirements for dischargers who have contributed any or all of the pollutants which have caused the toxic hot spot. These reevaluations shall be used to revise water quality control plans wherever necessary. Reevaluations shall be initiated according to the priority ranking established in cleanup plans.

The RWQCBs first developed proposed Regional Toxic Hot Spots Cleanup Plans in late 1997. These plans were revised subsequent to the adoption of the SWRCB Guidance Policy (SWRCB, 1998a).

Program Organization

Three groups support or review the activities of the BPTCP: (1) the Monitoring and Surveillance Task Force, (2) the Scientific Planning and Review Committee, and (3) the BPTCP Advisory Committee. The functions of each of these groups follow:

1. *Monitoring and Surveillance Task Force (MSTF)*. This committee was established to promote standard approaches for monitoring and assessing the quality of California's enclosed bays and estuaries [Section 13392.5(a)(1) of the Water Code]. While the primary focus of this committee has been on monitoring implementation, the committee has also developed and contributed to all other aspects of the Program including cleanup planning and ranking criteria development. The members of the task force are staff of the SWRCB, coastal RWQCBs, DFG and the Office of Environmental Health Hazard Assessment (OEHHA).

2. *Scientific Planning and Review Committee (SPARC)*. Although not legislatively mandated, SPARC brings together independent experts in the fields of toxicology, benthic ecology, organic and inorganic chemistry, program implementation and direction, experimental design, and statistics to review the approaches taken by the BPTCP. The committee has provided comments on the Program's monitoring approach(es), given input on the scientific merit of the approach(es) taken, and provided suggestions for monitoring improvement.

3. *BPTCP Advisory Committee*. This committee was established to assist the SWRCB in the implementation of the BPTCP (Section 13394.6(a) of the Water Code). The major purpose of the committee is to review the Program activities and provide its views on how the products of the BPTCP should be interpreted and used. The committee has members from (a) trade associations; (b) dischargers; and (c) environmental, public interest, public health and wildlife conservation organizations.

Legislative Deadlines

The BPTCP is required to complete several tasks using deadlines established in the Water Code (Table 1).

TABLE 1: WATER CODE-MANDATED DEADLINES FOR THE BPTCP

Activities	Deadline
Sediment Quality Objectives Workplan	July 1, 1991
Consolidated Database	January 30, 1994
Ranking Criteria	January 30, 1994
Progress Report	January 1, 1996
Regional Toxic Hot Spots Cleanup Plans	January 1, 1998
Consolidated Toxic Hot Spots Cleanup Plan	June 30, 1999

Scope of FED

The FED was developed with the consideration of: (1) existing State statute, regulations, and policies; (2) the Water Quality Control Policy for Development of Regional Toxic Hot Spots Cleanup Plans (SWRCB, 1998a); (3) revised Regional Toxic Hot Spots Cleanup Plans; and (4) the recommendations of the BPTCP Advisory Committee.

The final FED contains ten major sections: Introduction, Project Description, Policy Issue Analysis, Environmental Setting at Toxic Hot Spots, Proposed Remediation Alternatives at Toxic Hot Spots, Environmental Benefits of the proposed Plan, Adverse Environmental Effects of the Proposed Plan, Environmental Checklist, Comments and Responses, and References. Policy issues are considered separately from the remediation alternatives and the potential environmental impacts of implementing the remediation.

This FED is a program environmental document that is more specific than the FED developed for the SWRCB Guidance Policy (SWRCB 1998b). The FED for the Consolidated Toxic Hot Spots Cleanup Plan addresses: (1) broad policy issues that address Statewide concerns about the remediation and prevention of toxic hot spots, and (2) the remediation alternatives at specific sites or water bodies that have been identified by the RWQCBs as candidate toxic hot spots. While the Consolidated Plan presents options for the remediation of toxic hot spots, no specific funding has been identified to fully implement the Plan. Also, since the SWRCB and RWQCBs are prevented from prescribing means of compliance (Water Code Section 13360), the specific actions that will be implemented will be developed when sites are actually remediated.

PROJECT DESCRIPTION

Project Definition

The project is a Consolidated Toxic Hot Spots Cleanup Plan adopted as Policy for Water Quality Control (pursuant to Water Code Section 13140). The Consolidated Cleanup Plan includes provisions for:

1. The toxic hot spot definition and ranking criteria adopted by the SWRCB in September, 1998 and approved by OAL in November, 1998 (SWRCB, 1998a).
2. A consolidated list of ranked known toxic hot spots.
3. A process for delisting sites.
4. Guidance to the RWQCBs on revision of WDRs associated with toxic hot spots.
5. Funding mechanisms to implement the Consolidated Plan.
6. Policy on the prevention of toxic hot spots.
7. Findings on the need for a Program to implement the Consolidated Plan.
8. Each Regional Toxic Hot Spots Cleanup Plan submitted by the RWQCBs (Parts II and III) as approved by the SWRCB.

The proposed Consolidated Cleanup Plan addresses remediation at several toxic hot spots in the enclosed bays, estuaries and ocean waters of California in Regions 1, 2, 3, 4, 5, 8, and 9. The Plan is applicable to these water bodies. Figure 1 is a map of these areas. The prevention provisions of the Plan are also applicable to all watersheds that drain to enclosed bays, estuaries and coastal waters of the State. The Consolidated Cleanup Plan identifies 22 high priority, 20 moderate priority, and 6 low priority known toxic hot spots.

Statement Of Goals

The SWRCB's objectives for this project are to:

1. Comply with the Water Code-mandated requirement to submit a Consolidated Toxic Hot Spots Cleanup Plan to the California Legislature.
2. Provide approaches to address the identified pollution problems at high priority known toxic hot spots.
3. Provide policy to prevent the further pollution or creation of toxic hot spots in the enclosed bays, estuaries and coastal waters of the State.
4. Provide the RWQCBs with an approved Plan to attain the highest water quality that is reasonable and protect the quality of the most polluted coastal waters in the State from further degradation.

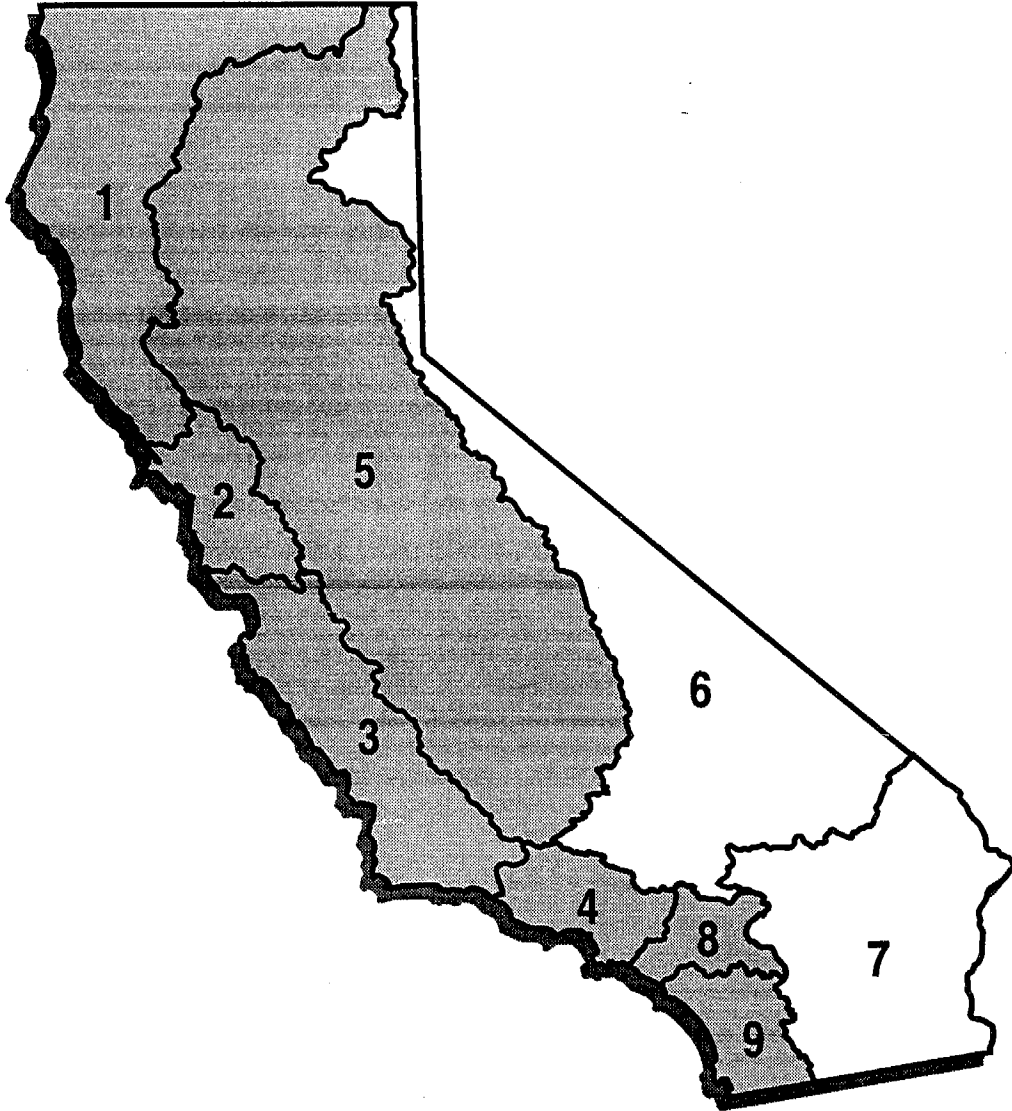


FIGURE 1: AREA THAT THE CONSOLIDATED CLEANUP PLAN IS APPLICABLE.

Proposed Action

The proposed action is SWRCB adoption of the proposed Consolidated Cleanup Plan as Policy for Water Quality Control outlined in the Project Definition (above).

The proposed Consolidated Cleanup Plan is being developed as a part of a phased approach. (This phased approach and components of the Consolidated Cleanup Plan are also explained in the Introduction to this FED.) Phase 1 was the adoption of a Water Quality Control Policy for Guidance on Development of Regional Toxic Hot Spot Cleanup Plans. Phase 1 was completed in November 1998.

In Phase 2, the RWQCBs developed; considered at public hearings and workshops; and five RWQCBs adopted Regional Cleanup Plans pursuant to the Guidance Policy. The remaining two RWQCBs did not adopt the Cleanup Plans due to a lack of quorum.

Phase 3 is the development of the Consolidated Cleanup Plan by the SWRCB. The SWRCB has compiled the regional cleanup plans, made additional findings as required by the California Water Code and plans to submit the Consolidated Cleanup Plan to the California Legislature. The SWRCB has complied with CEQA and the APA in developing the Consolidated Cleanup Plan.

Under Phase 3, the SWRCB will issue the Consolidated Cleanup Plan that specifically identifies known toxic hot spots and presents actions that can be implemented to remediate the sites.

POLICY ISSUE ANALYSIS

The staff analysis of each policy issue addressed during the development of the Consolidated Cleanup Plan is formatted consistently to provide the SWRCB with a summary of the topic or issue as well as alternatives for their action. The proposed Consolidated Cleanup Plan is presented in Appendices A and B.

Each issue analysis contains the following sections:

- Issue:** A brief description of the issue or topic.
- Present Policy:** A summary of any existing SWRCB policy related to the issue or topic.
- Issue Description:** A more complete description of the issue or topic plus (if appropriate) any additional background information, list of limitations and assumptions, and descriptions of related programs.
- Alternatives:** For each issue or topic, at least two alternatives are provided for SWRCB consideration.
- Staff Recommendation:** In this section, a suggestion is made for which alternative (or combination of alternatives) should be adopted by the SWRCB.

Issue 1: Authority and Reference for the Consolidated Toxic Hot Spots Cleanup Plan

Present Policy: None.

Issue Description: The Regional Cleanup Plans have been developed by the RWQCBs using the Water Quality Control Policy for Guidance on the Development of Regional Toxic Hot Spot Cleanup Plans (SWRCB, 1998a). As required by the California Water Code, the Consolidated Cleanup Plan is a compilation of the Regional Cleanup Plans with additional findings regarding the need for a cleanup program.

In creating the BPTCP, the California Legislature intended that a plan be prepared for remedial action at toxic hot spots (Water Code Section 13390) and required the development of cleanup plans that are distinct from Water Quality Control Plans (Chapter 5.6 requires the formulation of a water quality control plan for enclosed bays and estuaries (Section 13391) and toxic hot spot cleanup plans (Section 13394)). The Water Code further states (Section 13392) that the SWRCB and RWQCBs shall “...(1) identify and characterize toxic hot spots..., (2) plan for the cleanup or other appropriate remedial action at the sites, and (3) amend water quality control plans and policies to incorporate strategies to prevent the creation of new toxic hot spots and the further pollution of existing hot spots.”

If implementation of the Consolidated Cleanup Plan is mandatory, then the SWRCB must adopt the Consolidated Plan (e.g., as a plan, policy or guideline) in accordance with the requirements of CEQA and the APA.

The SWRCB should consider the format and form of the Consolidated Cleanup Plan.

Alternatives: 1. The SWRCB should consider incorporating the Consolidated Toxic Hot Spots Cleanup Plan into a Statewide Water Quality Control Plan.

The SWRCB is required to adopt a Water Quality Control Plan for the Enclosed Bays and Estuaries of California (Water Code Section 13391). This plan was first adopted in 1991 and was subsequently amended in 1992. The Plan contained requirements for beneficial use designations, water quality objectives, guidance

on development of site-specific water quality objectives, a program of implementation, and other regulatory provisions.

In 1994, the EBE Plan was nullified by the California Superior Court. The SWRCB is currently developing the Enclosed Bays and Estuaries Plan in two phases. The first phase is for the SWRCB to adopt a Policy for the Implementation of the California Toxics Rule (SWRCB, 1997b). Even though the Plan could be modified to contain the Consolidated Cleanup Plan, the EBE Plan redevelopment schedule would not allow the BPTCP to meet the Water Code-mandated deadline for adoption of the Statewide consolidated cleanup plan. This alternative is not appropriate because the California Water Code calls for a separate plan distinct from Water Quality Control Plans.

2. The SWRCB should consider adoption of the Consolidated Toxic Hot Spots Cleanup Plan as policy for water quality control. The SWRCB should adopt language that identifies the statutory authority to adopt a Policy and where the Policy applies.

The SWRCB has the authority to adopt Policy for Water Quality Control (Sections 13140 and 13142 of the Water Code).

Section 13142 states, in part:

"State policy for water quality control shall consist of all or any of the following: (a) Water quality principles and guidelines for long-range planning, including ground water or surface water management programs and control and use of reclaimed water. (b) Water quality at key locations for planning...and for water quality control activities. (c) Other principles deemed essential by the state board for water quality control...."

Development of the Consolidated Toxic Hot Spots Cleanup Plan as policy for water quality control would allow the SWRCB and the RWQCBs to meet the requirements of the Water Code for development of remediation plans (Sections 13392 and 13394). A policy will allow the SWRCB to influence prevention of toxic hot spots because Basin Plans must conform to State policy for water quality control (Water Code Section 13240).

3. The SWRCB should not adopt the Consolidated Toxic Hot Spots Cleanup Plan as a policy for water quality control.

A Consolidated Toxic Hot Spots Cleanup Plan has never been developed for the State and possibly new procedures for adoption would be needed. This alternative would not relieve the SWRCB from the requirements of the California Environmental Quality Act or the Administrative Procedure Act.

Staff Recommendation: Adopt Alternative 2.

Please refer to the Policy for Water Quality Control section of the proposed Consolidated Toxic Hot Spots Cleanup Plan for the authority and reference for development of the Consolidated Plan as policy for water quality control.

Issue 2: *Organization of the Consolidated Toxic Hot Spots Cleanup Plan*

Present Policy: The SWRCB adopted a specific format for the Regional Toxic Hot Spots Cleanup Plans, a definition for toxic hot spots and the site ranking criteria in the Water Quality Control Policy for Guidance on Development of the Regional Toxic Hot Spots Cleanup Plans (SWRCB 1998a).

Issue Description: After adoption of the Guidance Policy the coastal RWQCBs used the policy as the foundation to finalize the Regional Toxic Hot Spots Cleanup Plans (Regional Cleanup Plans). Each RWQCB used the same format, definitions and ranking criteria to develop their cleanup plans.

Following the required format, each Regional Cleanup Plan contains the specific definition of a toxic hot spot and the ranking criteria. To avoid duplication, should the SWRCB remove the definition and ranking criteria from the regional plans and place it in the Consolidated Toxic Hot Spots Cleanup Plan? Also, should the lists of “Areas of Concern” remain in the Consolidated Cleanup Plan?

Alternatives: 1. Remove the specific definition of a toxic hot spot and ranking criteria from each Regional Cleanup Plan and place the definition and criteria in the Consolidated Cleanup Plan. List the “areas of concern” at the end of the Regional Plans.

The specific definition of a toxic hot spot and the ranking criteria are listed in each Regional Cleanup Plan. If complete Regional Plans are consolidated then there would be significant duplication of the definition and ranking criteria. Listing the definition and ranking criteria one time would be concise and nonduplicative.

At present, most of the Regional Cleanup Plans list “areas of concern” before the candidate toxic hot spot lists (as required by the Guidance Policy (SWRCB, 1998a)). It now seems more efficient and clear if the areas of concern are listed at the end of each regional cleanup plan.

2. Consolidate the Regional Cleanup Plans without change.

Under this alternative the plans would be compiled and each plan would have duplicate sections that present the toxic hot spot definition and ranking criteria. Some of the identified sites may

not satisfy the definition of a toxic hot spot. There is some lack of clarity with respect to the “areas of concern”.

Recommendation:

Adopt Alternative 1.

Remove the toxic hot spot definition and ranking criteria from each Regional cleanup plan and place the definitions in Volume I of the Consolidated Cleanup Plan. Move the “areas of concern” sections to the end of each Regional Cleanup Plan.

Issue 3: *Approaches for consolidating and compiling Regional Toxic Hot Spots Cleanup Plans*

Present Policy: The SWRCB committed to address this issue in the Guidance Policy (SWRCB, 1998a).

Issue Description: The priority ranking for each site was included in each Regional Cleanup Plan which describes a number of factors including identification of likely sources of the pollutants that are causing the toxic characteristics and actions to be taken to remediate each site. The regional lists of ranked candidate toxic hot spots are required to be consolidated into a statewide, prioritized list of toxic hot spots, and included in the Consolidated Cleanup Plan. No specific direction on approaches for compiling the Regional toxic hot spot lists is given in the Water Code.

The issue is: What approach should the SWRCB take to clearly and concisely consolidate the toxic hot spot lists that allows for the best combination of Regional focus and between Region comparisons?

Alternatives: 1. Assemble the Regional Cleanup Plans into separate chapters.

The simplest way to consolidate and compile the Regional Cleanup Plans is to assemble the plans Region-by-Region into separate chapters. This alternative is simple and straight forward but does not allow for between region comparisons nor does it allow for a clear assessment of how many high priority toxic hot spots are identified Statewide.

2. Consolidate lists of candidate toxic hot spots into a single, summary list using the Regions' ranked lists; arrange by Region and alphabetical order. Use separate chapters for the remediation activities developed by the RWQCBs.

Compiling the RWQCB lists in this way would emphasize the most highly ranked toxic hot spots by geographic region. This alternative allows for a more comprehensive analysis of the toxic hot spots by Region. The alternative suffers from the same limitation as Alternative 1 that it makes it difficult to assess the numbers of high priority toxic hot spots Statewide.

3. Consolidate lists of toxic hot spots as follows: (1) toxic hot spots should be placed in a Statewide list and arranged in alphabetical order within each rank (high, moderate and low); and (2) toxic hot spots should be arranged by Region (from north to south) and in the order provided by the RWQCBs. Use separate chapters to detail remediation activities developed by the RWQCBs.

Alternative 3 allows for a clear analysis of the number of toxic hot spots in each ranking category as well as an analysis of the numbers of known toxic hot spots in each Region. The limitations of Alternatives 1 and 2 are avoided in this alternative. However, listing the toxic hot spots twice in the Consolidated Cleanup Plan seems duplicative. If the general list of known toxic hot spots by rank is presented in the portion of the cleanup plan intended for use by the Legislature and the Region-specific lists are presented when detailed action alternatives are presented then the duplication would be minimized.

The BPTCP Advisory Committee has evaluated the various approaches for listing toxic hot spots. The Committee has made the following recommendation to the SWRCB:

“The SWRCB should consolidate lists of candidate toxic hot spots into two summary lists using the Regions’ ranked lists as follows: (1) toxic hot spots should be placed in a Statewide list and arranged in alphabetical order (e.g., Table [2]) within each rank (high, moderate and low); and (2) toxic hot spots should be arranged by Region (from north to south) and in alphabetical order (e.g., Table [3]). The SWRCB should use separate chapters to detail remediation activities approved by the Regional Water Quality Control Boards (RWQCBs).”

The BPTCP Advisory Committee further recommended the tables should take the take general form presented in Tables 3 and 4. The Committee (at their February 22, 1999 meeting) agreed that listing the toxic hot spots in the regional plans should be as the RWQCB listed the sites (and not alphabetically). To be more understandable to the Legislature the tables should also have columns that list what triggered the listing of the sites, sources and the pollutants that cause or contribute to the impacts observed at the sites.

The second listing of the toxic hot spots should be as provided by the RWQCBs in order to preserve the Regional perspective in the cleanup plan.

TABLE 2: TOXIC HOT SPOTS ARRANGED BY RANK AND IN ALPHABETICAL ORDER WITHIN EACH RANK

Rank	Water Body (Region)
High	Sites or water bodies listed alphabetically
Moderate	Sites or water bodies listed alphabetically
Low	Sites or water bodies listed alphabetically

TABLE 3: TOXIC HOT SPOTS ARRANGED BY REGION (FROM NORTH TO SOUTH) AND IN THE ORDER PROVIDED BY THE RWQCBs.

Region	Rank	Toxic Hot Spot
North Coast	High	Site or water bodies listed
	Moderate	
	Low	
San Francisco Bay	High	Site or water bodies listed
	Moderate	
	Low	
.	.	.
.	.	.
.	.	.
San Diego	High	Sites or water bodies listed
	Moderate	
	Low	

Staff Recommendation: Adopt Alternative 3.

Issue 4: RWQCB Listing and Ranking of Candidate Toxic Hot Spots

Present Policy: The RWQCBs were required to use the SWRCB-adopted definition for toxic hot spots and the site ranking criteria in the Water Quality Control Policy for Guidance on Development of the Regional Toxic Hot Spot Cleanup Plans (SWRCB 1998a).

Issue Description: After adoption of the Guidance Policy the coastal RWQCBs used the policy as the foundation to finalize the Regional Cleanup Plans. Each RWQCB used the same definition of a toxic hot spot and the same set of ranking criteria while exercising their independent judgment where allowed by the Guidance Policy. Each RWQCB created a list of candidate toxic hot spots and a ranking matrix for each of the identified toxic hot spots. The RWQCBs identified a total of 22 high priority toxic hot spots, 21 moderate priority toxic hot spots, and 6 low priority toxic hot spots (Table 4).

Did each RWQCB correctly evaluate and use the definition of a toxic hot spot and rank sites using the approved ranking criteria? Should the SWRCB adopt the lists of candidate toxic hot spots and the ranking matrices as developed by the RWQCBs?

It appears that for the most part the RWQCBs have used the definition of a candidate toxic hot spot correctly. There is, however, one site that has been identified as candidate toxic hot spots that does not meet the requirements of the definition of a toxic hot spot listed in the Guidance Policy.

Alternatives: 1. Maintain the lists of candidate toxic hot spots as provided by the RWQCBs. Do not modify the regional cleanup plan lists of candidate toxic hot spots.

Under this alternative the SWRCB would not exercise its independent judgment of the lists of candidate toxic hot spots developed by the RWQCBs. A disadvantage of this alternative is that if toxic hot spots are listed in the Consolidated Toxic Hot Spots Cleanup Plan that do not meet the adopted definitions and ranking criteria, the SWRCB may be vulnerable to the court action because it did not follow its own rules.

TABLE 4: CANDIDATE TOXIC HOT SPOTS IDENTIFIED IN THE REGIONAL TOXIC HOT SPOTS CLEANUP PLANS.

Rank	Site Identification	Reason for Listing Definition trigger	Pollutants
High	Cañada de la Huerta Shell Hercules Gas Plant Site	Aquatic Life Concerns - Sediment & Water Toxicity, Sediment chemistry, bioaccumulation, Water Quality Concerns - violations of Basin Plan & Ocean Plan objectives.	PCBs
High	Delta Estuary, Cache Creek watershed including Clear lake	Human health impacts	Mercury
High	Delta Estuary	Aquatic life impacts	Diazinon
High	Delta Estuary - Morrison Creek, Mosher Slough, 5 Mile Slough, Mormon Slough & Calaveras River	Aquatic life impacts	Diazinon & Chlorpyrifos
High	Delta Estuary - Ulatris Creek, Paradise Cut, French Camp & Duck Slough	Aquatic life impacts	Chlorpyrifos
High	Humboldt Bay Eureka Waterfront H Street	Bioassay Toxicity,	Lead, Silver, Antimony, Zinc, Methoxychlor, PAHs

Rank	Site Identification	Reason for Listing Definition trigger	Pollutants
High	Los Angeles Inner Harbor Dominguez Channel, Consolidated Slip	Human health, aquatic life impacts	DDT, PCBs, PAH, Cadmium, Copper, Lead, Mercury, Zinc, Dieldrin, Chlordane
High	Los Angeles Outer Harbor Cabrillo Pier	Human health, aquatic life impacts	DDT, PCBs, Copper
High	Lower Newport Bay Rhine Channel	Sediment Toxicity, Exceeds Objectives	Arsenic, Copper, Lead, Mercury, Zinc, DDE, PCB, TBT
High	McGrath Lake	Sediment Toxicity	DDT, Chlordane, Dieldrin, Toxaphene, Endosulfan
High	Moss Landing Harbor and Tributaries	Aquatic life & Human health concerns - Sediment Chemistry, Toxicity, Bioaccumulation and exceedances of NAS and or FDA guidelines	Pesticides, PCBs, Nickel, Chromium, TBT
High	Mugu Lagoon/ Calleguas Creek tidal prism, Eastern Arm, Main Lagoon, Western Arm	Aquatic life impacts	DDT, PCBs, metals, Chlordane, Chlorpyrifos
High	San Diego Bay Seventh St. Channel, Paleta Creek, Naval Station	Sediment Toxicity and Benthics community impacts	Chlordane, DDT, PAHs and Total Chemistry ¹

¹ The total toxic chemical concentrations for a station were calculated as follows: The sum of individual ERM (or PELs) was divided by the number of chemicals analyzed for which ERM (or PELs) were known. The "average" ERM (or PEL), known as the Effects Range Median Quotient or ERMQ (or

Rank	Site Identification	Reason for Listing Definition trigger	Pollutants
High	San Francisco Bay Castro Cove	Aquatic life impacts	Mercury, Selenium, PAHs, Dieldrin
High	San Francisco Bay Entire Bay	Human Health Impacts	Mercury, PCBs, Dieldrin, Chlordane, DDT, Dioxin Site listing was based on Mercury and PCB health advisory
High	San Francisco Bay Islais Creek	Aquatic life impacts	PCBs, chlordane, dieldrin, endosulfan sulfate, PAHs, anthropogenically enriched H ₂ S and NH ₃
High	San Francisco Bay Mission Creek	Aquatic life impacts	Silver, Chromium, Copper Mercury, Lead, Zinc, Chlordane, Chlorpyrifos, Dieldrin, Mirex, PCBs, PAHs, anthropogenically enriched H ₂ S and NH ₃
High	San Francisco Bay Peyton Slough	Aquatic life Impacts	Silver, Cadmium, Copper, Selenium, Zinc, PCBs, Chlordane, ppDDE, Pyrene
High	San Francisco Bay Point Potrero/ Richmond Harbor	Human Health	Mercury, PCBs, Copper, Lead, Zinc
High	San Francisco Bay Stege Marsh	Aquatic life impacts	Arsenic, Copper, Mercury, Selenium, Zinc, chlordane, dieldrin, ppDDE, dacthal, endosulfan 1, endosulfan sulfate, dichlorobenzophenone, heptachlor epoxide,

Probable Effects Level Quotient or PELQ) was compared to the "threshold" ERMQs (or PELQs) calculated to be 0.85 X ERMQ (or 1.29 X PELQ). If a threshold quotient was equaled or exceeded, the station was assumed to have a total chemistry hit

Rank	Site Identification	Reason for Listing Definition trigger	Pollutants
High	San Joaquin River at City of Stockton	Exceedances of water quality objective	hexachlorobenzene, mirex, oxidiazon, toxaphene and PCBs Dissolved oxygen
High	Santa Monica Bay Palos Verdes Shelf	Human health, aquatic life impacts	DDT, PCBs
Moderate	Anaheim Bay, Naval Reserve	Sediment toxicity	Chlordane, DDE
Moderate	Ballona Creek Entrance Channel	Sediment toxicity	DDT, zinc, lead, Chlordane, dieldrin, chlorpyrifos
Moderate	Bodega Bay-10006 Mason's Marina	Bioassay toxicity	Cadmium, Copper, TBT, PAH
Moderate	Bodega Bay-10028 Porto Bodega Marina	Bioassay toxicity	Copper, lead, Mercury, Zinc, TBT, DDT, PCB, PAH
Moderate	Bodega Bay-10007 Spud Point Marina	Bioassay toxicity	NA
Moderate	Delta Estuary Delta	Aquatic life impacts	Chlordane, Dieldrin, Lindane, Heptachlor, Total PCBs, PAH & DDT
Moderate	Delta Estuary Delta	Human health impacts	Chlordane, Dieldrin, Total DDT, PCBs, Endosulfan, Toxaphene

Rank	Site Identification	Reason for Listing Definition trigger	Pollutants
Moderate	Delta Estuary Smith Canal, Mosher & 5-Mile, Sloughs & Calaveras River	Exceedance of water quality objective	Dissolved oxygen
Moderate	Los Angeles River Estuary	Sediment Toxicity	DDT, PAH, Chlordane
Moderate	Upper Newport Bay Narrows	Sediment Toxicity, Exceeds Water Quality Objectives	Chlordane, Zinc, DDE
Moderate	Lower Newport Bay Newport Island	Exceeds Water Quality Objectives	Copper, Lead, Mercury, Zinc, Chlordane, DDE, PCB, TBT
Moderate	Marina del Rey	Sediment Toxicity	DDT, PCB, Copper, Mercury, Nickel, Lead, Zinc, Chlordane
Moderate	Monterey Harbor	Aquatic life impacts, Sediment Toxicity	PAHs, Cu, Zn, Toxaphene, PCBs, Tributyltin
Moderate	San Diego Bay Between "B" Street & Broadway Piers	Benthic community impacts	PAHs, Total Chemistry
Moderate	San Diego Bay Central Bay Switzer Creek	Sediment toxicity	Chlordane, Lindane, DDT, Total Chemistry

Rank	Site Identification	Reason for Listing Definition trigger	Pollutants
Moderate	San Diego Bay Chollas Creek	Benthic community impacts	Chlordane, Total Chemistry
Moderate	San Diego Bay Foot of Evans & Sampson Streets	Benthic Community Impacts	PCBs, Antimony, Copper, Total Chemistry
Moderate	San Francisco Bay Central Basin, San Francisco Bay	Aquatic life impacts	Mercury, PAHs
Moderate	San Francisco Bay Fruitvale (area in front of stormdrain)	Aquatic life impacts	Chlordane, PCBs
Moderate	San Francisco Bay Oakland Estuary. Pacific Drydock #1 (area in front of stormdrain)	Aquatic life impacts	Copper, Lead, Mercury, Zinc, TBT, ppDDE, PCBs, PAHs, Chlorpyrifos, Chlordane, Dieldrin, Mirex
Moderate	San Francisco Bay, San Leandro Bay	Aquatic life impacts	Mercury, Lead, Selenium, Zinc, PCBs, PAHs, DDT, pesticides
Low	Seal Beach NWR Navy Marsh	Sediment toxicity	DDE

Rank	Site Identification	Reason for Listing Definition trigger	Pollutants
Low	Seal Beach Bolsa Avenue NWR	Sediment toxicity	Arsenic
Low	Bolsa Chica Ecological Reserve	Sediment toxicity	DDE
Low	Seal Beach NWR Left Reach	Sediment toxicity	DDE
Low	Seal Beach NWR Middle Reach	Sediment toxicity	Arsenic
Low	Huntington Harbor Upper Reach	Sediment toxicity	Chlordane, DDE, Chlorpyrifos

2. Remove the RWQCB-listed candidate toxic hot spots from the final lists of toxic hot spots because the provisions of the toxic hot spot definition were not satisfied.

Under this alternative the SWRCB would exercise its judgment in determining if the RWQCBs appropriately used the approved definitions and ranking criteria.

The lists of candidate toxic hot spots, supporting information and reference used as a foundation for the site listing are presented in each of the Regional Toxic Hot Spots Cleanup Plans (please refer to Appendix B; RWQCB 1998a; 1998b; 1998c; 1999a; 1999b; 1999c; 1999d). The site listed in Table 5 does not meet the definition of a toxic hot spot (as presented in the SWRCB, 1998a).

TABLE 5: SITE IDENTIFIED BY RWQCBs THAT DOES NOT QUALIFY AS A TOXIC HOT SPOT.

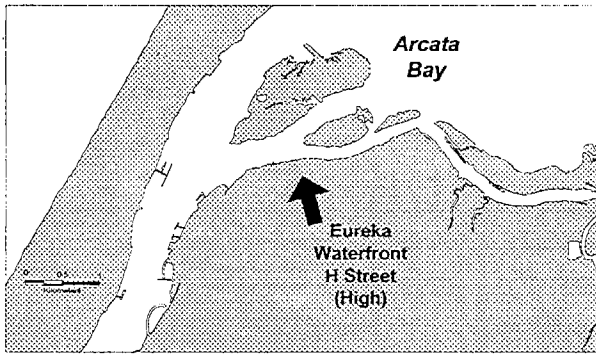
Region	Water Body, Site Identification	Reason for listing	Pollutants	Reason the site should be removed from the candidate toxic hot spot list
North Coast	Bodega Bay, Spud Point Marina	Bioassay Toxicity	Unknown	Pollutants associated with sediment toxicity are not identified.

Each of the other candidate toxic hot spots identified by the RWQCB satisfy the requirements of the specific definition of a toxic hot spot. All candidate toxic hot spots appear to be ranked appropriately.

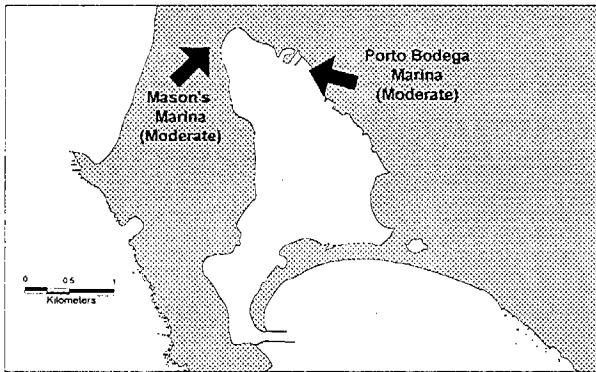
Recommendation: Adopt Alternative 2.

The SWRCB should (1) remove one candidate toxic hot spot listed in Alternative 2, (2) adopt the remaining candidate toxic hot spots as known toxic hot spots, and (3) present figures showing generally where the known toxic hot spots are located (Figure 2). The lists and figure should be included in the Consolidated Cleanup Plan with all the supporting information provided by the RWQCBs.

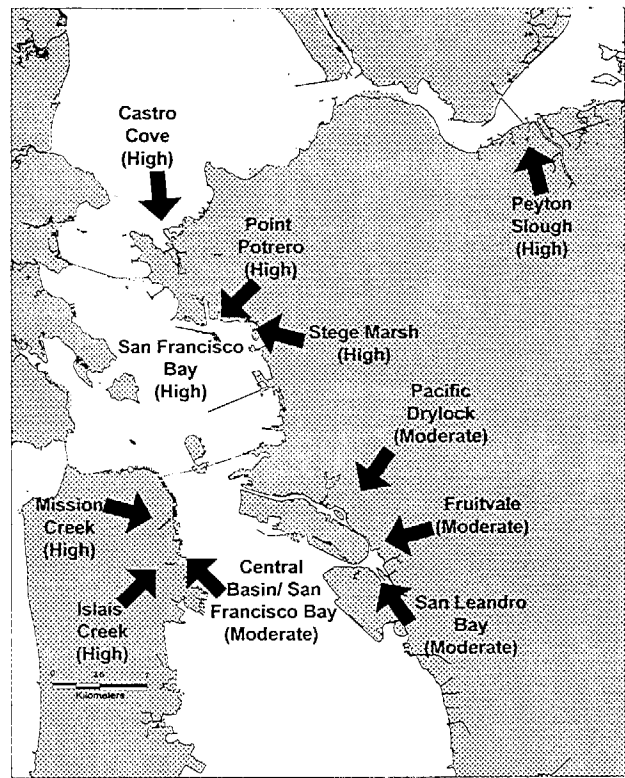
FIGURE 2: HIGH, MODERATE, AND LOW PRIORITY KNOWN TOXIC HOT SPOTS



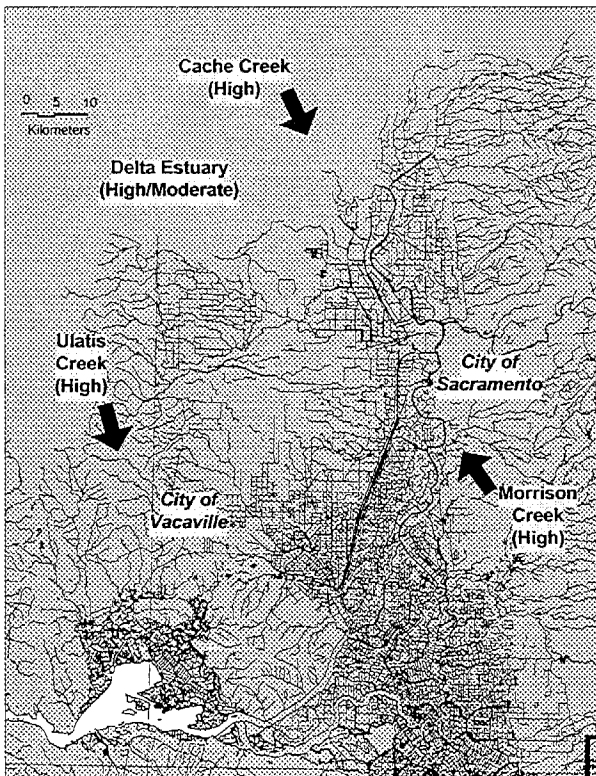
Humboldt Bay



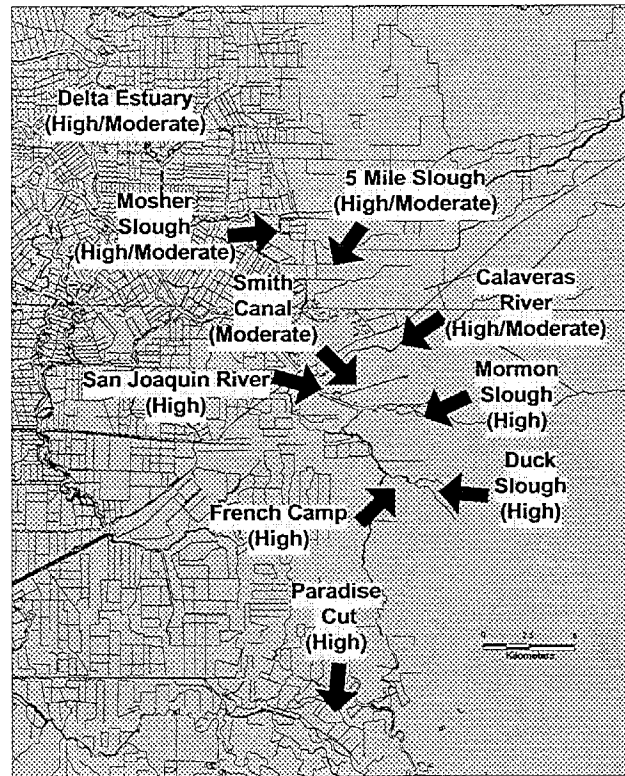
Bodega Bay



San Francisco Bay

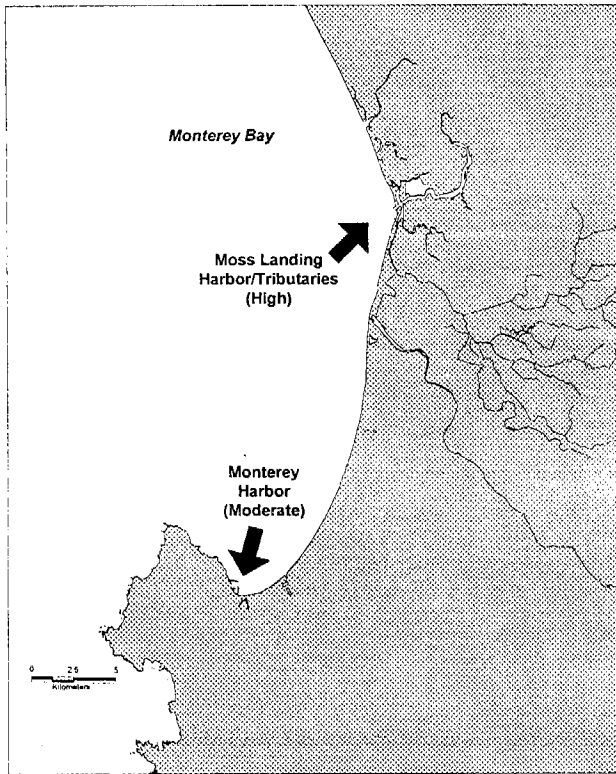


Delta Estuary

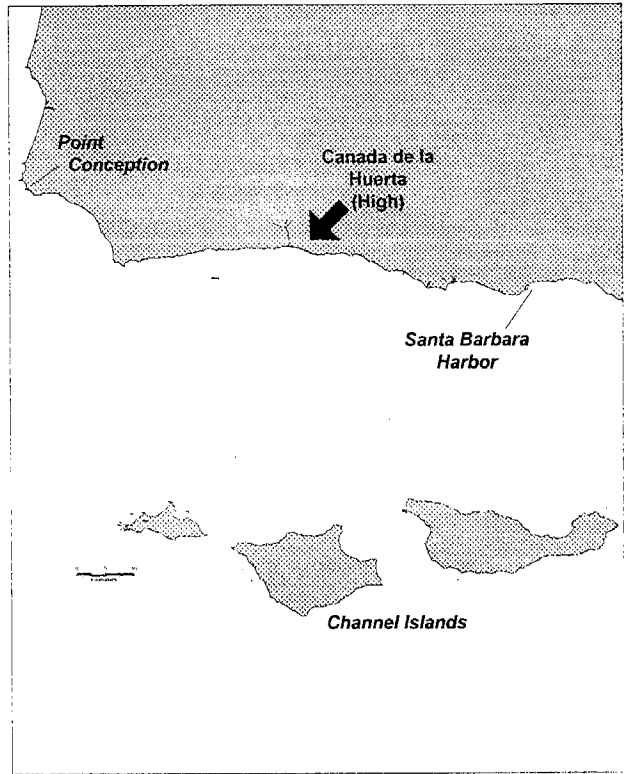


Delta Estuary

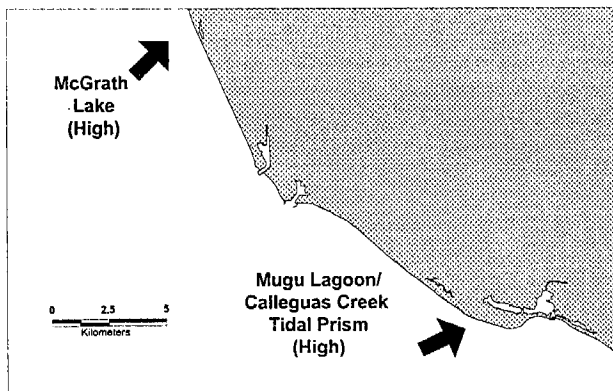
High, Moderate, and Low Priority Known Toxic Hot Spots



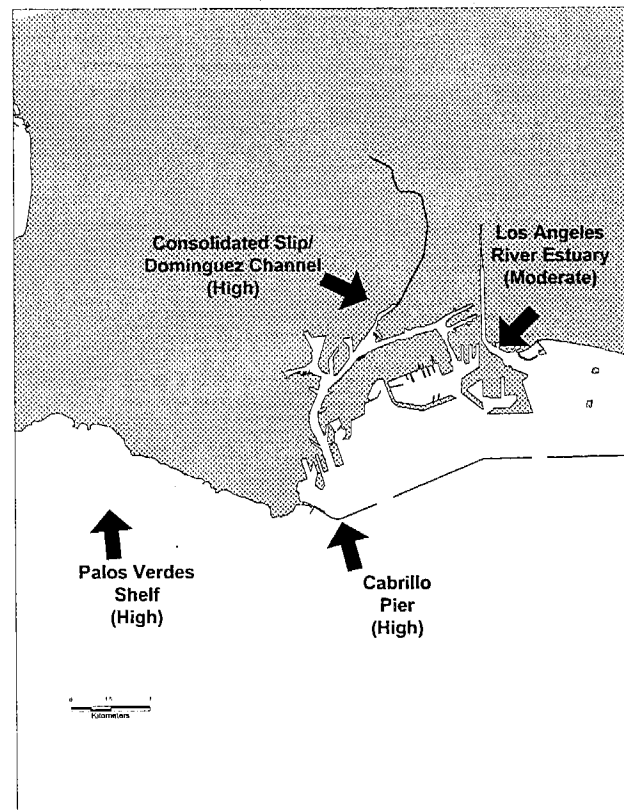
Monterey Bay



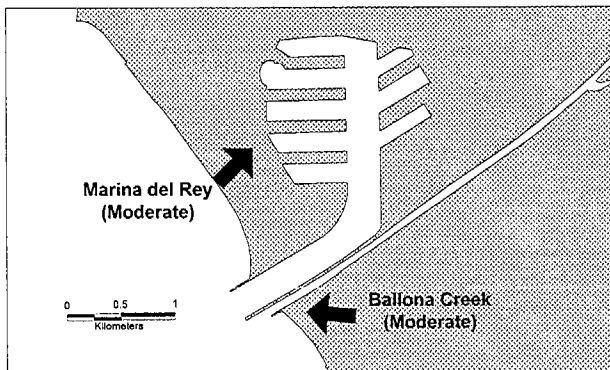
Canada de la Huerta



McGrath Lake/Mugu Lagoon

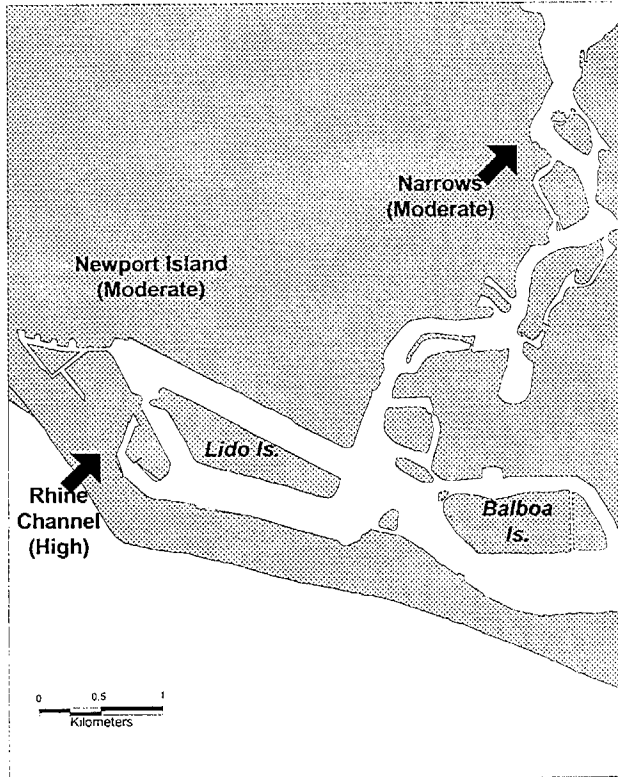


**Los Angeles/Long Beach Harbor/
Palos Verdes Shelf**

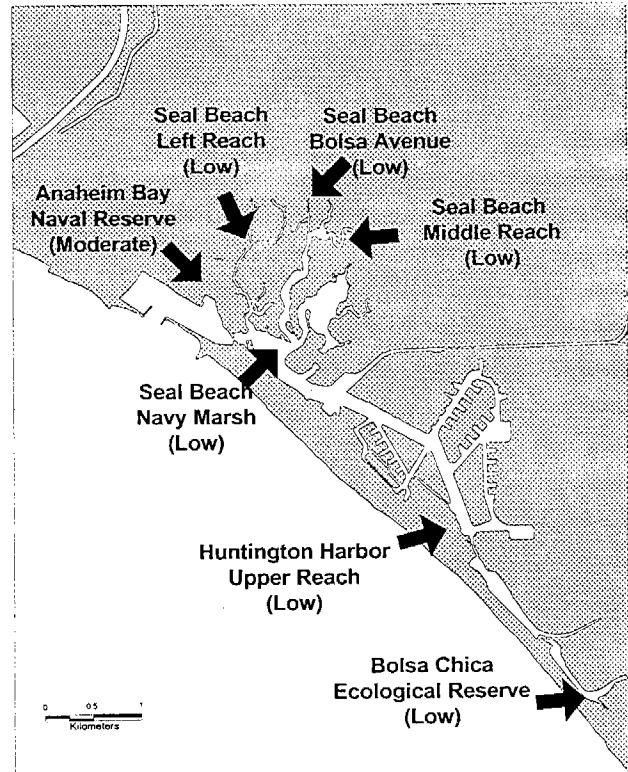


Marina del Rey/ Ballona Creek

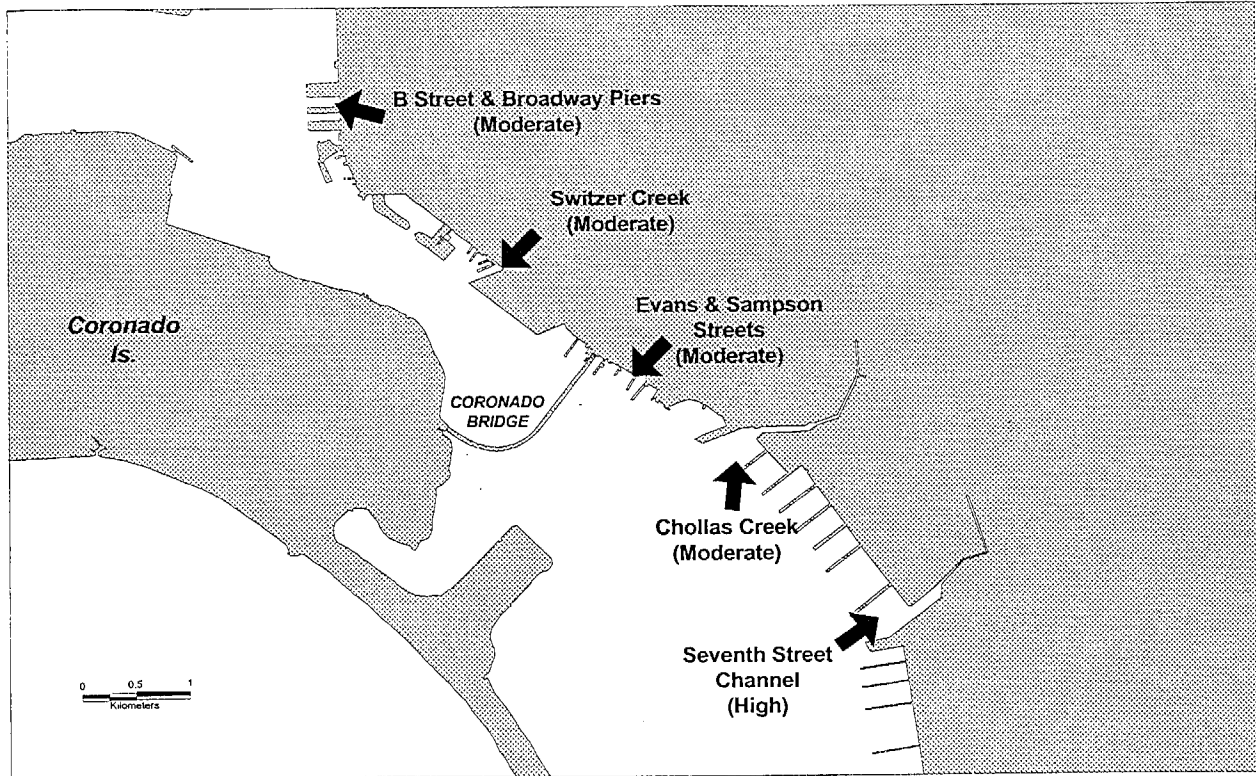
High, Moderate, and Low Priority Known Toxic Hot Spots



Newport Bay



Huntington Harbor/Anaheim Bay



San Diego Bay

Issue 5: *Removing locations from and reevaluating the list of known toxic hot spots*

Present Policy: The SWRCB committed to address this issue in the Guidance Policy (SWRCB, 1998a).

Issue Description: During the development of the Guidance Policy, many commenters discussed the need to establish a system for delisting of sites from the Consolidated Cleanup Plan . The SWRCB committed to consider this issue as part of the development of the Consolidated Plan.

The concern raised concerning delisting was that sites that have been remediated should no longer be listed in the Consolidated Cleanup Plan. If a site is remediated presumably the site is no longer a toxic hot spot.

The issue is: What approach should the SWRCB use to remove sites from the Consolidated Cleanup Plan or otherwise address sites that have been remediated?

Alternatives: 1. Provide no approach for delisting sites in the Consolidated Cleanup Plan .

Under this alternative, the SWRCB would not adopt an approach for delisting sites. If sites are to be delisted the SWRCB would have to create approaches to do so each time a request was made to remove a site from the toxic hot spot list.

The disadvantages of this alternative are many. There would be no mechanism for removing sites or acknowledging that the site has been remediated. Not having a delisting system would create significant confusion. It would also be unfair to affected dischargers because there would be no clear approach for clearing from the list sites that have been adequately addressed.

2. Once sites are remediated or no longer qualifies as a toxic hot spot, remove the sites from the Consolidated Cleanup Plan.

This alternative would require that the SWRCB modify the Consolidated Cleanup Plan to remove sites that have been remediated, were inappropriately listed as toxic hot spots, or no longer qualify as a toxic hot spot (as defined). This process could

involve petitioning the SWRCB to remove the site. The SWRCB would then evaluate the reasons for removing the site from the Plan. The SWRCB would consider the RWQCBs view on delisting the site. The SWRCB would remove all reference to the corrected site after complying with CEQA and the APA in modifying the Consolidated Cleanup Plan.

In using a delisting approach the SWRCB should consider providing the factors required to consider delisting a site (e.g., delisting criteria used by the State of Washington (Department of Ecology, 1995)). Some examples of factors to consider include:

- The reason for site delisting
- Documentation of investigations performed to demonstrate the site is no longer a toxic hot spot (post-remediation monitoring)
- All remediation actions taken
- Documentation of the likelihood the toxic hot spot will be prevented from reoccurring

A distinct advantage of this alternative is that by using this type of approach, it may be an incentive to dischargers to remediate sites quickly so their site can be removed from the Consolidated Cleanup Plan. Another advantage is that if sites are removed, this will allow greater focus in the Plan on sites where work is continuing.

A possible disadvantage is that the process for removing sites from the Plan may require the SWRCB to prepare the environmental documentation to support the delisting. This report may take considerable time to complete. This disadvantage could be lessened by interested parties and RWQCBs compiling the needed information before the petition is filed.

3. Do not remove sites from the Consolidated Cleanup Plan but, rather, report on the status of remedial action at sites.

This alternative would set up a status reporting system so RWQCBs could report to the SWRCB on whether a site has been remediated and whether any further action is necessary. Site status would be reported by a RWQCB if no further action is necessary to remediate the site. This system would not require that a site be removed from the known toxic hot spot list in the Consolidated Plan. Rather, a RWQCB would issue certification of “no further action” (NFA) to notify the discharger and the public that a site has

been remediated. The SWRCB would then take a formal action to update the status of the toxic hot spot. The status of site remediation would be reported administratively by the SWRCB to interested parties.

Under this option, the RWQCB would make the finding that no further action was required at the site. The issue would then have to be brought before the SWRCB for action to consider concurrence in the RWQCB finding. Even if sites were found to require no further remedial action the site would remain on the lists of known toxic hot spots. The site would still be considered a toxic hot spot even though the RWQCB has found remediation is complete. This approach would penalize dischargers even if they had made every effort to cleanup a site.

Recommendation:

Adopt Alternative 2.

Proposed language is presented in Volume I of the proposed Consolidated Cleanup Plan (Appendix A).

Issue 6: *Guidance on reevaluating waste discharge requirements in compliance with Water Code Section 13395*

Present Policy: The SWRCB committed to develop additional guidance on WDR revision when the Guidance Policy was adopted (SWRCB, 1998a). The Policy commits to consideration of new guidance to the RWQCBs on considerations when reevaluating WDRs in compliance with Water Code Section 13395.

Issue Description: During the development of the Guidance Policy, the SWRCB received many comments on the need to provide specific guidance on the reevaluation of WDRs. Many of the commenters said that the specific guidance should be provided in the Guidance Policy. However, it was pointed out in the Final FED (SWRCB, 1998b) that it was premature to develop guidance before the scope of the needed guidance could be evaluated.

The SWRCB should evaluate what additional guidance is needed for WDRs and the clearest way to reevaluate WDRs as required by the Water Code. California Water Code Section 13395 states that:

“Each regional board shall, within 120 days from the ranking of a toxic hot spot, initiate a reevaluation of waste discharge requirements for dischargers who, based on the determination of the regional board, have discharged all or part of the pollutants which have caused the toxic hot spot. These reevaluations shall be for the purpose of ensuring compliance with water quality control plans and water quality control plan amendments. These reevaluations shall be initiated according to the priority ranking established pursuant to subdivision (a) of Section 13394 and shall be scheduled so that, for each region, the first reevaluation shall be initiated within 120 days from, and the last shall be initiated within one year from, the ranking of the toxic hot spots. The regional board shall, consistent with the policies and principles set forth in Section 13391, revise waste discharge requirements to ensure compliance with water quality control plans and water quality control plan amendments adopted pursuant to Article 3 (commencing with Section 13240) of Chapter 4, including requirements to prevent the creation of new toxic hot spots and the maintenance or further pollution of existing toxic hot spots. The regional board may determine it is not necessary to revise a waste discharge requirement only if it finds that the toxic hot spot resulted from practices no longer being conducted by the

discharger or permitted under the existing waste discharge requirement, or that the discharger's contribution to the creation or maintenance of the toxic hot spot is not significant.”

The BPTCP Advisory Committee has provided the SWRCB with their advice on what guidance is necessary (Advisory Committee, 1998).

Alternatives:

1. Provide no additional guidance.

The RWQCBs use a variety of regulations and water quality control plans and policies to develop WDRs and NPDES permits. None of the existing guidance links or explains the relationship between NPDES permits or WDRs and the requirements of Water Code Section 13395.

The advantage of this alternative is the SWRCB would not have to issue any new regulations or guidance on WDR revision or reevaluation. The RWQCBs would continue to rely on existing programs for guidance to carry out the reevaluations required in Water Code Section 13395.

The disadvantages of this alternative are many. Section 13395 could be read to mean that all WDRs associated with high priority toxic hot spots should be reopened within 120 days of the approval of the Consolidated Cleanup Plan. This could place an unreasonable burden on the RWQCBs to complete revision of WDRs. There could also be confusion with regard to what action or revisions are necessary to address the toxic hot spots. Another serious disadvantage is the potential lack of consistency on the WDR reevaluations.

2. Provide guidance to the RWQCBs on the meaning of “reevaluation,” guidance on how to carry out a reevaluation on WDRs that are associated with known toxic hot spots, and prevention of toxic hot spots.

The time frame for “reevaluation” of WDRs associated with known toxic hot spots is very short (the first reevaluations should be initiated within 120 days). There may be so many WDRs (such as those WDRs associated with toxic hot spots in San Francisco Bay) that initiating a reevaluation of all WDRs may be not possible because of staffing limitations. To avoid creating this situation, the SWRCB should consider defining “...initiating a reevaluation of

waste discharge requirements...” as a requirement to the RWQCBs to establish which and in what order WDRs will be revised. This planning could be completed in the time frames established in Water Code Section 13395.

The SWRCB should also consider requiring RWQCBs to acknowledge the existence of the toxic hot spot in the WDR and the special measures needed to improve the water quality at the site or in the water body.

An advantage of this alternative is defining “reevaluation”, all dischargers and the RWQCB themselves would be clear on what is required to be in compliance with Water Code Section 13395. This would eliminate any confusion for “reevaluation” as used in the Water Code and would avoid interpretations that a “reevaluation” is a “reopening,” “revision” or “reconsideration” of WDRs. Another advantage of this alternative is the RWQCB would be required to acknowledge if a toxic hot spot needs to be addressed in a WDR.

The BPTCP Advisory Committee has recommended this approach to the SWRCB (Advisory Committee, 1998) .

A possible disadvantage is WDR scheduling would be delayed or not completed. This problem can be avoided by the SWRCB requiring that the RWQCBs submit a priority list for WDRs within the Section 13395 time frames.

Another disadvantage of this alternative is that the focus is primarily on point source dischargers. In preventing toxic hot spots, RWQCBs should also consider all sources of pollutants. Revising WDRs alone will not address the wide range of pollutant sources that may contribute to the formation and worsening of toxic hot spots. One way to mitigate this disadvantage is to issue a policy statement that the RWQCBs should favor the use of watershed management approaches to prevent toxic hot spots.

The SWRCB should consider adoption of the Prevention Section provisions from the SWRCB Guidance Policy (SWRCB, 1998a) into the Consolidated Cleanup Plan. By adopting these provisions the SWRCB will take a comprehensive approach to including point and nonpoint sources of pollution in preventing toxic hot spots.

3. Provide guidance on a range of WDR-related issues. For example, guidance on self-monitoring programs or permit conditions.

The SWRCB could provide specific guidance on any special permit conditions that may be necessary to address a wide range of toxic hot spots. The guidance could range from specific monitoring requirements, lists of special conditions to address toxic hot spots, or consideration of alternate implementation procedures (e.g., the use of prohibitions to reduce discharge at or near toxic hot spots).

An overriding disadvantage of this alternative is that environmental conditions vary greatly throughout the State and prescribing detailed guidance may cause RWQCBs to implement measures at sites that are either more protective or less protective than necessary. RWQCBs should be given substantial flexibility in developing WDR revisions that are tailored to Regional and site-specific needs.

Staff Recommendation: Alternative 2.

The SWRCB should provide guidance to the RWQCBs on the approach to take when preventing toxic hot spots. The proposed language encourages the use of watershed management. When reevaluating WDRs, the proposed approach requires a reevaluation letter be sent from the RWQCBs to the SWRCB stating:

1. The list of WDRs associated with each known toxic hot spot that can reasonably be expected to cause or contribute to the creation and maintenance of the known toxic hot spot.
2. An assessment of the need to revise the WDR to improve the quality of the known toxic hot spot.
3. A schedule for completion of the needed WDR revisions.

Issue 7: Implementation of Remediation at Identified Toxic Hot Spots

Present Policy: The SWRCB Guidance Policy (SWRCB, 1998a) requires the RWQCBs to develop a preliminary list of actions to remediate toxic hot spots identified using the specific definition and ranking criteria.

Issue Description: The California Water Code requires the RWQCBs and the SWRCB to present a preliminary assessment of the actions required to remedy or restore a toxic hot spot (Section 13394). The Water Code prevents the RWQCBs and the SWRCB from specifying "... the design, location, type of construction, or particular manner in which compliance may be had..." (Section 13360). To comply with both of these sections, the SWRCB Guidance Policy requires the RWQCBs to develop a list of preliminary alternate actions required to remedy or restore a toxic hot spot. The RWQCBs were required to list a range of alternatives so, if potential dischargers are identified, the actions listed were not prescriptive.

The SWRCB should also consider a requirement for the RWQCBs to implement the Consolidated Cleanup Plan. In developing this requirement, the SWRCB is limited by the fact that funding for remediation of toxic hot spots where dischargers are not identified is currently unavailable.

Alternatives: 1. Require RWQCBs to implement the Consolidated Cleanup Plan for all toxic hot spots.

Under this alternative the SWRCB would direct the RWQCBs to begin implementation of the Consolidated Cleanup Plan even though funding for each site has not been identified. This alternative would require that funding be redirected from other high priority activities.

2. Require the RWQCBs to move forward with implementation of the Consolidated Cleanup Plan for toxic hot spots where the discharger is identified. Delay implementation of other remediation activities until funding is identified. Provide a listing of some possible sources of funding.

With this alternative the RWQCBs could begin implementation of some aspects of the Consolidated Cleanup Plan immediately. At Sites where the potential discharger(s) have been identified, the RWQCBs could use their existing authorities to begin remediation activities. Where funding is not currently available, the RWQCB could seek funding through a variety of existing mechanisms (e.g., Clean Water Act Section 319, CALFED, supplemental environmental projects, etc.). The SWRCB could report the balance of funding needed to the California Legislature for their consideration. A summary of the estimated range of funding needed to remediate sites, the funds potentially recoverable from dischargers and the unfunded amount needed is presented in Table 6.

3. Do not provide direction on whether to proceed with implementation of the Consolidated Cleanup Plan.

This alternative would leave it up the discretion of the RWQCB whether to implement the Consolidated Cleanup Plan and how best to fund the identified activities. Under this alternative, the RWQCB would be allowed to implement the Consolidated Cleanup Plan at their discretion and within the existing resources. While this alternative provides considerable flexibility to RWQCBs it may allow inconsistent or no implementation of the Consolidated Cleanup Plan.

Recommendation:

Adopt Alternative 2.

TABLE 6: RANGE OF COSTS TO REMEDIATE TOXIC HOT SPOTS, FUNDING POTENTIALLY RECOVERABLE FROM DISCHARGERS AND UNFUNDED AMOUNT.

Site	Low Estimate	High Estimate	Amount Recoverable From Dischargers	Unfunded Amount
Cañada de la Huerta ²	\$2,600,000	\$2,600,000	All	0
Delta Estuary Mercury ³	\$3,105,000	\$3,105,000	None	\$3.1 million
Delta Estuary Pesticides (3 THS)	Not Determined	Not Determined	Not Determined	Not Determined
Humboldt Bay "H" Street	\$500,000	\$5,000,000	All	0
Los Angeles Inner Harbor	\$1,000,000	\$50,000,000	None	\$1.0-\$50 million
Los Angeles Outer Harbor	\$500,000	\$50,000,000	None	\$0.5-\$50 million
Lower Newport Bay Rhine Channel	\$10,581,800	\$10,581,800	1-10% of total cost	\$9.5-\$10.5 million
McGrath Lake	\$3,000,000	\$300,000,000	None	\$3 - \$300 million
Moss Landing Harbor & Tributaries ⁴	\$2,387,000	\$3,273,167	25-50% of Ag. cost share	\$1.94 to 1.99 million
Mugu Lagoon	\$1,000,000	\$72,500,000	None	\$1.0-\$72.5 million
San Diego Bay 7th St. Channel	\$145,520	\$7,405,200	50% of total cost	\$73,000 to \$3.7 million
San Francisco Bay, Castro Cove	\$2,200,000	\$21,200,000	All	0
San Francisco Bay, Entire Bay ⁵	\$25,000,000	\$45,000,000	\$5.8-8 million + \$75,000	\$19.05-36.9 million
San Francisco Bay, Islais Creek ⁶	\$1,900,000	\$81,400,000	All	0
San Francisco Bay, Mission Creek ⁶	\$1,900,000	\$78,000,000	All	0
San Francisco Bay, Peyton Slough	\$415,000	\$1,260,000	All	0
San Francisco Bay, Point Potrero ⁷	\$822,000	\$3,040,000	All	0
San Francisco Bay, Stege Marsh	\$1,600,000	\$10,200,000	All	0
San Joaquin River Dissolved O ₂ ⁸	\$692,000	\$692,000	None	\$692,000
Santa Monica Palos Verdes Shelf ⁹	\$13,000,000	\$67,000,000	All	0
Total	\$72,348,320	\$812,257,167		\$39.85-\$529.4 million

² Estimated total cost to cleanup site. Estimated cost for first 2 years is \$332,400.

³ Estimated grand total. Multi year cost for Cache Creek monitoring studies is \$1,120,000. Multi-year cost for estuarine monitoring studies is \$1,500,000.

⁴ Cost sharing programs to implement management measures to control erosion generally require project proponent to share 25% to 50% of overall project cost.

⁵ Estimated cost to carry out RMP is \$75,000/year for 2 years. Outreach and Public Education cost is \$150,000 for first two years then \$50,000/yr.

⁶ If significant structural changes are needed the cost could increase by \$75 million.

⁷ Sheetpile Bulkhead, Capping and Institutional Controls is the preferred alternative plus RWQCB costs at \$30,000/year for 3 years.

⁸ Includes Steering Committee cost is \$12,000/year. Monitoring/Reevaluation will cost \$20,000/year.

⁹ Via Superfund program it is estimated that up to \$125 million may be recoverable from municipalities, Montrose, Westinghouse, and other industrial dischargers.

Issue 8: Sources of Funds to Address Toxic Hot Spot Remediation

Present Policy: None.

Issue Description: If a potential discharger is not identified to pay the total cost of remediating a toxic hot spot, the SWRCB and RWQCB may need to address these problems by using funds allocated in the SWRCB budget. It is estimated that approximately \$40 to \$529 million is needed to fully implement the proposed Consolidated Plan (Table 6). There are several sources of funding that are potentially available to address existing toxic hot spots. Since no dedicated fund source is available specifically to fund remediation of toxic hot spots, RWQCBs need to identify funding to complete remediation. There are several funding sources available to the RWQCBs.

The RWQCBs need to locate and secure existing funding sources, to the extent possible, in order to address several of the listed known toxic hot spots. This issue focuses on which fund sources are currently available and which funds can be possibly directed to implement the Consolidated Cleanup Plan.

Alternatives: 1. Nonpoint Source Grants Clean Water Act (CWA) Section 319

The Clean Water Act (CWA), Section 319(h), provides grant funds for projects directed at the management of nonpoint source pollution. High priority projects are considered those which implement specified nonpoint source management practices under Section 319 requirements, and projects which address nonpoint source waters listed pursuant to CWA section 303(d), water quality limited segments.

2. Wetlands Grants

Section 104(b) of the Clean Water Act provides funds for wetland restoration. The focus of these grants is wetland protection, but wetland restoration can be included when it is part of an overall wetland protection program. Priorities for funding include watershed projects to address watershed protection which have a substantial wetlands component in a holistic, integrated manner, and development of an assessment and monitoring.

3. State Revolving Funds (SRF) Loan Program

The State Revolving Funds (SRF) Loan Program provides funding for the construction of publicly-owned treatment works (POTWs), for nonpoint source correction programs and projects, and for the development and implementation of estuary conservation and management programs. The loan interest rate is set at one-half the rate of the most recent sale of a State general obligation bond.

4. Agricultural Drainage Management Loan Program

The State Agricultural Drainage Management Loan Program funds are available for feasibility studies and the design and construction of agricultural drainage water management projects. The project must remove, reduce, or mitigate pollution resulting from agricultural drainage.

5. CALFED

The CALFED Bay-Delta Program was initiated in 1995 to address environmental and water management problems associated with the Bay-Delta system, an intricate web of waterways created at the junction of the San Francisco Bay and the Sacramento and San Joaquin rivers and the watershed that feeds them. The CALFED Bay-Delta Program is carrying out a process to achieve broad agreement on comprehensive solutions for problems in the Bay-Delta System.

6. Cleanup and Abatement Fund

The State Water Pollution Cleanup and Abatement Account (Cleanup and Abatement Fund) (Water Code Section 13440 et seq.) can be used by the SWRCB to pay for cleaning up waste or abating the waste effects on waters of the State. RWQCBs may apply for these funds if, among other things, the RWQCB does not have adequate resources budgeted.

7. ACLs to address problems at toxic hot spots. Exchange penalties for supplemental environmental projects at toxic hot spots.

The RWQCB may impose administrative civil liability orders on an alleged violator for discharging waste, for failure to furnish or furnishing false technical or monitoring reports, for various

cleanup and abatement violations, and other issues. These orders are based on the violation of a WDR, a NPDES permit, or a prohibition in a water quality control plan. As part of this process the RWQCB may direct dischargers to provide funding for a Supplemental Environmental Project. Supplemental projects should mitigate damage done to the environment by the discharger, and usually should involve the restoration or enhancement of wildlife and aquatic habitat or beneficial uses in the vicinity of the violation (SWRCB, 1997a).

8. Mass-based Permit Offset System (Trading credits)

A mass-based permit offset system is a tool used to ensure that the largest controllable ongoing sources of pollutants and most cost-effective approaches are used to reduce the discharge of pollutants. An offset system provides an increase in flexibility for dischargers with potential compliance problems or for groups that wish to develop credit for anticipated offset of future loads associated with future population growth or increase in industrial discharges.

The San Francisco Bay RWQCB has developed a pilot offset system for better and more cost-effective control of mercury discharges (SFRWQCB, 1998). Factors that the RWQCB is considering are: (1) favoring application of the system to sites that do not have a responsible discharger identified, (2) bioaccumulation of pollutants at sites near discharges, (3) toxicity at sites where pollutants are allowed at higher concentrations, and (4) the chemical form of the pollutant discharged.

9. Any combination of Alternatives 1 through 8 and any other funding source identified by the RWQCBs.

No one source of funding is large enough to accommodate all the needs identified in the Regional Toxic Hot Spots Cleanup Plans. It is therefore necessary for the RWQCB to use whatever sources are available to address sites where no potential discharger has been identified. Using or considering multiple funding sources will increase the chances for the cleanup plans to be implemented. Because toxic hot spots are considered to be the worst sites and the sites where we have the best information on impacts, it is likely that any planned work will have a good chance for funding.

Staff Recommendation: Adopt Alternative 9.

The Consolidated Cleanup Plan should list the programs most likely to fund different aspects of the Regional Cleanup Plans.

Issue 9: Findings in the Consolidated Toxic Hot Spots Cleanup Plan

Present Policy: None.

Issue Description: The California Water Code requires the SWRCB to make a specific finding and recommendation in the Consolidated Cleanup Plan on the need for establishment of a toxic hot spots cleanup program (Water Code Section 13394(i)). This cleanup program would presumably be a new effort focused on implementing the Consolidated Cleanup Plan since the existing BPTCP would end after completion of the Regional and Consolidated Cleanup Plans.

Since these findings are directed to the California Legislature and focused on funding, the findings are not regulatory. Consequently, it is not necessary for OAL to approve this section (Government Code Section 11353).

The issue is: What findings and recommendations should be made on the need for a follow-up program to implement the Consolidated Cleanup Plan?

Alternatives: 1. Recommend that the BPTCP be continued as it currently exists.

The existing BPTCP started the task of identifying toxic hot spots and planning for their cleanup in 1990. The Program has focused resources on identifying problem areas using the best available scientific methods and approaches, development of Regional Cleanup Plans and now preparation of the Consolidated Cleanup Plan.

The BPTCP has provided new insights into locating and assessing water and sediment quality problems in California's bays and estuaries (please refer to SWRCB, 1996). No funding beyond the current year is available to support any new program activities. Certain activities that do not have Water Code-mandated deadlines (e.g., development of the California Enclosed Bays and Estuaries Plan) have yet to be completed. These activities could be completed using existing or redirected resources. The Consolidated Cleanup Plan would have to be implemented using existing resources.

2. Recommend that the focus of the BPTCP be changed to remove certain mandates and add new mandates.

The existing BPTCP has effectively identified toxic hot spots in several enclosed bays and estuaries in California. Plans to remediate high priority toxic hot spots have also been developed.

Consideration should be given to reassessment of the need for, or modification of, the existing BPTCP activities. Suggestions have been made over the years that the BPTCP be modified to focus activity on monitoring enclosed bays and estuaries and providing information for implementation of watershed management (SWRCB, 1996).

3. Recommend that the Consolidated Cleanup Plan be implemented through existing authorities and that watershed management be the focus of implementation measures. Identify a range of resource needs.

Under the California Water Code, the SWRCB and the RWQCBs have broad authority to regulate water quality. The tools for implementing a regulatory program are available currently but identification of problem locations has been difficult in some circumstances. The Consolidated Cleanup Plan lists many sites that are considered to be the worst-of-the-worst sites and many of the actions proposed to remediate the sites focus on existing regulatory approaches. To fairly address both point and nonpoint sources of pollution, new emphasis on prevention of toxic hot spots and watershed management should be highlighted and special funding could be sought to support these activities.

Under this alternative, the SWRCB would make findings on the number of toxic hot spots Statewide, present a range of costs to implement the Consolidated Toxic Hot Spots Cleanup Plan (from Table 6), and recommend that funding be provided for implementation of the cleanup plans and watershed management to the extent funding is allocated in the State budget.

4. Recommend a combination of Alternatives 1, 2 and 3.

Recommendation:

Adopt Alternative 3.

The SWRCB should provide to the California Legislature:
(1) findings on the number of known toxic hot spots, (2) findings on the relative rank of toxic hot spots, (3) findings on the estimate of how much funding is needed (i.e., a range) to implement the

Consolidated Cleanup Plan, and (4) the need to create a program to fund cleanup.

Additionally, the SWRCB should address the need to fund watershed management.

ENVIRONMENTAL SETTING AT TOXIC HOT SPOTS

This section is a description of the physical environmental conditions in the vicinity of the proposed high priority known toxic hot spots, as they exist before the commencement of the project from both a local and regional perspective. The RWQCBs have used the hot spot definition in the SWRCB Guidance Policy to identify a number of toxic hot spots in coastal areas of the State.

In the following sections, the environmental setting at each high priority toxic hot spot is described. The general locations of the high priority toxic hot spots is presented in Figure 3. General descriptions of the environmental setting in each Region is presented in the FED prepared for the SWRCB Guidance Policy (SWRCB, 1998b). Several reports developed by the BPTCP are available that assess the conditions of selected enclosed bays, estuaries and coastal waters (e.g., Jacobi et al., 1998; Hunt et al., 1998a; Downing et al., 1998; Anderson et al., 1998; Phillips et al., 1998; Fairey et al., 1996; and Fairey et al., 1998). Each site environmental setting is a summary of the information presented in the Regional Toxic Hot Spots Cleanup Plans. For a complete description of the sites please refer to Appendix B.

North Coast Region (Region 1)

G&R Metals at the Foot of H Street Between First Street and Humboldt Bay Eureka, California (scrap yard)

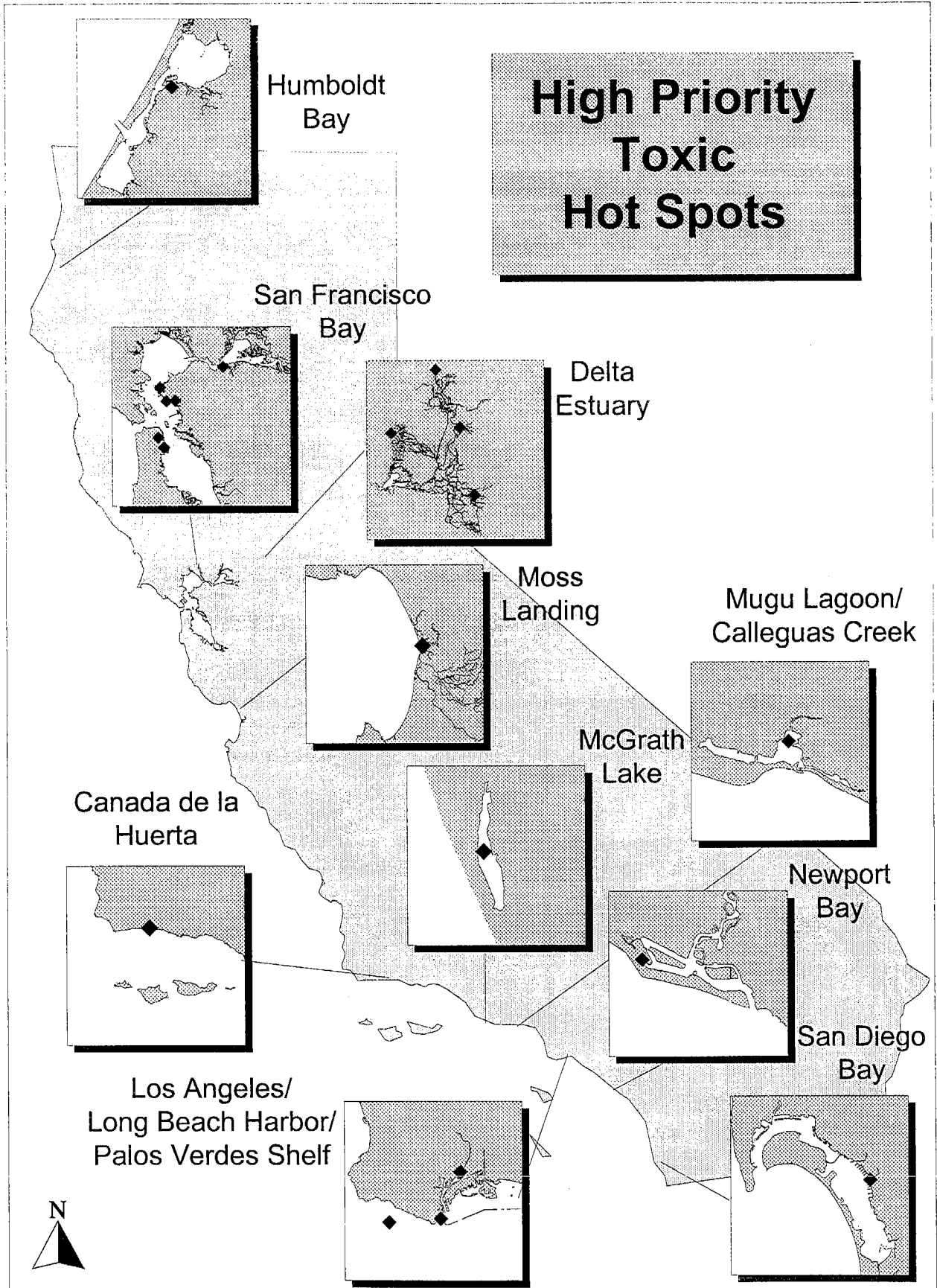
Site Description

Humboldt Bay includes Arcata Bay and three segments of Humboldt Bay. This whole area encompasses approximately 15,000 acres and is considered a shipping port, industrial center and a population hub. Fifteen sampling stations were located in the Humboldt Bay, The G&R Metals (scrap yard) site at the foot of "H" Street between first street and Humboldt Bay shore was found to rank high in the Toxic Hot Spot Ranking list due to sediment toxicity.

Pollutants of Concern

The pollutants of concern at this site are lead, arsenic, chromium, cadmium, cobalt, copper, mercury, zinc, and PCBs.

FIGURE 3: HIGH PRIORITY TOXIC HOT SPOTS



Background

The northern and central portions of the Bay are encircled by two cities and several small unincorporated communities. Along with these communities there are associated industrial activities, such as pulp mills, bulk petroleum plants, fossil fuel and nuclear power plants, lumber mills, boat repair facilities and fish processing plants. Small commercial and sport marinas have been constructed in the Bay and agricultural lands surround much of the Bay. Two large landfills are located adjacent to the Bay. Coal and oil gasification plants historically have been operated at various locations at the edge of the Bay. Municipal wastewater, industrial wastewater and storm water runoff have been discharged into the Bay throughout its 150 year history. Because there is a very narrow opening connecting Humboldt Bay and the Pacific Ocean, circulation and flushing are severely restricted, resulting in a high potential for sediment and pollutant deposition.

Areal Extent

The areal extent of the toxic hot spot has been estimated to be 3.5 acres with an average depth of pollution of 2 feet. The total polluted sediment quantity is about 10,000 cubic yards.

Sources

The site is located on the shore of Humboldt Bay and has been used for industrial activities since the early part of the century. It has been operated as a scrap metal facility since the early 1950s. Operations at the site included disassembly, incineration, and crushing of automobiles, storage of metals, batteries, radiators, metals reclamation from electrical transformers, and miscellaneous refuse. These operations occurred across the site. All industrial activities have ceased at the site but the historic uses have resulted in an area contaminated with PCBs, PAHs, metals and Methoxychlor. Cleanup and abatement activities remain to be performed at this site. These activities include: a.) performing an ecological and human health risk assessment, b.) conducting a feasibility study assessing remedial alternatives, and c.) performing appropriate cleanup and abatement activities. The site has not been used since 1980. On-going activity is limited to site assessment work to determine the extent of the contamination and the appropriate remediation needed to clean up the site.

San Francisco Region (Region 2)

The San Francisco Bay Region is comprised of most of the San Francisco estuary up to the mouth of the Sacramento-San Joaquin Delta. The San Francisco estuary conveys the water of the Sacramento and San Joaquin rivers into the Pacific Ocean. Located on the central coast of California, the Bay system functions as the only drainage outlet for waters of the Central Valley. It also marks a natural topographic separation between the northern and southern coastal mountain ranges.

The Sacramento and San Joaquin rivers, which enter the Bay system through the Delta at the eastern end of Suisun Bay, contribute almost all of the freshwater inflow to the Bay. Many smaller rivers and streams also convey fresh water to the Bay system. The rate and timing of these freshwater flows are among the most important factors influencing physical, chemical and biological conditions in the estuary. Flows in the region are highly seasonal, with more than 90 percent of the annual runoff occurring during the winter rainy season between November and April.

San Francisco Bay is typical of estuaries worldwide in that it provides critical habitat for aquatic species, including many commercially and ecologically important marine species that use estuaries as rearing grounds for sensitive early life-stages. San Francisco Bay is also home to hundreds of introduced exotic species, brought in over the last 150 years, primarily in ship ballast water. The San Francisco estuary is made up of many different types of aquatic habitats that support a great diversity of organisms. Suisun Marsh in Suisun Bay is the largest brackish-water marsh in the United States. San Pablo Bay is a shallow embayment strongly influenced by runoff from the Sacramento and San Joaquin Rivers. The Central Bay is the portion of the Bay most influenced by oceanic conditions. The South Bay, with less freshwater inflow than the other portions of the Bay, acts more like a tidal lagoon. Together these areas sustain rich communities of aquatic life and serve as important wintering sites for migrating waterfowl and spawning areas for anadromous fish.

San Francisco Bay

Site Description/ Background

San Francisco Bay is part of an estuarine system which conveys the waters of the Sacramento and San Joaquin rivers to the Pacific

Ocean. This is a highly complex system that includes large brackish marshes, tidal lagoons and freshwater rivers and creeks. The diversity of these ecosystems support a wide variety of organisms. While the upper part of the estuary has been widely used for mining and agricultural activities the San Francisco Bay region has been heavily urbanized and is the site of many industrial activities and ports.

The San Francisco estuary has high concentrations of metals due to contributions from numerous sources, both natural and anthropogenic. Natural sources include drainage of water from formations that are naturally enriched in some metals, such as the Franciscan Formation that is exposed throughout the Bay area, and the rocks that make up the Sierra Nevada Mountains. This drainage flows into the streams that empty into the Bay. Localized concentrations of these metals were exploited in a great wave of mining activity from the 1820's continuing, in some cases, into the 1970s.

Mercury was mined at numerous locations in the Coastal Range and then transported to the Sierra Nevada foothills to be used in the amalgamation of gold in placer and hydraulic mining. Drainage from natural mercury deposits, mine tailings, and directly from mining activities have had a major impact on the San Francisco Bay and estuary.

San Francisco Bay is an extremely dynamic depositional environment. Sediments flow from the major river systems and are deposited in the Bay. Strong winds and tidal currents resuspend and redeposit these sediments resulting in a system where sediments are well mixed. Bioaccumulative contaminants attach to sediments and are distributed and mixed by the same physical processes. Therefore, the sediment acts as a sink for contaminants. The sediment, however, is also a source of contaminants to organisms in the aquatic food chain and ultimately to humans.

Although the San Francisco estuary extends from the ocean up through the river systems, the jurisdiction of the San Francisco Bay RWQCB only extends to the area just west of Antioch. The Central Valley RWQCB includes the Delta and extends through the river systems. Since the health advisory on fish consumption effects both Regions, it is important that a coordinated strategy is developed, especially in regard to mercury contamination.

Reason for listing

In 1994, the BPTCP conducted a study to measure the levels of contaminants in fish in San Francisco Bay (SFBRWQCB, 1995). Results from the study indicated that six chemicals exceeded the screening levels based on U.S. EPA guidance (U.S. EPA, 1993, 1995) that were established prior to the study. These chemicals were PCBs, mercury, DDT, chlordane, dieldrin and dioxins. In response to the results of the study, the Office of Environmental Health Hazard Assessment (OEHHA) issued a health advisory on consumption of fish caught in San Francisco Bay and the Delta. The health advisory was primarily based on elevated levels of PCBs and mercury in fish tissue and the human health risk related specifically to these chemicals. While, DDT, dieldrin, chlordane and dioxins were also listed as chemicals of concern as a result of exceedance of screening values, OEHHA determined that the health concerns associated with these chemicals were less than for PCBs and mercury. Therefore, while the general discussion will include DDT, dieldrin, chlordane and dioxins, the remediation plan for San Francisco Bay will focus on mercury and PCBs.

Areal extent

The San Francisco Bay and Delta cover approximately 1631 square miles.

Sources

Mercury

Mercury was mined in the Coast Range from the early 1800s through the mid-1900s. Initially most of the mercury was used in the amalgamation of gold in placer and hydraulic mining operations. Mining activity introduced mercury into the San Francisco Estuary system in a number of ways. Runoff from mercury mines within the region transported sediment rich in mercury to the Bay and estuary. In the Sierra, mercury was added to sediment to aid in the separation of gold from waste in placer and hydraulic mining operations. Most of this mercury ended up in the aquatic system, becoming attached to sediment particles flushing downstream. The mining of gold and silver ores may also expose surrounding rock that was enriched in mercury by the same geologic processes that created the gold and silver deposits, again introducing sediment enriched in mercury to the stream systems that drain into San Francisco Bay. Ongoing drainage from these

mines has introduced mercury and other metals into the streams that drain into the estuary.

Core samples of Bay sediment indicate background concentrations of mercury of 0.06 +/- 0.02 ppm dw (Hornberger et al., 1999). Superimposed upon these background levels are concentrations that reflect historic and ongoing loadings. Core samples of Bay sediment indicate that an historic gradient of contaminated sediment (up to 0.9 ppm Hg) entered the Bay from the Sacramento-San Joaquin Delta during the Gold Rush, then diffused into cleaner sediment as it moved seaward towards the Golden Gate. These core samples indicate a contaminated (0.5-0.9 ppm Hg) layer buried in the sediment, the depth of which varies from location to location, with the most concentrated levels of mercury in the upper estuary. Surficial sediments throughout the Bay system generally contain 0.3 to 0.4 ppm mercury, except in areas of the lower South Bay affected by drainage from the New Almaden mining area. Mixing between these two sediment layers is a key factor in determining the concentration of mercury in surficial sediments, the mass balance of mercury in the Bay and the rate at which concentrations can change.

The estuary, therefore, has become a sink for sediments rich in mercury and an ongoing source for the bioaccumulation of mercury up the food chain. Monitoring data from the BPTCP shows that mercury concentrations in the estuary are elevated and highly dispersed. There are a number of individual sites around the margins of the Bay where mercury concentrations higher than these generally elevated levels are found. These are usually due to past industrial practices such as the smelting of ore.

Although there is very little active mining in the San Francisco Bay drainage system, runoff from abandoned mines and mine tailings continue to be an ongoing source of mercury to the estuary. Data from the Sacramento River indicate that the Cache Creek drainage and the Sacramento drainage above the Feather River are major, ongoing sources to the lower watershed. In the southern part of San Francisco Bay, the major ongoing source is the drainage from New Almaden mining region. Other less significant sources include urban runoff, POTWs, industrial discharges and aerial deposition. Recent pollution prevention audits indicate that human waste, water supplies, laundry waste, household products, and waste from hospitals and dental facilities are the most significant sources to POTWs. Known industrial discharges of

mercury are from raw materials used in the facilities. About half the aerial deposition appears to come from global fuel combustion and the other half from local fuel combustion.

The key environmental concern about mercury in the San Francisco Bay system is the extent to which it bioaccumulates in the food chain. Bioaccumulation, in turn, is governed by the level of methyl mercury in the aquatic environment. Methyl mercury is formed primarily by microbial activity, and only under certain physical and chemical conditions. A complex set of factors influence the rate and net production of methyl mercury by bacteria. These include chemical factors that change the oxidation state of mercury in the aquatic system; "habitat" characteristics that promote the growth of methylating bacteria such as the availability of sulfur compounds used as food and the presence of anoxic zones conducive to these bacteria; and much larger scale processes such as wind, tide, and runoff patterns that serve to mix and transport particle bound mercury throughout the estuary. Significant changes in any of these factors may potentially change the rate of mercury methylation. These processes must be better understood in order to appropriately manage environmental risks associated with the existing reservoir of mercury, as well as to regulate ongoing sources. A particular concern is to prevent the creation of environments, that is some subset of these physical and chemical factors, that may increase the rate of mercury methylation.

PCBs

PCBs have also accumulated in the sediments of the estuary due to historic use. This class of chemicals is comprised of 209 compounds called congeners. Mixtures of congeners have been manufactured in the U.S. since 1929 and sold under the trade name Aroclor. These mixtures were used extensively in the U.S. prior to 1979 when their manufacture, processing, use and application was banned, except in totally enclosed applications such as transformers. PCBs were used for industrial applications requiring fluids with thermal stability, fire and oxidation resistance, and solubility in organic compounds. PCBs have proven to be extremely persistent in the environment. RMP monitoring data indicate that in the water column PCBs exceed non-promulgated U.S. EPA water quality criteria throughout the estuary. This is most probably due to resuspension from the sediments, although ongoing sources may still contribute a significant amount of PCBs. BPTCP monitoring has shown that, except for a few areas, PCBs

are fairly well mixed in the sediments of the estuary where they provide an ongoing source to organisms in the food chain.

Although the use of PCBs has been banned there are historic deposits in the sediment and on land. Point Potrero, at the Port of Richmond, had ten times the PCB concentration (19.9 ppm) of any other sample collected under this region's BPTCP and the highest concentration of any BPTCP sample in the state. Stormwater events can mobilize PCBs deposited on land and transport them into the estuary. Recent monitoring by the RMP has shown that there seems to be current sources contributing to PCB loads in the South Bay from Coyote Creek. In addition, a recent RMP workgroup evaluating PCBs has come to the preliminary conclusion that there are probably significant ongoing sources of PCBs to the Bay. Increased monitoring is necessary to identify and cleanup any ongoing sources.

Chlorinated Pesticides

Three chlorinated pesticides exceeded screening levels in the BPTCP fish study: DDTs, chlordanes and dieldrin. All three have similar properties in that they are extremely persistent in the environment and highly lipid soluble. Since these lipid soluble compounds are not easily metabolized or excreted, they are stored in fatty tissue and can readily bioaccumulate in fish tissue with high lipid content.

Although all three of these chemicals have been banned for use in the U.S. for approximately 20 years they are still commonly detected in sediments and in tissue. These compounds are dispersed in the sediments throughout the estuary. One large historic source of DDT, Lauritzen Canal in Richmond Harbor, has been recently cleaned up. Other sources may be detected through increased monitoring of stormwater.

Dioxins

Dioxins are released into the environment as by-products of thermal and chemical processes. These chemicals are not intentionally manufactured. Stationary sources include the incineration of municipal, hospital and chemical wastes, paper pulp chlorine bleaching, oil refining and the manufacturing of pesticides and PCBs. Mobile sources include combustion engines in cars, buses and trucks, particularly those that use diesel fuel. Since the great majority of dioxins are emitted directly to the air, their primary source to the aquatic environment is through aerial

deposition and runoff. The Bay Area Air Quality Management District has estimated that 69% of the current dioxin emissions in the Bay area is from on and off road mobile sources and 15% from residential wood burning. The San Francisco Bay RWQCB staff has estimated that greater than 90% of dioxins entering the Bay are transported by stormwater runoff or result from direct deposition from the air to the Bay.

Castro Cove

Description of site

Castro Cove is a protected embayment located in the southern portion of San Pablo Bay in Richmond, California. Castro Cove is defined as the cove enclosed by a line drawn from the Point San Pablo Yacht Club breakwater to the northwest corner of the West Contra Costa Sanitary Landfill. The embayment is protected by diked margins on the west, south and most of its eastern margin. The southeastern portion, where Castro Creek enters the cove, is a salt marsh. Castro Cove is shallow with extensive mudflats and marshlands that are subject to tidal action. Castro Creek empties into a channel that is about 30 to 75 feet wide and about three to six feet deep at mean lower low water.

Historical Background

Since studies started in 1987 for Chevron's deep water outfall, petroleum hydrocarbons have been detected in Castro Cove. Several studies showed high levels of PAHs in the southwest portion of Castro Cove, the area where an historic outfall was located. The last surface sample collected in Castro Cove by the BPTCP, in 1995, had the highest concentration of PAHs measured in over 600 samples analyzed for PAHs statewide. The concentration of PAHs in this sample (227,800 ppb) was over four times the ERM and was collected in the top five centimeters of sediment. This was the highest concentration of PAHs ever collected at this site. Individual PAHs also exceeded ERMs. Several studies, including the BPTCP, also showed levels of mercury exceeding the ERM. In the last BPTCP sampling, chlordane was measured at levels exceeding the ERM and selenium and dieldrin were measured at elevated concentrations.

Toxicity tests have been conducted on sediments from Castro Cove on five separate occasions. Significant toxicity has been observed in several species of amphipods and in urchin and bivalve development tests during the five sampling events. The southwest

portion of the cove always showed toxicity when sampled. The last samples collected by the BPTCP, in 1995, had 0% amphipod survival and 0% normal urchin development.

For three years, from 1988 to 1990, the State Mussel Watch Program deployed mussels in Castro Cove. Their results showed increasing concentrations of PAHs over these three years. In addition, the last sample collected had the second highest PAH concentration (40,210 ppb dry weight) of any sample measured statewide in the 20 year history of the program.

The benthic community at Castro Cove has been sampled three times, in 1989, 1990 and 1991. All three sampling events identified species in Castro Cove that were indicative of stressed or frequently disturbed environments. An evaluation of the 1991 data in the 1996 RMP Annual Report categorized this site as a moderately contaminated sub-assemblage due to the presence of species indicative of stressed environments.

As part of the PRMP gradient study conducted in Castro Cove in 1991, speckled sanddabs were exposed to Castro Cove sediment in the laboratory. Results showed increasing effects with increasing PAH concentrations. The most significant effects were seen in fish exposed to sediment from the area of the old outfall. Fish exposed to sediments collected at stations in Castro Cove showed statistically significant gill histopathology. Gill histopathology was significantly correlated with PAH concentration of the sediment, as well as with P4501A content in the gills and hepatic EROD activity, both indicators of exposure to PAHs.

To comply with State Order 86-4 and an NPDES permit requiring an investigation of sediment quality along a deep-water outfall, an E.V.S. study was undertaken in 1987. The focus was to determine the quality of the deep sediments at sites along the location of the deepwater outfall. Oil and grease and petroleum hydrocarbons were detected at one location just outside Castro Cove. The results of the amphipod survival test showed lower survival rates with sediments from Castro Cove. For the bivalve larvae bioassay, all five test samples had significantly lower rates of normal development than the sediment control.

A three-year monitoring program at Castro Cove conducted by Entrix determined that Castro Cove sediments were finer than those from Castro Creek and from San Pablo Bay. Oil and grease

was detected both in Castro Cove and in offshore sediments. The greatest concentrations of oil and grease within Castro Cove were usually detected where Castro Creek enters Castro Cove. Mercury was detected at concentrations greater than the ERM in Castro Cove. Other Entrix investigations determined that Castro Cove sampling locations showed the top four species of benthic taxa, and they are considered indicators of stressed or frequently disturbed environments.

As part of the State Mussel Watch Program, bioaccumulation of contaminants was measured in Castro Cove (SWRCB, 1995). The concentration of PAHs from mussels collected on March 21, 1990 was the second highest concentration measured statewide in the 20 year history of the State Mussel Watch Program.

Castro Cove was sampled three different times under the BPTCP to determine if sediments were being naturally capped. Chemical analyses and toxicity tests were performed to determine if concentrations of contaminants or the levels of toxicity were decreasing. Samples were collected in Castro Cove under the Pilot Regional Monitoring Program (PRMP), the Reference Site Study and the Screening/Confirmation Studies.

The southwest sediment station, which was closest to the old outfall, had a PAH concentration greater than the ERM at depth and greater than the ERL on the surface. Porewater development tests for the deep core layers indicated significant toxicity at three of the four Castro Cove sites, including the southwest station, relative to the reference site. Only the southwest station exhibited toxicity in the deep core elutriate urchin larvae development test. It was determined that the benthic community at Castro Cove was representative of a moderately contaminated sub-assemblage due to the presence of species indicative of stressed environments. Castro Cove sediments showed alteration of the gills of speckled sanddabs, and indicated exposure to PAHs.

The 1995 Castro Cove sediment sample had the highest PAH concentration of the more than 600 sediment samples analyzed for PAHs statewide in the BPTCP. Mercury and chlordanes were detected at concentrations greater than the ERM. Selenium and dieldrin also had elevated concentrations. Toxicity test results showed 100% amphipod mortality and 100% abnormal development in the urchin development test.

Areal Extent

Based on the distribution of oil and grease and PAHs, two main areas of contamination can be delineated: the south/southwest and the north/northeastern portions of Castro Cove. Similar patterns in the surface distribution of mercury are also evident. The distribution of biological effects is slightly more extensive than the chemical distribution, but overlays the spatial area delineated by detection of oil and grease and PAHs. Although horizontal extent has not been bounded, the contaminated area is estimated to range between 10 and 100 acres based on past studies and the established boundaries of Castro Cove. The depth of contamination has not been determined, but in one set of core samples the depth of visible petroleum hydrocarbons seemed to extend from the surface to approximately three feet below the sediment surface, the maximum depth of the cores.

Sources

The Chevron refinery and the San Pablo Sanitary District discharged effluent directly into Castro Cove until the 1980's. Currently, the refinery and San Pablo Sanitary District discharge their waste effluent into San Pablo Bay via two separate deep-water outfalls. Contaminants may have also entered Castro Cove via Castro Creek due to urban runoff.

From the turn of the century, Chevron discharged wastewater which was only treated by an oil water separator into Castro Creek up to a rate of 50 MGD. The Chevron USA refinery discharged treated effluent into Castro Cove from 1972 until 1987. San Pablo Sanitary District discharged untreated sewage into Castro Creek near the confluence with Wildcat Creek until 1955 when construction of a municipal treatment plant was completed. From 1955 to 1981, the district discharged treated effluent directly into the cove through a channel running along the southern end of the West Contra Costa Landfill. In 1981, the district relocated its outfall to a deep-water site offshore of Point Richmond. These discharges were not associated with the Chevron Refinery effluent discharges.

Based on the historical discharge of untreated waste by the Chevron refinery and the presence of petroleum related contaminants (oil and grease and PAHs), Chevron is the most likely source of the contamination in Castro Cove.

Peyton Slough

Description of Site

Peyton Slough is located in Martinez, northern Contra Costa County, California. The slough discharges into the San Francisco estuary at the confluence of Suisun Bay and the Carquinez strait, near Bull Head Point, just east of the Benecia Bridge.

Sediments in Peyton Slough are comprised of firm clays that do not appear to erode easily. Sediments from Peyton Slough appear to have been dredged in the past with the dredge spoils deposited on the east and west shore forming levees. There are openings in the east levee downstream of the tidal gate that provide exchange between Peyton Slough and a large brackish wetland to the east of the slough.

During the winter, Peyton Slough receives fresh water discharge from the Contra Costa Canal and storm water runoff from the surrounding area. During the dry weather months, Peyton Slough receives fresh water treated discharge primarily from a waste water treatment plant (Mountain View Sanitary District) through a tidal gate. Some minor flow from the Contra Costa Canal may also occur during the dry months. A tidal gate had been configured such that fresh water from upstream can be released when the water level is greater on the upstream side of the gate. In 1998, this tidal gate was replaced with a newer gate which will allow water to flow from the bay into a wetland area situated upstream from Peyton Slough.

Two major historical industrial activities have taken place in the vicinity of Peyton Slough on a site currently owned and operated by Rhodia: sulfuric acid production and the smelting of copper. Historically, the first recorded industrial use near Peyton Slough was by the Mountain Copper Company (MOCOCO). This company used the site for a copper smelting operation from the early 1900s until 1966 at which time it was purchased by Stauffer Chemical Company. During the smelting of copper, a fused silicate slag was generated which was discharged over the north and south sides of the hillside housing the smelter. MOCOCO also roasted pyrite ore to recover its sulfur. Resulting cinders remain on site.

Cinder and slag, classified as Class B Mining Waste, from the smelting operations were stored in large piles on the site. The

north cinder/slag area covers 8.3 acres, while the south cinder/slag covers 7.1 acres. Due to their weights, the cinder and slag piles subsided 30 to 35 feet into the softer bay mud below the existing ground surface. Stauffer Chemical Company bought the site from MOCOCO and removed the cinder/slag piles to the depth of the water table, but it is estimated that over 500,000 tons of waste material remains below the surface. The remaining north and south cinder/slag piles have been capped with a minimum of two feet of low permeability soil in 1978 and 1980 respectively.

In 1972, a leachate removal and containment system (LRCS) was installed in response to cease and desist order No. 71-21 issued by the RWQCB. The LRCS prevented leachate from moving to Carquinez Strait and Peyton Slough by a cut-off wall consisting of compacted bay mud along the bay shoreline. Prior to 1988, the leachate from the north cinder/slag area was pumped to a north solar evaporation pond. Leachate from the south cinder/slag piles was pumped from two deep sumps to the south solar evaporation pond. Starting in 1988, the Process Effluent Purification (PEP) system was installed and begun treating this leachate prior to discharge to a deep water outfall. Cutoff walls were not constructed along Peyton Slough. However, to date there is no evidence that leachate is being discharged into the slough.

Currently, the Contra Costa Mosquito Vector Control District (CCMVCD) is planning a restoration project in Shell marsh. This project intends to restore the marsh south of Peyton slough back to a brackish marsh with regular inputs of salt water from San Francisco Bay. As part of this project, the CCMVCD has replaced the tidal gate in Peyton Slough and is proposing to dredge Peyton Slough to allow for higher flows of saline water up the slough into Shell marsh. This project is partially funded by Caltrans to mitigate for discharge from Route 680 and to prevent flooding of the highway. Rhodia is also working with CCMVCD to coordinate the dredging of Peyton Slough. Regional Board staff has been helping to coordinate completion of the marsh restoration project in order to remediate the toxic hot spot, restore Shell marsh and alleviate flooding on Route 680.

Reason for Listing

Multiple investigations have shown that sediments from Peyton Slough have elevated concentrations of metals, especially copper and zinc. Copper and zinc concentrations in Peyton Slough were the highest from over 600 samples analyzed statewide by the

BPTCP. The metal contamination can be traced to past activities at a nearby industrial site, and perhaps also to the continued presence of slag and cinder below the water table. The contaminated sediment was shown to exhibit recurrent toxicity over time to two different aquatic organisms, and the Toxicity Identification Evaluation (TIE) points to metals as the source of toxicity. In addition, although benthic community indices categorized this site as transitional, the upper and end stations rated only slightly higher than the cutoff of 0.3. Recent studies indicate that there are elevated concentrations of cadmium, copper, lead and zinc detected throughout Peyton Slough.

Areal extent

Elevated metal concentrations were detected from the mouth of Peyton Slough all the way to the tidal gate. Toxicity to aquatic organisms was found at all BPTCP locations, but recurrent toxicity was only measured at the upper sampling location. The areal extent of the channel is approximately 1.25 acres. In specific locations, vertical extent of contamination could not be determined as the deepest sample, 8 feet below the sediment surface, still showed elevated concentrations of one or more metals.

Sources

The most likely source of contaminants in Peyton Slough is the historical industrial activity associated with the creation of the cinder/slag piles. Potential current subsurface transport of metals in groundwater from the buried cinder piles to Peyton Slough is not known.

Stege Marsh

Site Description

Stege Marsh occupies approximately 23 acres on the western margin of San Francisco Bay in the City of Richmond, California. Stege Marsh is located on property currently owned by Zeneca Agricultural Products and the University of California Field Station. The cinder landfill separates east and west Stege marsh. The East Bay Parks District currently owns the land south of the historic railroad track which is now a hiking trail.

Eastern Stege marsh rests directly on the alluvial fan-deltaic deposits of Carlson Creek interspersed with Bay mud. Bedrock at the site is likely to be Franciscan Formation rocks, cretaceous and younger in age, consisting of an assemblage of marine sedimentary

and volcanic, and some metamorphic rocks (The Mark Group, 1988). Western Stege Marsh is fed by Meeker Creek. Between 1947 and 1969, a railroad track was constructed just south of Stege marsh resulting in siltation and thus the extension of the tidal marsh into a previously subtidal area (May, 1995).

Stauffer Chemical Company utilized the industrial portion of the site to roast pyrite ores for the production of sulfuric acid from about 1919 until 1963. This industrial process resulted in the production of cinders, which were placed on the site surface. Elevation at the bottom of the cinders is at mean sea level throughout the facility, which indicated past placement of cinders at ground level. The presence of a layer of peaty silt under the base of the cinders also supports that cinders were disposed of on the site surface. The cinder pile extends along the north and east sides of Stege marsh. The cinders were covered with a one-foot clay layer, that was itself covered by a one-foot layer of topsoil to comply with RWQCB Order No. 73-12 and its 1974 amendment.

Besides pyrite cinders, other products that have been generated or utilized on the industrial site include fuels, sulfuric acid, ferric sulfate, proprietary pesticides, solvents and alum. Until recently, Zeneca produced proprietary agricultural chemicals on the industrial portion of the site. Currently, Zeneca uses the site solely as a research laboratory. The discharges resulting from past industrial activities were treated through a series of settling, neutralization and alum mud ponds ending in two evaporation ponds situated just north of the marsh. Effluent discharge from the two evaporation ponds into the marsh occurred at two points, one in between the two evaporation ponds and the other located southeast of the evaporation ponds. The ponds were closed in the early 1970s and replaced with new lined ponds. The discharge of stream waste to the marsh ended in the 1980s. Since then, treated effluent has been discharged from the evaporation ponds into the Richmond sanitary sewer system. Under wet weather conditions, when the city of Richmond cannot handle inflow and the holding capacity of the Zeneca Facility are exhausted, discharges to the marsh are permitted. Contaminated groundwater from the industrial portion of the site is being removed by an intercept trench, treated and discharged with the treated industrial effluent.

In western Stege marsh several explosives manufacturing companies had been in production since the 1840s. During this time various areas were used for the production of mercury

fulminate, manufacturing of ammunition shells and blasting caps, and storage and testing of explosives (Jonas and Associates 1990).

Historical Background

In 1991, URS Corporation performed a site investigation for U.S.EPA and found elevated concentrations of metals and metalloids (arsenic, copper, lead, mercury, selenium, and zinc) and organic contaminants (DDTs and PCBs). A follow up sediment investigation by ICF Kaiser also found elevated concentrations of metals and metalloids (arsenic, copper, lead, and zinc). Organic contaminants were not detected by ICF Kaiser, but were reported with elevated detection limits due to analytical interferences. Zeneca and the RWQCB independently analyzed a split sediment sample from the north-western section of the marsh and found elevated concentrations of metals, metalloid and organic contaminants.

The BPTCP program collected screening sediment samples at three locations: 21401 in the Richmond field station, 21402 in the north-west section of eastern Stege marsh and 21403 near outfall 002 , as well as a reference sample in Carlson Creek (21404). All three marsh samples had elevated concentrations of metals, metalloids and organic compounds, and resulted in 100% mortality of *Eohaustorius estuarius*. Locations 21401 and 21402 were resampled as part of the BPTCP confirmation sampling. Both sediment samples were toxic to *Eohaustorius estuarius* with 99 and 100% mortality respectively. The Relative Benthic Indices of 0 were measured at these two sampling locations, indicating the lack of living organisms present at the time of the sampling. Stege marsh falls in the high priority toxic hot spot category due to elevated chemistry (including the highest concentrations of arsenic, selenium and several pesticides measured by the BPTCP statewide), recurrent sediment toxicity, and impairment to in-situ benthic organisms.

A summary of investigations conducted at Stege marsh is presented in the following sections.

ICI Americas Investigations (1987)

In 1987, ICI Americas sampled 10 foot cores of sludge and the underlying soil in the neutralization pond, surge pond, carbon column pond, agriculture yard pond and both evaporation ponds. The sludge samples were analyzed for total and WET extractable metals. Elevated concentrations of arsenic, copper and zinc were

found in samples from the two evaporation ponds. Soluble threshold limit concentrations (STLC) were also exceeded for arsenic and lead in samples from the evaporation ponds. Effluent from these two evaporation ponds was regularly discharged to the marsh in the past. Samples from other ponds had elevated concentrations of copper, lead, selenium and zinc. These samples also had detected concentrations greater than STLCs for copper and zinc. Metal contaminated soil below the sludge in the ponds may contribute to these concentrations since both soil and sludge were sampled and homogenized. Relevant analytical results are listed in Table D-1. This study indicates that the evaporation ponds may have been a source of contaminants to Stege marsh.

The Mark Group Investigations (1990, 1991)

These two reports present the results of an underground site investigation of the cinder area next to Stege marsh. Hydrologic data are also reported but are not discussed in this report.

These investigations resulted in the production of cross-sections depicting the horizontal and vertical extent of the cinders in upland soils. Potential presence of cinders in the marsh was not investigated, although the presence of subsurface cinders was mapped in upland soils up to the edges of Stege marsh. Also, the chemical constituents of the cinders were not reported as part of this site investigation. Cinders may have been and/or remain a potential source of contamination in or near Stege marsh.

URS Corporation Investigation (1991)

URS Corporation performed an investigation of the chemistry of the marsh sediments in 1992 for the U.S. EPA. Elevated concentrations of arsenic, copper, lead, mercury, selenium, zinc, DDTs and PCBs were detected in samples throughout Stege marsh during this investigation. This investigation indicated that Stege marsh is contaminated with multiple chemicals.

Woodward-Clyde Consultants Investigation (1993)

Woodward-Clyde Consultants performed a subsurface investigation next to Stege marsh of the extent of cinders and groundwater hydrology and chemistry. Cinders were found next to the marsh, but the marsh was not investigated for the presence of cinders. Groundwater chemistry results showed low pH and elevated solution concentrations of metals and metalloids in some monitoring wells next to Stege marsh. This investigation suggests

that subsurface transport of chemicals was and/or remains a pathway for contamination in Stege marsh.

ICF Kaiser Investigation (1997)

In 1997, ICF Kaiser undertook a follow-up investigation to that by URS Corporation. Arsenic, copper, lead and zinc were again detected with elevated concentrations. Mercury and selenium concentrations were detected but at lower concentrations than in the URS Corp. investigation. Since chemical concentrations were reported on a wet weight basis in this study, comparisons to other analytical results and to screening guidelines are not possible. DDTs, DDEs and DDDs were not detected in sediment samples in this investigation likely due to the elevated detection limits reported for these compounds. Mercury concentrations were not as elevated as in the URS investigation, but the areas with elevated mercury concentrations were not sampled by ICF Kaiser. As with the URS Corporation investigation, contamination of Stege marsh by metals and metalloids was evident in these data.

Zeneca and RWQCB sediment sample (1997)

In 1997, Zeneca and SFB-RWQCB jointly collected a sediment sample in the northwest corner of Stege marsh based on a complaint received by the SFB-RWQCB of a barren area in this location. Split samples were sent to two independent laboratories for chemical analyses. Metal results show elevated concentrations of arsenic, cadmium, copper, lead, selenium and zinc. Organic compounds detected at concentrations above San Francisco Bay ambient sediment concentration include chlordanes, dieldrin, hexachlorohexanes, DDTs and PCBs. Again note that the results from the Zeneca split sample are reported on a wet weight basis. Contamination of Stege marsh is evident by the elevated concentration of chemicals reported.

Bay Protection and Toxic Cleanup Program (1998)

Under the Bay Protection and Toxic Clean-up Program, the RWQCB collected three screening and two confirmation samples from Stege marsh, as well as a reference sample from Carlson Creek. Sampling location 21401 is located in the Richmond field station in the vicinity of the cinder pile. Sampling location 21402 is situated in the barren portion of the Stege marsh on Zeneca property. This is in the vicinity of the SFB-RWQCB sample discussed in the previous section. Sample location 21403 is situated in Stege marsh south of evaporation pond 1 near outfall 002. Reference samples (location 21404) were also collected from

Carlson Creek during both screening and confirmation sampling events.

The three screening samples were analyzed for chemical constituents. As with the URS Corp. study, elevated concentrations of arsenic, copper, mercury, selenium, zinc and DDTs were detected at concentrations much greater than both ERM and ambient concentrations. Arsenic and selenium concentrations were the highest measured in 544 samples collected statewide in the BPTCP. In these samples, PCBs were also detected at concentrations much greater than both ERM and ambient concentrations. Also, multiple chlorinated pesticides were detected at elevated concentrations. Dieldrin, endosulfan sulfate, mirex, oxadiazon and toxaphene were detected in Stege marsh at the highest concentrations from over 600 samples collected statewide by the BPTCP. The mean ERM quotients were 2.7 (21401), 0.61 (21402) and 2.59 (21403). Mean ERM quotients greater than 0.5 are believed to represent elevated concentrations of mixtures of chemical compounds. These chemicals are detected at concentrations in Stege marsh that are believed to pose a threat to waters of the state.

Exposure to all three sediment samples from Stege marsh resulted in 100 percent mortality to *Eohaustorius estuarius* in the 10-day solid phase bioassay. The two confirmation samples also exhibited high mortality (99 and 100 percent) for the same bioassay. Urchin development bioassays using a sediment-water interface exposure resulted in 100 percent abnormal development for the two sediment screening samples. These results denote a significant impact of the sediments to these test species.

Benthic community analysis of the two confirmation samples from Zeneca marsh found no living individuals. The measured Relative Benthic Index was zero denoting the total absence of benthic organisms in these sediments. This represents a significant impact to the marsh biota.

Pacific Eco-Risk Laboratories

In 1998, Zeneca Agricultural performed a site investigation in sloughs and the northwest corner of eastern Stege marsh. The results showed elevated concentrations of arsenic, copper, lead, mercury, selenium and zinc in the sediments. Toxicity to the bivalve embryo *Mytilus edulis* was found at multiple locations in the sloughs and in the northwest corner of eastern Stege marsh

(Table D-10). Toxicity to *Eohaustorius estuarius* was found at all locations sampled in Stege marsh. The pH of sediment and porewater samples at this site was, in general, unusually low. The pH of several highly acidic sediment and porewater samples was adjusted to a normal pH and toxicity tests were repeated. Although pH adjustment lowered the toxicity of most samples, high levels of toxicity remained in all undiluted porewater samples and in 1 out of the 2 sediment samples in which pH was successfully adjusted. In addition, there was toxicity at stations with normal pH. Low pH seems to contribute to toxicity at some stations at this site, however, it is clear that other factors play a significant role. Benthic community analyses showed decreased populations in the northwest corner of eastern Stege marsh.

Areal extent

Based on the distribution of elevated concentrations of metals, metalloids and organic compounds, three areas of contamination can be seen. The first is near evaporation pond 1 and outfall 2. This area has elevated concentrations of arsenic, mercury, zinc and DDTs. The second area is in the north-west corner of eastern Stege marsh and is characterized by low pH measurements, elevated concentrations of arsenic, copper, zinc and DDTs, aquatic toxicity, and is devoid of benthic organisms. The third area is located in the U.C. Richmond Field Station. This location is characterized by elevated concentrations of arsenic, mercury, selenium, zinc, DDTs and aquatic toxicity, and is devoid of benthic organisms. Further study may show that these areas are continuous rather than discrete. Regardless, the areal extent of the THS is greater than 10 acres. The entire marsh encompasses an area of 23 acres.

Sources

Oxidation of pyrite cinders in the presence of sulfides is the most likely source of the low pH at the site. Leaching of metal at this low pH is a probable source of toxicity. Subsurface transport of metals from upland cinders may also be a source of contaminants to Stege marsh. Effluent discharge from the two evaporation ponds is also a likely source of contaminants to Stege marsh. Contaminants may have also entered the marsh via Carlson or Meeker Creeks in urban runoff or from upland industrial facilities. In western Stege Marsh munitions manufacturing is a possible source.

Point Potrero/Richmond Harbor

Site Description

The site designated Point Potrero/Richmond harbor is a 400 foot long intertidal embayment, the Graving Inlet, on the western side of the Shipyard #3 Scrap Area at the Port of Richmond. The Shipyard is currently used as a parking lot, but in the past the site has been used for shipbuilding, ship scrapping, sand blasting and metal recycling. The geographic feature identified with the site is Point Potrero, although the original configuration of the point has been modified by quarrying of a bedrock hillside and filling of intertidal mudflats.

The embayment known as the Graving Inlet was excavated in 1969 to allow ships to be beached in shallow water for final scrapping operations. Site investigations have shown that the sediments in the Inlet have the same types of contaminants found in the adjacent Shipyard #3, including heavy metals, PCBs and PAHs. While the most heavily contaminated sediments are in the intertidal zone and shallow subtidal zone within the Inlet, elevated levels of PCBs and metals are also found in the subtidal zone outside of the inlet.

Historical Background

Point Potrero has been listed as a candidate toxic hot spot due to the extremely high levels of bioaccumulative contaminants, including the highest levels of PCBs and mercury found by the BPTCP in over 600 samples collected statewide. These contaminants are listed in the San Francisco Bay/Delta Fish Advisory as primary chemicals of concern to human health due to fish consumption. In addition, there is a site-specific health advisory for the Richmond Harbor Channel area based on PCBs and DDTs that was issued by the Office of Environmental Health Hazard Assessment (OEHHA) and published by the California Department of Fish and Game. Lauritzen Canal, the source of the DDT was cleaned up, under CERCLA, by the summer of 1997.

Levels of contaminants found in the Inlet exceed ERMs in most cases. For example, PCBs exceed ERMs by up to 110 times and mercury by over 10 times. Attempts have been made to associate sediment concentrations of particular contaminants in fish tissue. Concentrations of PCBs at Point Potrero exceed the Washington State Department of Ecology proposed human health based sediment quality criteria by more than 3 orders of magnitude.

Regulatory agencies became involved with the onshore portion of the site in 1984, starting with investigations of leaking and/or unlabeled drums. PCBs, metals and oil and grease were identified in the soils and sandblast waste at the site. Between 1987 and 1988, preliminary remedial actions occurred onshore (removal of drums, sand blast waste and underground storage tanks), the site was graded, storm drains were installed and up to two feet of road base aggregate was added to the site.

Areal Extent

The area that has the highest levels of contaminants (Graving Inlet) has a well-characterized boundary and comprises about one acre. This area is surrounded on three sides by land and the open end of the inlet has been defined by five cores with subsamples at 0 to 0.5 feet, 0.5 to 2.5 feet and 2.5 to 4.5 feet. Other areas along the waterfront have elevated levels of metals (including mercury), PCBs and PAHs, but there is conflicting data on the concentrations and extent of contamination. It is possible that contaminants may extend over one or two additional acres.

Sources

The contaminants found in the sediments near Point Potrero are the same as those found on the adjacent upland: metals, PCBs and PAHs. These areas were the site of shipbuilding operations during World War II and later ship scrapping activities. The sediments with the highest chemical concentrations are found in the Graving Inlet.

Industrial activities that have taken place at the site in the past include: shipbuilding, ship scrapping, and metal scrap recycling. Prior to 1920 the site consisted of unimproved marshland and tidal flats at the foot of the Point Potrero hills. During World War II, the U.S. government appropriated much of the waterfront for wartime ship construction. The two finger piers on the west side of the site were constructed between 1942 and 1949. From the end of World War II until 1964 the site was leased to Willamette Iron and Steel for use as a ship repair, construction, scrapping and steel fabrication facility. After 1964 the shipbuilding and steel fabrication ended when Levin Metals took over the site, but scrapping and recycling continued until 1987. In 1969, the Graving Inlet was excavated into the northwest shoreline of the property to allow final dismantling of the keels of scrapped ships. These activities are the most probable source of sediment contamination at the Graving Inlet and around Point Potrero.

Mission Creek

Site Description

Mission Creek is a 0.75 mile long arm of the Bay in the eastern side of the San Francisco waterfront. Formerly, the estuary of Mission Creek reached back a couple of miles. It was filled to roughly its present dimension before the turn of the century. Currently, the creek is 100 to 200 feet wide in most sections and narrower at the two bridges at 3rd and 4th Streets. Concrete rip rap and isolated bands of vegetation line Mission Creek's banks.

Ten to fifteen houseboats are docked at the Mission Creek Harbor located between 5th and 6th Streets along the south shore of the creek. Many of the houseboats have year round on-board residents.

The City and County of San Francisco operates seven combined sewer overflow structures in Mission Creek from 3rd Street to the upper end at 7th Street. Light industrial and urban development line the shores of Mission Creek. A new baseball stadium will soon open on the north shore at the mouth of Mission Creek near 2nd Street in China Basin. Currently, demolition debris cover the remainder of the north shore. According to City plans, new retail development will occupy this area in the near future. Along the south shore, there is a golf driving range near 6th Street, warehouse facilities, and a sand and gravel operation near the mouth of the Creek. Finally, Interstate Freeway 280 crosses over Mission Creek between 6th and 7th Streets.

Reason for listing

The upper end of Mission Creek in the vicinity of 6th Street meets the definition of a toxic hot spot due to impacts on aquatic life resulting from contaminated sediment. The primary basis for the determination is the BPTCP data. Also, data from a 1979 study the City and County of San Francisco commissioned support the determination. Below is a summary of these data and the specific reason for listing.

The BPTCP data show that the upper end of Mission Creek has recurrent sediment toxicity, elevated concentrations of chemicals, and an impacted benthic community. The report, Sediment Quality and Biological Effects in San Francisco Bay (Hunt et al., 1998a), contain details of these data. Also, the 1979 study the City and County of San Francisco commissioned to assess the impacts of

their wastewater overflows (CH2M Hill, 1979) provides support that there are elevated metals and an impaired benthic community at this site.

The BPTCP results show recurrent toxicity to both the amphipod and sea urchin tests at a station located in the upper end of Mission Creek. The amphipod survival was 5 and 19 percent, in the screening and confirmation phases, respectively. Sea urchin larvae development was zero percent normal in the pore water and 11 percent normal in the sediment-water interface exposure. All of these results were lower than the respective reference envelope limits for that test, less than 90% the appropriate minimum significant difference (MSD), and significantly different than controls.

This toxicity is associated with mean ERM quotients of 0.51 for the screening phase and 3.93 for the confirmation phase. The value of 3.93 is the highest of all the BPTCP stations in the Bay. The chemicals consistently found above the ERM values are chromium, lead, and chlordane. Mercury, copper, silver, zinc, dieldrin, PCBs, phenanthrene, and PAHs were also found above the ERM values during confirmation sampling. In addition, chlorpyrifos and mirex levels were in the top 10% of samples in the statewide BPTCP database.

The 1979 study supports the conclusion that there are elevated metals in the sediments at this site. Data from a station 20 yards upstream of 6th Street show metals in the sediment above the ERM levels for copper, lead, mercury, nickel, silver, and zinc.

The BPTCP benthic community analysis for this site shows a Relative Benthic Index (RBI) of zero. A RBI of less than or equal to 0.3 is an indicator that pollutants or other factors are negatively impacting the benthic community.

The 1979 study found no benthic organisms with the exception of one invertebrate, an oligochaeta, in one out of five sampling events between February and April.

During the reference site study a large composite sediment sample was collected from Mission Creek for a Phase I TIE. This sample was toxic to the amphipod *Eohaustorius*. There were high levels of unionized ammonia and hydrogen sulfide in the sample. After the ammonia and hydrogen sulfide were removed toxicity

remained. This residual toxicity had to be due to toxicants other than ammonia and sulfide, since those two compounds were reduced to non-toxic levels. However, the residual cause of the toxicity could not be determined (S.R. Hansen & Assoc., 1996).

Areal extent

Our best estimate of the areal extent of the toxic hot spot at this time is approximately 9 acres. This includes the entire width of Mission Creek from its upper end at 7th Street down to the 4th Street bridge. This is a rough estimate based on data from the BPTCP, as discussed below. The precise areal extent is unknown at this time because there are insufficient sampling locations. Additional sampling is necessary to define the actual areal extent, however, it is estimated that it may range from 5 to 12 acres.

The BPTCP collected samples at three stations along Mission Creek: one at the upper end near 6th Street, another near the mouth and a third (added during the confirmation phase) located midway between the two near 4th street. It is data from the upper end station that forms the primary basis for determining that this area is a toxic hot spot.

For the western boundary of the toxic hot spot, we assumed that the upper end station is representative of the sediments upstream to the end at 7th Street. This is a conservative assumption and accurate if the primary source of pollutants is from the combined sewage overflow discharge points located at 6th and 7th Streets. Data from a 1979 study also supports this assumption. The data show elevated metals and impaired benthic community in sediment collected upstream of 6th Street (CH2M Hill, 1979).

We believe the eastern boundary of the toxic hot spot may extend to the 4th Street bridge based on data from the BPTCP midway station. The data show that the sediments here are somewhat impacted though not as impacted as at the upper end station.

Sources

The most likely source of pollutants is either historic or legacy source or storm water either by way of direct discharge to the channel or as discharged during the infrequent combined sewer overflows (CSO) operated by the City and County of San Francisco. Other sources may include deposition from air emissions from vehicles traveling the Interstate 280 overpass and surrounding streets. PAHs are associated with fossil fuel

combustion and mercury along with other metals are a contaminant in diesel exhaust. The magnitude of these various sources is still to be determined, however it is probable that all sources have an effect on the toxicity at this location.

The City and County of San Francisco operates seven CSO discharge points into Mission Creek. The largest one is located at the upper end near 7th Street (often referred to as the Division Street overflow structure). The City reports that this CSO structure receives approximately 95% of the overflows. Other CSO structures are located along Mission Creek at 6th, 5th, 4th and 3rd Streets.

CSO discharges consist of sanitary sewage, industrial wastewaters, and storm water runoff from the City's combined sewer system. Currently, CSO discharges occur when storm water and wastewater flows exceed the treatment capacity of the City's treatment plants. The City is currently permitted to overflow an average of ten times per year to the structures in Mission Creek. Before about 1988, the overflows were untreated and occurred anytime rainfall exceeded 0.02 inches per hour. After 1988, newly constructed storage and consolidation facilities provided treatment of the overflows equivalent to primary treatment standards. Primary treatment involves removal of a significant portion of settleable and floatable solids from the wastewaters.

Although there is sparse data on the quality of the historic overflows to Mission Creek, data from recent discharges and other similar sources support the conclusion that the CSOs are source of the pollutants. These data show that most if not all the pollutants exceeding ERMs in the sediment at this site are also present in urban runoff and/or sewage. Additionally, a 1979 study commissioned by San Francisco concluded that the accumulative impact of the CSOs on the sediments was evident (CH2M Hill, 1979). The impact of CSO events on sediment distribution and the relationship of historic versus current discharges is uncertain.

Islais Creek

Site Description

Islais Creek is a one mile long channel of the Bay running east-west on the San Francisco waterfront near the foot of Potrero Hill and Caesar Chavez Street. Formerly, the estuary of Islais Creek reached back a couple of miles as far as Bayshore Boulevard, and

was fed by a creek that ran down what is now Alamy Boulevard. Before the turn of the century, the area was filled to roughly its present size.

A bridge at Third Street forms a narrow 100-foot wide constriction that physically divides the channel into two segments. The eastern segment is approximately 400 to 500 feet wide; the western, 250 to 300 feet wide.

The City and County of San Francisco operates four wet weather overflow structures that discharge into the western segment. San Francisco also operates a sewage treatment plant effluent outfall that discharges into the western segment at Quint Street.

The banks of Islais Creek are covered with concrete rip-rap with narrow bands of vegetation in small isolated areas. Long stretches of creek bank in the eastern segment are under pier structures. Old pier pilings dot the southern shore of the western segment.

Light industrial and urban development surround Islais Creek. On the shores of the eastern segment are a sand and gravel facility, grain terminal, oil and grease rendering facility, warehouse, and container cargo terminal. Auto dismantlers and auto parts dealers, scrap metal recyclers, and warehouses make up the bulk of the current activities surrounding the western segment. Interstate 280 passes over the western end of Islais Creek.

Reason for listing

The western segment of Islais Creek meets the definition of a toxic hot spot due to impacts on aquatic life resulting from contaminated sediment. The primary basis for our determination is the BPTCP data. Data from various other studies also support our determination. Below is a summary of these data and the specific reasons for listing.

The BPTCP data show that the western segment of Islais Creek has sediment toxicity, elevated concentrations of chemicals, and an impacted benthic community. The report Sediment Quality and Biological Effects in San Francisco Bay (Hunt et al., 1998a) contain these data. The BPTCP report Evaluation and Use of Sediment Reference Sites and Toxicity Tests in San Francisco Bay (Hunt et al., 1998b) contain additional details. Also, a research study in 1987 and a study MEC conducted for San Francisco provide supporting data for our determination that this site is a

toxic hot spot. Below are summaries of the data related to each of the three factors.

Recurrent Toxicity

The BPTCP results show recurrent toxicity to both the amphipod and sea urchin tests at a station located in the western segment of Islais Creek. The BPTCP collected sediment samples from this station during the reference site study in 1995 (which served as the screening for this site), and two years later during a confirmation phase.

The amphipod survival was 57% and 0%, in the screening and confirmation phase, respectively. The sea urchin larvae development was 0% normal in the pore water and sediment-water interface during the screening phase. In the confirmation phase, there was only 8% normal development. All of these results were lower than the respective reference envelope limits for that test, less than 90% of the appropriate minimum significant difference (MSD), and significantly different than controls.

During the reference site study, a large composite sediment sample was collected for a Phase I Toxicity Identification Evaluation (TIE). The results of the Phase I Characterization procedures indicated that the sediments from Islais Creek were toxic to the urchin *Strongylocentrotus p*). Sediments were high in unionized ammonia and hydrogen sulfide. When the ammonia and hydrogen sulfide were removed there was still toxicity remaining. The residual toxicity had to be due to toxicants other than ammonia and hydrogen sulfide since those two compounds were reduced to non-toxic levels. The cause of the remaining toxicity was not identified but may have been due to polar organics (S.R. Hansen & Assoc., 1996).

Data from a research study in 1987 supports the finding of toxicity in sediments in the western segment of Islais Creek. This study found toxicity to amphipods and mussel larvae (Chapman et al., 1987).

A study MEC conducted for the City and County of San Francisco in 1996 shows toxicity to amphipods compared to controls in four out of fifteen samples in the western segment (MEC, 1996). Although this study did not find toxicity at all locations in the western segment, the results still support recurrent toxicity and may suggest sediment quality is dynamic in this segment.

Elevated Chemicals

The toxicity described above is associated with a mean ERM quotient of 1.18 for the confirmation phase. This quotient is calculated from the concentrations of a list of metals and organic compounds divided by an average of sediment quality guideline values (ERMs) for those compounds. Sediments with a quotient of greater than 0.5 are considered to have elevated chemical concentrations. The chemicals found above the ERM values are chlordane, dieldrin, PCBs, and low molecular weight PAHs. In addition, endosulfan sulfate was in the top 10% of samples in the statewide BPTCP database.

Data from a 1979 study by CH2M Hill and another research study in 1987 support the conclusion that there are elevated PCBs in the sediments in the western segment. The 1979 study found a mean of 500 ug/kg total Aroclor; the 1987 study found total PCBs at 255 ug/kg (Chapman et al., 1987). Furthermore, the 1987 study found sediments with elevated low and high molecular weight PAHs.

These studies also found metals in the western segment sediments above ERM values. The metals include lead, mercury, and silver. Sediment monitoring in the western segment of Islais Creek by the City and County of San Francisco from 1990 to 1993 show levels of mercury exceeding the ERM in every year except 1990. The ERM value for lead was also exceeded in 1991 (CCSF, 1990-1993).

Impacted Benthic Community

The BPTCP benthic community analysis of the western segment of Islais Creek shows a RBI of 0.22. A RBI of less than or equal to 0.3 is an indicator that pollutants or other factors are negatively impacting the benthic community.

The 1979 study found few to no benthic organisms in five sampling events between February and April in the western segment of Islais Creek. There were a total of only eleven species, six of which the report's authors noted as being unusual because they were freshwater organisms or fly larvae common at sewage treatment plants.

A 1987 research study concluded that this area of Islais Creek was the most depauperate compared to other sites in the study, in terms of taxa richness and total abundance (Chapman et al., 1987).

Areal extent

At this time, our best estimate of the areal extent of the hot spot is approximately 11 acres, comprising the entire width of Islais Creek from its upper end at Selby Street down to Third Street. This is a rough estimate based on data from the BPTCP, as discussed below. The precise areal extent is unknown at this time because there are insufficient sampling locations. Additional investigation is necessary to determine the actual areal extent which may range from 5 to 35 acres.

The BPTCP collected samples at three stations along Islais Creek: one at the upper end near Selby Street, and the other two down stream about 200 feet west (mid-gradient) and 400 feet east (lower end) of the Third Street Bridge. The last two were added during the confirmation phase. It is data from the upper end station that forms the primary basis for determining that that area is a toxic hot spot. Therefore, the western boundary for the toxic hot spot is the upper end of Islais Creek at Selby Street.

The eastern boundary of the toxic hot spot extends out to the Third Street Bridge and probably farther east towards the Bay. The BPTCP data show that the sediments at the mid-gradient station are impacted though not as highly impacted as at the upper end station. The sediment at this station was toxic to sea urchin larvae with 47% normal development, had elevated chemicals with an ERM quotient of 0.6, and had a Relative Benthic Index (RBI) of 0.25.

Support for the statement that the toxic hot spot extends farther east of the Third Street Bridge comes from the last BPTCP station and other studies. These other studies show that the quality of sediments in the eastern segment of Islais Creek has high variability either spatially or temporally. These studies include one by the National Oceanic and Atmospheric Administration in 1992 (Long et al., 1992), another by the Lawrence Berkeley National Laboratory in 1995 (Anderson et al., 1995), and two others by Advanced Biological Testing in 1998 (ABT, 1998a and 1998b).

In 1997, the sediments at the BPTCP lower end station appear impacted. The sediment was toxic to amphipods with 49% survival, and had elevated chemicals with an ERM quotient of 0.62. However, the benthos was less impacted than the other two BPTCP stations with a RBI of 0.43.

A 1992 study collected sediments from Islais Creek at stations further east of the BPTCP stations. These data show mercury, PAHs, and PCBs at concentrations above ERM levels (Long et al., 1992). There was also observed cytogenetic effects on mussel and sea urchin larvae exposed to sediments at these stations compared to controls (Long et al. 1992). The 1995 study also found sediment in this vicinity to be toxic to sea urchins and mussels compared to a reference site (Anderson et al., 1995).

Studies conducted in 1998 for the Port of San Francisco sampled sediments midway along the north shore of the eastern segment of Islais Creek (ABT, 1998a; 1998b). The purpose of the studies was to characterize the sediments for maintenance dredging. The data did not show elevated concentrations of chemicals although several samples were toxic to mussel larvae and one sample was toxic to amphipods.

Sources

The most likely source of pollutants is some combination of storm water and urban runoff either entering the channel directly or through the combined sewer overflow (CSO) operated by the City and County of San Francisco. Another possible source is San Francisco's treatment plant discharge outfall at Quint Street. Because of recent improvements in treatment of the discharges from the CSO and the Quint Street outfall in the past two years, historic discharges from these sources are probably more of a factor than current discharges. Other sources may also contribute. And the actual magnitude of contribution of sources is still to be determined. Additional description of all these sources and potential sources are below.

CSOs

The City and County of San Francisco operates four CSO discharge points into Islais Creek. Two are at the upper end near Selby Street (referred to as the Selby Street and Marin Street overflow structures). The other two CSO structures are at Third Street.

CSO discharges consist of sanitary sewage, industrial wastewaters, and storm water runoff from the City's combined sewer system. CSO discharges occur when storm water and wastewater flows exceed the treatment capacity of the City's treatment plants. The City is currently permitted to overflow an average of four times per year to the structures in Islais Creek. Newly constructed storage

and consolidation facilities provide treatment of the overflows equivalent to primary treatment standards. Primary treatment involves removal of a significant portion of settleable and floatable solids from the wastewaters. However, prior to the completion of these consolidation facilities in 1996, the overflows were untreated and occurred anytime rainfall exceeded 0.02 inches per hour.

Although there is sparse data on the quality of the historic overflows to Islais Creek, data from recent discharges and other similar discharges support the conclusion that the CSOs are one of the sources of the pollutants. Most if not all the pollutants exceeding ERMs in the sediment at this site are or were pollutants in urban runoff and/or sewage. Additionally, a 1979 study commissioned by San Francisco concluded that the accumulative impact of the CSOs on the sediments was evident (CH2M Hill, 1979).

Quint Street Outfall

This outfall is at the south shore of Islais Creek at Quint Street just west of the Third Street Bridge. San Francisco uses this outfall when wastewater flows from the Southeast Wastewater Treatment Plant exceed the capacity of the main deep water discharge outfall to the Bay. The capacity of the deep water outfall is 100 million gallons per day.

After completing a re-piping project and increasing the secondary treatment capacity of the plant in 1997, San Francisco discharges only secondary treated wastewater to the outfall. Prior to 1997, the Quint Street outfall received a blend of primary and secondary treated wastewaters from the treatment plant.

Secondary treatment is a higher level of treatment than primary. Primary treatment relies on physical separation and removal of settleable and floatable solids. Secondary involves using biological treatment technologies which can remove dissolved pollutants. Secondary treatment standards require removal of at least 80% of the suspended solids and oxygen consuming matter from the sewage.

As is the case for the CSO, most if not all the pollutants exceeding the ERMs in the sediment at this site are or were pollutants in treated sewage. Therefore, the discharges from the Quint Street Outfall are or were a likely source of pollutants.

Other Potential Sources

Other sources of pollutants to Islais Creek may include sheet runoff or any past discharges from auto dismantlers and metal recycling facilities bordering Islais Creek. Deposition from air emissions from vehicles traveling the Interstate 280 overpass and surrounding streets may also contribute. PAHs are associated with fossil fuel combustion. Mercury and other metals are contaminants in diesel exhaust.

Central Coast Region (Region 3)

Moss Landing and Tributaries

Site Description

Moss Landing and the surrounding vicinity has special importance for both the State and Nation. Because of the unique nature of the marine environment within the area, the National Oceanic and Atmospheric Administration (NOAA) established the Monterey Bay National Marine Sanctuary in 1992. Elkhorn Slough is a NOAA National Estuarine Research Reserve. These designations reflect the high resource values found within the area.

Moss Landing Harbor receives drainage water from Elkhorn Slough watershed, Moro Cojo Slough watershed, Tembladero Slough watershed, the Old Salinas River, and the Salinas River.

The watershed areas include only the lower portions of the Salinas watershed. Some Salinas River water drains to the Old Salinas River and then to Moss Landing Harbor. A slide gate near the mouth of the Salinas River permits approximately 250 cubic feet per second to pass to the Old Salinas River (Gilchrist et al., 1997). Other watercourses such as the Blanco Drain and the Salinas Reclamation Canal also drain either directly or indirectly to Moss Landing Harbor.

Because of a "high" ranking for impacts to aquatic life due to sediment toxicity with confirming chemistry and tissue bioaccumulation, the areal extent of the problem, and the sensitive nature of the area, "high priority toxic hot spot" status is warranted for the Moss Landing area. The area was given a moderate ranking for Human Health because of pesticide levels in tissue repeatedly exceeding federal standards. It was not given a "high" ranking for Human Health because health advisories have not been issued recently.

Sediments from Moss Landing Harbor have been shown for a number of years to contain high levels of pesticides, in some cases at levels which cause concern for human and aquatic life.

Concentrations of a number of pesticides in fish and shellfish tissue have exceeded National Academy of Sciences (NAS) Guidelines, USEPA Screening Values, and Food and Drug Administration (FDA) Action Levels.

In addition to pesticides, PCBs have also been identified as a concern in the Harbor and its watershed; they have been detected in shellfish tissue by the State Mussel Watch Program at elevated concentrations for many years.

High levels of Tributyltin exceeding EPA Screening Values have been detected in mussel tissue at several locations in the Harbor. The Harbor's watershed supports substantial agricultural and urban activities, which are sources of pesticides and other chemicals. Several chemicals detected by the program have been banned for many years. Although chemical types and usages have changed, banned chemicals, particularly chlorinated hydrocarbons, are still mobilized through eroding sediments. Actions to alleviate this problem consist of proper disposal of dredged materials, source control management measures for the chemicals of concern, and management of erosion of associated sediment.

Moss Landing was given a moderate "remediation potential" ranking according to BPTCP guidelines, since improvements may or may not occur over time without intervention. Although concentrations of persistent chemicals which have been banned will eventually decrease without action in aquatic systems, the time involved in significant reductions in the Harbor would have to be measured in decades. Reducing land erosion and implementing Best Management Practices in urban, agricultural and harbor areas will remediate the problem more rapidly and provide other benefits for both the land and Harbor. Both chemical concentrations and the volumes of sediment which must be dredged from the Harbor will be reduced, improving aquatic habitat and reducing problems with dredge spoil disposal. Implementation of appropriate erosion control practices will serve to restore and protect the status of beneficial uses including navigation, aquatic life, and human health.

Background and most likely sources of pollutants

The majority of chemicals found at excessive concentrations in the Harbor and its tributaries are pesticides, and most have already been banned. Chemical exceedances of State Mussel Watch and Toxic Substances Monitoring Program guidelines have been detected from fish and shellfish data collected within the Moss Landing watershed in the past ten years (Rasmussen 1991, 1992, 1993, 1995a, 1995b, 1995c, 1996, 1997). Tissue data (Rasmussen, 1995, 1996, 1997) shows that total DDT values in the southern Harbor increased dramatically after the end of the drought of the mid and late 1980's. Other pesticides follow a similar trend. Nesting failure of the Caspian Tern (a bird species of special interest) in Elkhorn Slough in the heavy rain year of 1995 was attributed to high tissue levels of DDT resulting from storm-driven sediments (Parkin, 1998). High flow events carry large amounts of chemical-laden sediments into sensitive aquatic habitats and the Moss Landing Harbor. Soil erosion from numerous sources is a major transport mechanism for a variety of chemicals impacting the Harbor (Kleinfelder, 1993).

Agricultural Activities

Past and present storage and use of agricultural biocides is a primary source of chemicals found in Moss Landing Harbor. Fine sediment in runoff from agricultural land is the primary transport mechanism for many chemicals (Kleinfelder, 1993; NRCS, 1994; AMBAG, 1997). Erosion from farm land is a concern for private landowners and the public alike. Though most of the chemicals of concern are no longer applied to agricultural land, they are still present in soils. Banned chemicals found in soils tested on agricultural land in the Elkhorn Slough watershed include DDT and its breakdown products, Dieldrin, Endrin, Chlordane and Heptachlor Epoxide (Kleinfelder, 1993, RWQCB, raw data 1998). Though PCBs were used extensively in industrial applications, prior to 1974 they were also components of pesticide products and may originate from agricultural as well as industrial sources (U.S. EPA Envirofacts, 1998). Several currently applied chemicals have been detected at various sites in the watershed, including Chlorpyrifos, Diazinon, Dimethoate and Endosulfan (Ganapathy et al., draft).

River and Stream Maintenance Activities

Local agency personnel indicate DDT was used for mosquito control in the sloughs draining to Moss Landing in past years (Stillwell, pers. comm., 1997). This must have introduced large

amounts of DDT and its breakdown products directly into the river and estuarine systems.

River systems in the area have been treated for riparian plant control for a number of years in order to increase water supply and channel capacity (Anderson-Nichols & Co., 1985). Vegetation removal, which increases flow velocities and consequent sediment transport, may exacerbate erosion and transport of chemicals of concern.

Urban Activities

Large amounts of certain pesticides are used in the urban environment. These have included chlordane and dieldrin for treatment of termites and other wood boring insects, and diazinon and other chemicals for household and garden use.

PCBs were widely used in industrial applications prior to 1974, when their use was confined to transformers and capacitors. They have not been used in any application since 1979. Because of their diverse past use and extreme persistence, they are still present at many sites throughout the watershed.

Polyaromatic Hydrocarbons (PAHs) are petroleum related chemicals. These are common pollutants in urban runoff, from improperly handled waste oil, street and parking lot runoff, and other sources.

Sampling conducted in Tembladero Slough for BPTCP found highest levels of dieldrin below the City of Salinas, exceeding Effects Range Median (ERM) values by six-fold. Concentrations of this chemical generally decreased with distance below the City. Other concentrations for nearly all measured pesticides and PAHs were higher here than anywhere else measured in the drainage. Both sediment and water toxicity were found at this site. (SWRCB et al., 1998). Because agricultural activity occurs above the City of Salinas and no sampling site was placed upstream of the City, it is not possible to discriminate between agricultural and urban sources at this time. However, the decrease in concentrations in downstream agricultural areas indicate that urban sources may be significant contributors and should be the subject of further study.

Harbor Activities

Tributyltin has been documented over the years at several sites in Moss Landing Harbor. This chemical was the active ingredient in antifouling paint for boat bottoms. Its use has been banned for many years, but it is persistent in the environment. Other chemicals associated with Harbor activities include PAHs, copper, zinc, and other metals.

Cañada de la Huerta – Shell/Hercules Site

Site Description

The Shell Western/Hercules Gas Plant site (now owned by Aera Energy LLC (Aera)) is located adjacent to Cañada de la Huerta, approximately 18 miles west of Goleta in Santa Barbara County. The plant was constructed in 1963 and operated until 1988. It processed natural gas from offshore wells for pipeline transport. The site is located in a canyon (known as Cañada de la Huerta) that is approximately 3600 feet in length (from the headwaters of the canyon to the ocean) and approximately 1200 feet wide (from ridge to ridge). This canyon can be divided into four zones described as follows:

Sea Cliff - This zone is approximately 400 feet in length and includes the canyon's point of discharge from a three-foot diameter culvert to the sea wall and into the ocean. The culvert inlet is located on the north side of Highway 101 and runs beneath the highway and the Union-Pacific Railroad right-of-way.

Lower Canyon – This zone is approximately 700 feet in length and includes a riparian area with a perennial surface water flow fed by groundwater seepage.

Fill Pad – This zone is approximately 600 feet in length and was the former location of Shell Western E&P Inc.'s gas plant. Shell constructed a terraced fill pad, involving three levels, through this zone. The Fill Pad was constructed from soils excavated at the head of this canyon. A four-foot diameter culvert is located beneath and along the full length of this zone. The culvert's inlet is located in a sediment retention basin, described below, and terminates at the head of the Lower Canyon.

Upper Canyon – This zone is approximately 1500 feet in length and includes riparian areas along an ephemeral stream. There is a sediment retention basin at the south end of this zone. As

indicated, the head of the Upper Canyon was the borrow site for constructing the Fill Pad.

In 1986 soils at the site were discovered to contain PCBs and other chemicals, due to operations and maintenance at the plant, and storage of a heat transfer fluid onsite. In 1988, a remedial investigation was initiated, as a result of a Consent Agreement between Shell Western and the Department of Toxic Substances Control. The investigation found soils containing PCBs in concentrations exceeding 50 parts per million (ppm). The soil was excavated from the site and removed to a landfill for disposal. A Human Risk Assessment comprised a large part of the analysis associated with the Remedial Action Plan. The analysis only considered individuals in direct contact with the site. Cleanup at 50 ppm was deemed appropriate to protect Human Health given a "Reasonable Maximum Exposed" individual. This corresponds to the Toxic Substances Control Act Protection Level for PCBs, but is considerably less protective than other suggested protection levels as published in the National Sediment Quality Survey (U.S. EPA, 1997).

Data collected as part of the post-remediation monitoring program in 1997- 98 indicate that PCB levels at the site still violate USEPA, Ocean Plan, and Basin Plan standards in both surface and ground water by orders of magnitude. Toxicity has been documented in both water and sediment. Sediment PCB levels from post-remediation sampling have ranged at some sites between 3,000 and 20,000 ppb (wet weight). These values are orders of magnitude higher than numerous protective levels referenced in the 1997 U.S. EPA document which are intended to provide protection for various beneficial uses.

A number of different species still show elevated tissue levels of PCBs, with many exceedances of EPA Screening levels (10 ppb), FDA Action Levels (2,000 ppb), and/or NAS Guidelines for protection of wildlife (500 ppb). Worm tissue collected at the site is particularly high in PCBs. Tissue from marine species, including mussels and shore crabs, are also elevated above EPA Screening levels and Maximum Tissue Residual Levels.

It was assumed at the onset of post-remediation monitoring that the site could take a year or more to stabilize following treatment. The first year of monitoring data indicates both water quality violations and tissue bioaccumulation concerns. In spite of prior remediation

efforts, the site appears to qualify at this time as a high priority toxic hot spot based on Bay Protection and Toxic Cleanup Program guidelines; we recommend that it be included as a “known toxic hot spot”.

Aera (formerly Shell) owns 56 acres of this canyon (a portion of the Lower Canyon, the Fill Pad and Upper Canyon). Four acres of Aera’s property was used as the gas plant site area (essentially the Fill Pad zone). It is unclear to what extent the remediation effort reduced the areal extent of contamination at the site, but it is likely that the areas remediated are still a source of contamination (e.g., soils were taken from a sediment retention basin onsite to fill the excavated area in the lower canyon). At least ten acres may still require additional remediation in order to fully protect beneficial uses. We are proposing amending the Post-Remediation Monitoring Program to address this issue.

Background and most likely sources of pollutants

The Shell Western E & P Inc. Hercules Gas Plant used a heat transfer fluid, Therminol oil, as part of the treatment process while in operation from 1963 to 1989. This fluid contained PCB. PCBs were released to site soils, ground waters and surface waters from Shell’s various practices at this site. In addition to PCBs, activities at the plant caused releases to the environment of benzene, toluene, xylenes, ethylbenzene, total petroleum hydrocarbons and polynuclear aromatic hydrocarbons, along with many other chemicals and some metals.

Some pollution, though probably minimal, may possibly also originate from Highway 101 and railroad right-of-way stormwater runoff, which discharges to the seawall culvert onsite.

Los Angeles Region (Region 4)

Region Description

The Los Angeles Region encompasses all coastal drainages flowing to the Pacific Ocean between Rincon Point (on the coast of western Ventura County) and the eastern Los Angeles County line, as well as the drainages of five coastal islands (Anacapa, San Nicolas, Santa Barbara, Santa Catalina and San Clemente). In addition, the region includes all coastal waters within three miles of the continental and island coastlines.

The region contains two large deepwater harbors (Los Angeles and Long Beach Harbors) and one smaller deepwater harbor (Port Hueneme). There are small craft marinas within the harbors, as well as tank farms, naval facilities, fish processing plants, boatyards, and container terminals. Several small-craft marinas also occur along the coast (e.g., Marina del Rey, King Harbor, Ventura Harbor); these contain boatyards, other small businesses and dense residential development.

Several large, primarily concrete-lined rivers (e.g., Los Angeles River, San Gabriel River) lead to unlined tidal prisms which are influenced by marine waters. Salinity may be greatly reduced following rains since these rivers drain large urban areas composed of mostly impermeable surfaces. Some of these tidal prisms receive a considerable amount of freshwater throughout the year from publicly-owned treatment plants discharging tertiary-treated effluent. Lagoons are located at the mouths of other rivers draining relatively undeveloped areas (e.g., Mugu Lagoon, Malibu Lagoon, Ventura River Estuary, Santa Clara River estuary). There are also a few isolated coastal brackish water bodies receiving runoff from agricultural or residential areas.

Santa Monica Bay, which includes the Palos Verdes Shelf for the purposes of the Bay Protection and Toxic Cleanup Program, dominates a large portion of the open coastal waters in the region. The region's coastal waters also include the areas along the shoreline of Ventura County and the waters surrounding the five offshore islands in the region.

Santa Monica Bay/Palos Verdes Shelf

The contaminated sediments on the Palos Verdes Shelf appear to significantly impact the marine community and may pose a serious threat to individuals who regularly consume fish from the area. Currently, elevated levels of DDT and PCBs are found in the organisms that live in the area of the contaminated sediments, including bottom feeding fish such as white croaker, and water column feeders such as kelp bass. Marine mammals and birds may be affected through the consumption of contaminated fish (Ecological Risk Evaluation Report for the Palos Verdes Shelf, Draft report prepared by SAIC for United States Environmental Protection Agency, September 1998).

The ongoing release of these hazardous substances from the sediment into the environment and the resulting accumulation of DDT and PCB in food chain organisms may persist if no action is taken. Commercial fishing and recreational fishing have been affected by the contamination. The State of California has published recreational fishing advisories for most areas offshore of Los Angeles and Orange Counties and has closed commercial fishing for white croaker on the Palos Verdes Shelf.

Areal Extent of the Toxic Hot Spot

In July 1996, the United States Environmental Protection Agency initiated a response action under Superfund site and began an evaluation to address the large deposit of DDT and PCB contaminated sediments on the Palos Verdes Shelf. The contaminated sediment footprint identified as the study area for this evaluation was defined as the boundary for one part-per-million (mg/kg) sediment DDT concentration described by the United States Geological Survey (USGS), covering portions of the continental shelf and continental slope between Point Vicente in the northwest and Point Fermin to the southeast. This entire area is proposed as a candidate known toxic hot spot. Studies by the U.S. Geological Survey in 1992 and 1993 indicated that this layer of contaminated sediments is about two inches to two feet thick and covers an area of more than 15 square miles, with the highest concentrations located in a 3-square mile band near the outfall pipes. The total volume of contaminated sediments on the Palos Verdes Shelf is approximately 9 million cubic meters and covers a surface area of approximately 40 square kilometers, with approximately 70% of this volume present on the continental slope in water depths less than 100 meters. The total mass of p,p'-DDE

in the contaminated sediments is estimated to be greater than 67 metric tons.

In samples collected for the Bay Protection and Toxic Cleanup Program sediment concentrations at stations exceeded the ERM thresholds for Total DDT and Total PCB. Samples collected at other stations also exceeded the ERM thresholds for Total DDT and Total PCB. Porewater toxicity to abalone was recorded, as was a degraded benthic community at other stations in the area.

Sources of Pollutants

From 1947 to 1983, the Montrose Chemical Corporation of California, Inc., manufactured the pesticide dichloro-diphenyl-trichloroethane (DDT) at its plant in Los Angeles. Wastewater containing significant concentrations of DDT was discharged from the Montrose plant into the sewers, flowed through the Los Angeles County Sanitation Districts' wastewater treatment plant and was discharged to the Pacific Ocean waters on the Palos Verdes Shelf through subsurface outfalls offshore of Whites Point. Montrose's discharge of DDT reportedly stopped around 1972, and the plant was shut down and dismantled in 1983.

Polychlorinated biphenyls (PCBs) also were present in the wastewater discharged from the LACSD wastewater treatment plant and are found along with DDT in the effluent-affected deposits on the ocean floor along the Palos Verdes Shelf. Historically, PCB contamination entered the sewer system as the result of discharges from several industrial sources.

Although DDT and PCBs were banned in the early 1970s, resuspension of historically deposited sediments continues to be a source of these toxic chemicals. Concentrations of total DDT and p,p'-DDE (the predominant metabolite of DDT) in the surface sediments have remained relatively high since the late 1980s. This suggests that historical deposits are brought to the sea floor surface by a combination of natural physical, chemical or biological processes.

Besides DDT and PCB, there has been little evidence that the concentrations of other toxic organic compounds, such as PAHs and heavy metals (including copper, cadmium, chromium, nickel, silver, zinc and lead), discharged from the LACSD wastewater treatment plant have caused impacts to marine organisms. However, the concentrations of heavy metals in the sediments on

the Palos Verdes Shelf are significantly higher than the background levels found in most parts of Santa Monica Bay and other parts of the Southern California Bight.

Mugu Lagoon/Calleguas Creek Tidal Prism

Monitoring of Mugu Lagoon and the lower Calleguas Creek watershed has identified the following problems: (1) impaired reproduction in the light-footed clapper rail, a resident endangered species inhabiting the lagoon, due to elevated levels of DDT and PCBs; (2) fish and shellfish tissue levels exceeded National Academy of Sciences guidelines for several pesticides; (3) possible exceedances of U.S. Environmental Protection Agency water quality criteria for the protection of saltwater biota for nickel, copper and zinc at some locations; (4) possible impacts to sediment and water quality, as well as aquatic community health, from operations at the Naval Air Base over many years. Several pesticides whose use has been discontinued still are found at high concentrations in the sediment and biota; (5) excessive sediment loading.

The Point Mugu Naval Air Base is located in the immediate vicinity of Mugu Lagoon. The surrounding Oxnard Plain supports a large variety of agricultural crops. These fields drain into ditches which either enter the lagoon directly or through Calleguas Creek and its tributaries. The lagoon borders on an Area of Special Biological Significance and supports a great diversity of wildlife, including several endangered birds and one endangered plant species. Except for the military base, the Oxnard Plain portion of the watershed is relatively undeveloped.

Calleguas Creek and its major tributaries (Revolon Slough, Conejo Creek, Arroyo Conejo, Arroyo Santa Rosa and Arroyo Simi) drain an area of 343 square miles in southern Ventura County and a small portion of western Los Angeles County. This watershed is about 30 miles long and 14 miles wide.

The Calleguas Creek watershed exhibits some of the most active and severe erosion rates in the country. Although erosion rates are naturally high in this tectonically active area, land use also is a factor in erosion and sedimentation problems. Channelization of Calleguas Creek was initiated by local farmers in Somis and downstream areas beginning about 1884, and around Revolon Slough in 1924. Following complete channelization, eroded sediment generated in the higher reaches of the Calleguas Creek

watershed has begun to reach Mugu Lagoon even during minor flood events. At current rates of erosion, it is estimated that the lagoon habitat could be filled with sediment within 50 years.

Urban developments generally are restricted to the city limits of Simi Valley, Moorpark, Thousand Oaks and Camarillo. Although some residential development has occurred along the slopes of the watershed, most upland areas still are open space. Agricultural activities (primarily cultivation of orchard and row crops) are spread out along valleys and on the Oxnard Plain. The U.S. Navy maintains a Naval Air Base on much of the area around Mugu Lagoon.

The main surface water system drains from the mountains and toward the southwest, where it flows through the flat, expansive Oxnard Plain before emptying into the Pacific Ocean through Mugu Lagoon. Mugu Lagoon, situated at the mouth of the Calleguas Creek system, is one of the few remaining salt marshes in southern California along the Pacific Flyway. Threatened and endangered species that are supported by valuable habitats in Mugu Lagoon include the peregrine falcon, least tern, light-footed clapper rail and brown pelican. In addition to providing one of the last remaining habitats on the mainland for harbor seals to pup, Mugu Lagoon is a nursery ground for many marine fish and mammals.

The Eastern Arm of Mugu Lagoon is somewhat removed from the rest of the lagoon and tends to receive water from and drain directly into the lagoon mouth. The arm empties and fills rather quickly, leaving a considerable amount of sand near its western end, but moving towards finer sediments further east. The water tends to be marine in character the majority of the time.

The Main Lagoon and Western Arm are the areas most heavily used by birds (including endangered species). The Western Arm, with its slight gradient and slow water flow, has the most widespread freshwater influence during dry weather, receiving water from several drains. The Main Lagoon is affected primarily by Calleguas Creek, which may carry a considerable amount of fresh water during storms, although this flow generally is funneled into a channel which leads to the lagoon mouth.

Areal Extent of the Toxic Hot Spot

Sediment contamination clearly exists throughout Mugu Lagoon and within the Calleguas Creek Tidal Prism. Problems appear to be worst in the Western Arm of Mugu Lagoon, particularly near the Rio de Santa Clara, which drains neighboring agricultural lands, and parts of the Eastern Arm. Although sediment contamination problems occur in the Main Lagoon, it appears that the large volume of this waterbody and good flushing is helping to keep contamination and associated effects at a lower level than might otherwise be expected. It is estimated that approximately 20% of the Western Arm and approximately 10% of the Eastern Arm of Mugu Lagoon contain contaminated sediments. The total volume of contaminated sediments is estimated to be approximately 725,000 cubic yards (based on approximately 150 acres with 3-foot depth of contamination).

Twenty-two miles of Calleguas Creek are listed as impaired due to high sediment concentrations of pesticides and accumulation in fish and shellfish. However, the area with the greatest contamination problem is estimated to cover approximately 3 miles. The total volume of contaminated sediments is estimated to be approximately 50,000 to 100,000 cubic yards.

In samples collected for the BPTCP on February 6, 1997, sediment concentrations at stations 48013.0, 48014.0, 48015.0, 48016.0, 48017.0 and 48018.0 exceeded the ERM Thresholds for p,p'-DDE and Total DDT. Station 44054.0 also exceeded the p,p'-DDE threshold on June 19, 1996. No sediment chemistry data was collected during sediment toxicity screening surveys conducted on January 12, 1993 and April 14, 1994.

Amphipod toxicity with whole sediment was observed at stations 44016.0, 44050.0, 44051.0, 44052.0, 44053.0 and 44054.0 on January 15, 1993. Amphipod toxicity was observed at stations 44053.0 and 44054.0 on April 18, 1994, and station 48015.0 on February 10, 1997. A degraded benthic community was found at all of the stations analyzed (48013.0, 48014.0, 48015.0, 48016.0, 48017.0 and 48018.0) on February 10, 1997.

Fish were collected from Mugu Lagoon for bioaccumulation analyses. Shiner surfperch exceeded the EPA guidelines for total PCB, but not for total DDT. Topsmelt did not exceed the EPA screening guidelines for total DDT or total PCB.

Sources of Pollutants

Pesticides are of concern in Mugu Lagoon at the mouth of the Calleguas Creek watershed. The primary source of pesticides probably is agricultural runoff, both during dry weather and wet weather. Water-soluble pesticides currently in use, such as diazinon and chlorpyrifos, may be occurring in sediment porewater at high enough concentrations to be causing observed porewater toxicity. These pesticides are likely involved with observed upstream ambient toxicity. Historical discharges of pesticides, such as DDT, PCBs, toxaphene, chlordane and others, probably has contributed to the existing sediment contamination problem. Erosion from unlined channels in the watershed and from agricultural lands probably contributes to the excessive sediment loading in Mugu Lagoon. Metals may originate from non-point source runoff during dry and wet weather conditions.

The RWQCB has issued 37 permits for discharges of wastewater from point sources into the Calleguas Creek watershed. Of the 22 permitted discharges under the NPDES program, 7 are for municipal wastewaters from publicly-owned treatment works, accounting for a combined permitted discharge of 36.7 million gallons per day (98% of the total permitted discharges). Of the remaining NPDES permits, 11 are for discharges of treated groundwater from hydrocarbon or other contamination, and 5 are general permits for discharges of either well development water or ground water from dewatered aquifers at construction sites. In addition, 88 releases of stormwater from major municipalities, certain industrial activities and construction projects are now permitted under the Regional Board's NPDES program for storm water.

Only one landfill, the Simi Valley Landfill, is active in the watershed. Simi Valley Landfill began operating in 1970. Hazardous wastes were accepted until 1983; since that time, only Class III wastes (municipal solid waste) have been discharged at this landfill. Since operations at the landfill predate current regulations for siting waste management units, only a portion of the Simi Valley Landfill is lined in accordance with current regulations. Leaks from unlined portions of the landfill have contaminated ground water in an underlying sandstone aquifer; corrective actions are underway by the operator under the direction of the RWQCB.

Los Angeles/Long Beach Harbors

The Los Angeles and Long Beach Harbors are located in the southeastern portion of the Los Angeles Basin. Along the northern portion of San Pedro Bay, there is a natural embayment formed by a westerly extension of the coastline which contains both harbors, with the Palos Verdes Hills as the dominant onshore feature. Offshore, a generally low topographic ridge is associated with the eastern flank of the Palos Verdes uplift and adjacent Palos Verdes fault zone, and extends northwest across the San Pedro shelf nearly to the breakwater of the Los Angeles Harbor.

The port and harbor areas have been modified over the course of more than one hundred years to include construction of breakwaters, landfills, slips and wharves, along with channelization of drainages, dredging of navigation channels and reclamation of marshland. The inner harbor includes the Main Channel, the East and West Basins, and the East Channel Basin. The outer harbor is the basin area located between Terminal Island and the San Pedro and Middle Breakwaters. Los Angeles and Long Beach Harbor are considered to be a single oceanographic unit, and share a common breakwater across the mouth of San Pedro Bay. The outer harbor areas reflect the conditions of the coastal marine waters of the Southern California Bight, while the inner harbor areas typically have lower salinities.

In the presence of the strong currents and rocky habitat of the outer harbor, aquatic life communities are similar to those of the nearby coast, while the inner harbor supports biota generally found in bays and estuaries. The inner harbor has a mostly soft bottom character.

The major surface drainages in the area include the Los Angeles River, which flows in a channel and drains parts of the San Fernando Valley, as well as downtown and south Los Angeles, into eastern San Pedro Bay at Long Beach. The Dominguez Channel drains the intensely urbanized area west of the Los Angeles River into the Consolidated Slip of the Los Angeles Inner Harbor, carrying with it mostly urban runoff and non-process industrial waste discharges. A major source of both freshwater and waste in the outer harbor is secondary effluent from the Terminal Island Treatment Plant. Waste discharges to the inner harbor area of Los Angeles Harbor consist of both contact and non-contact industrial cooling wastewater and stormwater runoff. Fuel spills and oil spills from marine vessel traffic or docking facilities also contribute pollutants to the inner harbor.

Los Angeles Outer Harbor/Cabrillo Pier

Areal Extent of the Toxic Hot Spot

The site's toxic hot spot status is based on several factors, including a fish advisory warning against human consumption of white croaker, which resulted from an OEHHA study released in 1991 which cited elevated DDT and PCB levels in a number of fish species caught in the area. Sediment DDT levels in some BPTCP samples collected from the site were elevated above that found elsewhere in the harbor, while sediment PCB levels were comparable to other sites. Sediment toxicity fluctuated widely. This is a heavily used sustenance and sportfishing pier. It is unclear whether fish caught there are contaminated from DDT found locally or from sources outside of but close to the harbor. It is estimated that 25,000 to 50,000 cubic yards of contaminated sediments exist within the Cabrillo Pier area (based on 1 to 2 foot depth of contaminants).

Based on samples collected for the BPTCP, sediment concentrations exceeded the ERM Threshold for Total DDT at every station (40010.1, 40010.2, 40010.3, 49001.0, 49002.0, 49003.0) on each occasion that sediment chemistry analyses were conducted (August 18, 1992; September 16, 1992; August 19, 1993; May 19, 1994; February 15, 1994; May 13, 1997). Sediment concentrations also exceeded the ERM for copper at station 40010.1 (Replicates 1, 2 and 3) on February 14, 1994. Amphipod toxicity with whole sediments was observed at station 40010.1 on May 28, 1993, and again at stations 40010.1, 40010.2 and 40010.3 on February 14, 1994. A degraded benthic community was observed at station 40010.2 (Replicate 2) on August 17-19, 1993.

Fish were collected on May 12, 1997, to assess bioaccumulation of DDT and PCB. Total DDT and total PCB in white croaker muscle tissue samples exceeded EPA screening values at stations 49001.0, 49002.0 and 49003.0. Total PCB in white surfperch muscle tissue also exceeded the EPA screening value at all three stations, although total DDT concentrations fell below the EPA screening value. Clams (*Macoma*) collected at station 49002.0 also exceeded the EPA screening value for total PCB. Sources of Pollutants Historical discharges of DDT, PCBs and metals are the probable cause of sediment contamination in the Cabrillo Pier area. Discharge of wastewater effluent from the Terminal Island Treatment Plant is a potential source of pollutants, especially metals. Nonpoint sources of pollutants include spills from ships

and industrial facilities, as well as stormwater runoff. Many areas of the port have experienced soil and/or groundwater contamination, which may result in possible transport of pollutants to the harbor's surface waters.

Los Angeles Inner Harbor/Dominguez Channel, Consolidated Slip

Areal Extent of the Toxic Hot Spot

A reservoir of polluted sediment in Consolidated Slip (moving down from Dominguez Channel) probably is continuing to contaminate a large part of Los Angeles Inner Harbor. It is estimated that approximately 30,000 cubic yards of contaminated sediments exist in Consolidated Slip and approximately 20,000 cubic yards in Dominguez Channel (based on 6 miles of channel contaminated to an average depth of 1 foot).

In limited sampling conducted on July 30, 1992, sediment samples from stations 40006.1 and 40006.2 exceeded ERM thresholds for zinc, total chlordane and total PCB; in addition, station 40006.1 also exceeded the ERM for mercury. Amphipod toxicity with whole sediments, as well as porewater toxicity with the abalone test, were observed at both stations. A degraded benthic community was observed at station 40006.1.

In limited sampling conducted on February 3, 1994, sediment samples from station 40006.1 (Replicates 1, 2 and 3) exceeded ERM thresholds for zinc, total chlordane, total PCB and high molecular weight PAH; in addition, Replicate 3 from this station also exceeded the ERM for mercury. Amphipod toxicity was observed in Replicates 1 and 2 from station 40006.1. Benthic samples were not analyzed on this occasion.

A more extensive survey was conducted at several stations on July 22, 1996, including the collection of surface samples and subsurface samples. Sediment samples from stations 47001.0, 47002.0, 47003.0, 47004.0, 47005.0, 47010.0, 47007.0, 47008.0 and 47009.0 all exceeded at least one ERM threshold, and sometimes exceeded several, including those for cadmium, copper, lead, mercury, zinc, dieldrin, total PCB, low molecular weight PAH, high molecular weight PAH and total PAH. Amphipod toxicity with whole sediment was observed at stations 47001.0 (surface and depth 2), 47002.0 (surface), 47003.0 (surface and depth 2), 47004.0 (surface and depth 2), 40005.0 (surface and depth 2), 47007.0 (surface), 47008.0, 47009.0 (surface) and 47010.0 (surface). A degraded

benthic community was found at stations 47002.0, 47003.0, 47009.0 and 47010.0.

When average ERM Quotient exceeds 1.00, the probability of amphipod toxicity was found to be 71% (Long et al., 1995). When average PEL Quotient exceeds 1.00, probability of significant amphipod toxicity was found to be 56% (McDonald, 1996). Consolidated Slip exceeded both of these effect thresholds at several stations (47004.0, 4006.1, 47002.0, 47009.0, 47003.0, 47008.0, 47001.0, 40006.2, 40007.0). When sediment concentrations were found to exceed 11 or more of the ERM thresholds, 85% of the samples have been found to be significantly toxic to amphipods. When sediment concentrations exceeded 21 or more of the PEL thresholds, 100% of the samples have been found to be significantly toxic to amphipods. One of the Consolidated Slip stations exceeded the ERM threshold (47004.0), but not the PEL threshold.

Sources of Pollutants

Historical discharges of DDT, PCBs and metals probably caused much of the existing contamination. Current point source discharges of process water and other waste streams from refineries located along Dominguez Channel may be contributing to the contamination problem. Numerous nonpoint sources, such as spills, vessel discharges, leaching of pollutants from boat anti-fouling paints, and storm drains, also are present in the area.

McGrath Lake

Site Description and Background

McGrath Lake is a 40-acre lake within McGrath State Beach Park and is under the stewardship of the California Department of Parks and Recreation. The area is managed for low intensity uses, such as hiking and nature observation. Adjacent uses include oil-related facilities to the north and a power generating station to the south. Park land and agricultural fields lie to the east. A public beach is located immediately to the west end of the lake.

The lake surface currently measures approximately 3000 feet in length and is approximately 450 feet at its widest point. It is a shallow lake, with an average depth of approximately 2 feet. The southern portion of the lake generally is deeper than the northern portion, with a maximum depth of approximately 5 feet. The lake contains brackish water, with salinities varying from 2.5 to 5 parts

per thousand throughout much of the lake, with higher salinities (up to 24 parts per thousand) in some of the deeper areas.

The lake does not have an ocean connection, but waves occasionally overtop the beach berm. Water is pumped from the lake to the ocean throughout most of the year to maintain a lowered lake level and avoid flooding of upstream agricultural fields. In addition, the lake is breached intermittently at the southern edge during the wet season to prevent flooding of nearby agricultural fields.

Water sources to the lake include seawater intrusion from the ocean through the coastal dunes, groundwater seepage, and irrigation and stormwater runoff. McGrath Lake was included on the Los Angeles Regional Water Quality Control Board's 1996 list of 303(d) impaired water bodies due to sediment pollution (elevated pesticides and other contaminants) and sediment toxicity. The lake was impacted in 1993 when a ruptured pipeline released nearly 80,000 gallons of crude oil into an agricultural ditch draining into the lake. However, PAH levels in the sediments are relatively low, suggesting little long-term effect on sediment contamination due to the oil spill.

The lake historically was part of the Santa Clara River Estuary. The backdune coastal lake is unique in Southern California and plays a key role in the avian migratory flyway. It is fronted by a coastal dune which is rare because of the undisturbed natural processes, which allow the dunes to continue to grow and build.

McGrath Lake is an important coastal resource that has been impaired by high levels of trace metals, pesticides, and other organic contaminants. Elevated levels of several chemical contaminants in the lake sediments and the demonstrated toxicity of these sediments appear to have limited productivity within the lake and threatens the health of wildlife, such as birds, associated with the habitats provided by the lake.

Areal Extent and Pollutants of Concern

Sediment contamination appears to exist throughout most of McGrath Lake. To estimate the volume of contaminated sediments present in the lake, we have assumed that the layer of contamination extends down approximately 3 feet (based on core samples collected in 1998); however, the contaminated layer could extend deeper, since the sampling device employed for this study

could not penetrate beyond this level. In addition, some of the shallowest areas of the lake were not sampled and could contain contaminated sediments. The total volume of contaminated sediments is estimated to be approximately 150,000 to 300,000 cubic yards.

In samples collected for the BPTCP on January 13, 1993 and June 19, 1996, sediment concentrations at station 44027.0 exceeded the ERM Thresholds for chlordane, p,p'-DDE, Total DDT, Dieldrin and Total PCB. No sediment chemistry data were collected during the sediment toxicity screening survey conducted on April 13, 1994. Amphipod toxicity with whole sediments was observed at the single station tested on January 13, 1993, but in only one of the three replicate samples collected on April 14, 1994 (testing with Rhepoxynius abronius). No sediment toxicity was observed at the single station tested during the June 19, 1996 sampling period (testing with Eohaustorius estuarius). No benthic infaunal community analyses were performed.

During a sediment characterization investigation of McGrath Lake conducted in October 1998, sediment concentrations at several stations exceeded the ERM Thresholds for chlordane, Total DDT, dieldrin and Total PCB. During this 1998 survey, two stations (S1 and N1) exceeded the ERM Threshold for mercury. Sediment toxicity was observed at nine of the ten stations samples (all but S10) during this study (testing with Eohaustorius estuarius). Benthic infaunal analyses indicated that McGrath Lake supports an extremely limited benthic community, in terms of number of species present and abundance. Insect larvae (family Chironomidae) were found at most stations, indicating a degraded benthic community.

Sources of Pollutants

Historical discharges of DDT and other pesticides, as well as PCBs, probably were responsible for some of the existing contamination. However, although sediment contamination has been found in the deeper layers of core samples collected from the lake, contaminant levels also were extremely high in the surficial sediments (top 2 centimeters), suggesting continuing present-day sources of contamination. Runoff from approximately 1000 acres of agricultural fields enters McGrath Lake and may be the primary source of both historical and current contamination problems. Although PCBs and the pesticides contaminating the lake's sediments have been banned from use for many years, residues

may exist in the soil on the agricultural fields, acting as a continuing source of contamination as erosion and stormwater runoff carries material from the fields into the lake.

Central Valley Region (Region 5)

Mercury

Site Description

The Central Valley Region covers the entire area included in the Sacramento and San Joaquin River drainage basins. The two basins cover about one fourth of the total area of the State and include over 30% of the State's irrigable land. Waters from the Sacramento and San Joaquin River drainages meet to form the Delta which ultimately drains to San Francisco Bay. The Delta is a maze of river channels and diked islands covering roughly 1,150 square miles, including 78 square miles of water area.

Background

Mercury has been identified in the cleanup plan as responsible for creating a candidate BPTCP hot spot in the Sacramento-San Joaquin Delta Estuary. In January 1998 the Central Valley RWQCB adopted a revised 303(d) list, ranked mercury impairments in the lower Sacramento River, Cache Creek, Sulfur Creek, Lake Berryessa, Clear Lake and the Sacramento-San Joaquin Delta Estuary as high priority because of elevated concentrations in fish tissue and committed to the development of a load reduction program by the year 2005. The widespread distribution of mercury contamination emphasizes the regional nature of the problem and the need for regional solutions.

In 1970 a human health advisory was issued for the Sacramento-San Joaquin Delta Estuary advising pregnant women not to consume striped bass. In 1994 an interim health advisory was issued by the OEHHA for San Francisco Bay and the Delta recommending no consumption of large striped bass and shark because of elevated mercury and PCB concentrations.

In California mercury was historically mined in the Coast Range both north and south of San Francisco Bay and transported across the Valley for use in placer gold mining in the Sierra Nevadas. Both operations caused widespread mercury sediment contamination in water courses in the Coast Range, Sierra Nevada

Mountains, Valley floor, and Sacramento-San Joaquin Delta Estuary.

The limited mercury work undertaken so far in the Central Valley has concentrated on estimating mercury loads to the Estuary and on determining *in situ* mercury bioavailability in valley waterways. A loading study conducted by Larry Walker and Associates (1997) estimated that 640 kg of mercury were exported by the Sacramento watershed to the Estuary between October 1994 and September 1995. Most of the material was contributed during winter high flow periods. Surprisingly, the Feather and American River watersheds, sites of intensive historical placer gold mining activity, only accounted for about 25 percent of the total load. The majority of mercury appeared to originate from the Sacramento watershed above the confluence of the Feather River. The Sacramento Regional Wastewater Treatment Plant, the largest NPDES discharger in the Region, accounted for less than 2 percent of the total load.

In a companion study mercury concentration in aquatic invertebrates and fish in the historic gold mining region of the Sierra Nevada Mountains was evaluated (Slotton *et al.*, 1997a). Concentrations of mercury in aquatic indicator organisms increased in a predictable fashion with increasing trophic feeding level. A clear signature of mine derived mercury was found associated with the most intensively worked river stretches. Mercury concentrations were lower in non-hydrologically mined reaches of the Feather and American Rivers.

Foothill reservoirs were found to operate as traps for both bioavailable and sediment associated inorganic mercury (Slotton *et al.*, 1997a; Larry Walker and Associates, 1997). Significantly lower levels of mercury were found in aquatic organisms below reservoirs as compared to concentrations both in and above them. Similarly, bulk loads of mercury entering foothill reservoirs were greater than the amount exported. This suggests that foothill reservoirs in placer gold mining districts may act as interceptors of mercury, trapping and preventing downstream transport to the Estuary. This may explain the lower than expected loads measured by Larry Walker and Associates (1997) in the Feather and American Rivers.

Between 1993 and 1995 the Central Valley RWQCB also conducted a bulk mercury loading study to the Estuary from the

Sacramento watershed. The study differed from that of Larry Walker and Associates (1997) in that the RWQCB study also included an assessment of loads from the Yolo Bypass during high flows. During flood conditions the Bypass receives overflow from the Sacramento River and significant input from several coastal watersheds.

The RWQCB estimated that the Sacramento Watershed (Sacramento River at Greene's Landing plus Yolo Bypass at Prospect Slough) exported 800 kg of mercury to the Estuary between May 1994 and April 1995 (Foe and Croyle, 1998). Staff found, like Larry Walker and Associates, that most of the mercury was transported into the Estuary during high flow periods. High mercury concentrations in the Yolo Bypass suggested possible local inputs. Follow up studies demonstrated that Cache Creek was exporting about 1,000 kg of mercury during the year. Half of the mercury appeared to be trapped by the Cache Creek Settling Basin at the confluence with the Bypass while the remainder was exported to the Estuary.

In the spring of 1996 a one time benthic invertebrate survey was conducted in the upper Cache Creek basin to determine local mercury bioavailability (Slotton *et al.*, 1997b). All invertebrate tissue samples with mercury concentrations greater than background were associated with known mercury mines or geothermal hot springs. These included Sulfur and Davis Creeks, Harley Gulch, and the discharge from Clear Lake. The highly localized nature of these sites was demonstrated by the lower biotic tissue concentrations in adjacent streams without historic mercury mining activity. Invertebrates collected in the upper mainstem of Cache Creek away from all historic mining had tissue concentrations comparable to similar indicator organisms obtained from mainstem Sierra Nevada river gold mining activity indicating that Coast Range mercury is at least as bioavailable as that in the Sierras. However, tissue concentrations in Cache Creek decreased downstream suggesting that much of the large bulk loads of mercury observed by the RWQCB might not be very biologically available in the lower watershed.

Limited fish tissue sampling has occurred in Cache Creek. Most sampling has been conducted in the lower watershed between Woodland and the Settling Basin. Mean mercury concentrations in fish of a size eaten by people ranged between 0.2 and 0.4 ppm for benthic predators (channel and white catfish) and between 0.4 and

0.9 ppm composite fillet wet weight for water column predators (squawfish, crappie, small and large mouth bass, Davis, 1998; Slotton *et al.*, 1997b). Concentrations in small fish (2-4 inches) suitable for consumption by wildlife ranged between 0.1 and 0.3 ppm whole body wet weight. Sufficient data have not yet been collected to warrant evaluating the Cache Creek watershed for a possible human health fish consumption advisory.

Estuarine bioavailability of Cache Creek mercury is not known. However, the Creek serves as the major water source for the recently created Yolo Wildlife Refuge. In addition, the CALFED Bay Delta Program is proposing to purchase large areas downstream in the Yolo Bypass and further out in the Estuary for conversion to shallow water wildlife habitat. Follow up studies are needed to ascertain the methylation potential of mercury at such sites and also to compare the methylation potential of mercury from sources in the Coast Range to that from the Sierra Nevada Mountains.

Areal Extent

There is a human health advisory in effect in the Delta and in San Francisco Bay because of elevated mercury levels in striped bass and other long lived fish. The entire area of the Delta is therefore considered a hot spot. The Delta is a maze of river channels and diked islands covering roughly 78 square miles of open water and about 1,000 linear miles of channel.

Cache Creek is a 1100 square mile watershed in the Coast Range with about 150 linear miles of mercury impacted waterways. The watershed also contains Clear Lake, the largest natural lake in California at 43,000 acres. A human health advisory has been posted in Clear Lake because of elevated mercury concentrations in fish tissue. The source of the mercury is Sulphur Bank Mine, a U.S. EPA Superfund site.

Sources

Four major bulk sources of mercury have been identified for the Sacramento-San Joaquin Delta Estuary. They are: (1) exports from the placer gold mining regions of the Sierra Nevada Mountains, (2) mercury mining in the Coast Range, (3) resuspension of estuarine sediment, and (4) effluent from municipal and industrial discharges to surface water. Not known, but critically important, is the relative methylation potential of

mercury from each source once in the estuary. The four sources are briefly reviewed below.

1. Sierra Nevada Mountains It has been estimated that over 3 million kg of mercury were lost in the Sierra Nevada Mountains during the gold rush (Montoya, 1987). All this mercury was initially in an elemental form (quicksilver) and most of it is probably still highly oxidized. Foothill reservoirs appear to trap most of the bioavailable and total mercury entering them. Therefore, only the mercury presently located in water courses below the foothill reservoirs appear available for transport into the estuary, unless major flooding events move large volumes of sediment downstream from behind reservoirs. This needs evaluation.
2. Coast Range Some of the largest historic mercury mines in the world were located in the Coast Range both north and south of San Francisco Bay. Most of the mercury in the Coast Range is as mercuric sulfide (cinnabar) and is probably emanating from abandoned mine portals and deposits around retorts and slag piles, geothermal springs and seeps, and erosion of mercury rich landforms. The Coast Range is drier than the Sierra Nevada Mountains and therefore has fewer reservoirs and permanently flowing waterways. Off site movement of mercury from the Coast Range appears to occur mostly in the winter after large rainstorms although evidence from Clear Lake indicates it may be occurring year-round. Cache Creek has been identified as a major source of mercury to the Estuary. Sites in the Cache Creek watershed with highly bioavailable loads include runoff from Sulfur Creek, Harley Gulch, Schneider Creek and Clear Lake.
3. Sediment Potentially the largest source of mercury is already present in the Estuary buried in sediment. Mercury from sediment is potentially available through natural fluxing, bioturbation, scour and erosion from wave action, dewatering and beneficial reuse of dredge spoils on levees, and creation of intertidal shallow water habitats by breaking levees and reflooding Delta agricultural land. Potential bioavailability of mercury from each action depends on, among other things, the chemical form of the metal in sediment and environmental conditions in the Estuary which influence biological processes at the time of release to the food chain.

3. Municipal and Industrial Discharges Undoubtedly, the smallest source of mercury to the Estuary is from permitted municipal and industrial discharges to surface water. Load estimates are only available for the Sacramento Regional Wastewater Treatment Plant, the largest discharger in the Central Valley. The facility was estimated to have discharged 9.9 kg of mercury during water year 1995 (Larry Walker and Associates, 1997). This represents less than 2 percent of the total annual load from the Sacramento Basin. More recent mercury effluent data indicates that the annual mass discharge from the Regional Plant may be as low as 2 kg/yr. This contribution represents less than one percent of the total mercury load from the Sacramento watershed at Rio Vista (Grovhoug, personal communication).

San Joaquin River Dissolved Oxygen

Background

Low dissolved oxygen concentrations in the San Joaquin River in the vicinity of the City of Stockton has been identified in the cleanup plan as constituting a candidate BPTCP hot spot. In January 1998 the Central Valley RWQCB adopted a revised 303(d) list which identified low dissolved oxygen levels in Delta Waterways in the lower San Joaquin River as a high priority problem and committed to developing a waste load allocation (TMDL) by the year 2011. The purpose of the Cleanup Plan is to develop a strategy to collect the information necessary to implement the TMDL.

The San Joaquin River near the City of Stockton annually experiences violations of the 5.0 and 6.0 mg/l dissolved oxygen standard¹⁰. Violations are variable in time but usually occur over a ten mile River reach between June and November. Dissolved oxygen concentrations in the mainstem River can be chronically below the water quality objective and can reach below 2.5 mg/l.

In 1978 the RWQCB adopted more stringent biochemical oxygen demand (BOD) and total suspended solid (TSS) effluent limits for the Stockton Regional Wastewater Control Facility (RWCF) with the intent of reducing or eliminating the low dissolved oxygen conditions in the San Joaquin River. The plant has constructed the

¹⁰The 5.0 mg/l standard applies between 1 December and 30 August while the 6.0 mg/l standard is for the period of 1 September through 30 November.

necessary additional treatment facilities and has complied with the more stringent effluent limitations. Despite the Cities best efforts, the low dissolved oxygen conditions persist.

The City completed a river model (Schanz and Chen, 1993) assessing the impact of the Stockton RWCF on receiving water quality. Water quality parameters considered included TSS, BOD, ammonia, nitrate and dissolved oxygen. The model suggested that: (1) low dissolved oxygen conditions occur in the fall and spring due to a high mass loading of BOD and ammonia, (2) the current Stockton RWCF contributions are a significant portion of the oxygen demand of the River during critical low dissolved oxygen periods, and (3) the San Joaquin River would not meet the receiving water dissolved oxygen standards even if the entire discharge from the Stockton RWCF were eliminated from the River.

Taking these facts into consideration, the RWQCB adopted a stricter permit in 1994 requiring the Stockton RWCF to further reduce CBOD and ammonia concentrations. Stockton appealed the permit to the State Board on a variety of grounds including that hydraulic conditions had changed in the River since the RWQCB had considered the permit. The State Board remanded the permit back to the RWQCB for consideration of new Delta flow standards.

In the interim the Stockton RWCF refined the dissolved oxygen model for the River (Chen and Tsai, 1997). The model suggests that the principal factors controlling in-stream oxygen concentration are temperature, flow, upstream algal production, sediment oxygen demand (SOD), and discharge from the Stockton RWCF. Obviously, only one of these factors is within the ability of the Stockton RWCF to control. Solutions to the dissolved oxygen problem will require a more holistic watershed approach. Each factor is described briefly below.

Dissolved oxygen problems are most acute at high temperature in the San Joaquin River in late summer and early fall. Temperature is important because the oxygen carrying capacity of water decreases with increasing temperature while biotic respiration rates increase. Water temperature is controlled by air temperature and reservoir releases.

Flow of the San Joaquin River at Stockton is regulated by upstream reservoir releases and pumping at the state and federal pumping facilities at Tracy. Net flows at the City of Stockton are often zero or negative in late summer. The lowest dissolved oxygen levels in the River occur during prolonged periods of no net flow.

Algal blooms occasionally develop in the faster moving shallow upper River and are carried down past the City to the deeper slower moving deep water ship channel. Respiration exceeds photosynthesis here resulting in net oxygen deficits. Upstream algal blooms are controlled by turbidity and nutrient inputs from other NPDES dischargers, the dairy industry, erosion, stormwater runoff, and agricultural inputs.

Finally, the new model identified discharge from the Stockton RWCF as contributing to the dissolved oxygen problem. The model indicates that improvements in effluent quality would increase dissolved oxygen levels in the River during critical periods. However, the model confirmed that exceedance of the dissolved oxygen water quality objective would persist if the entire discharge of the Stockton RWCF were removed from the River. The City of Stockton has expressed the concern that the estimated costs for the additional treatment are disproportionate to the benefits and that more cost-effective improvements in dissolved oxygen levels are possible.

Adult San Joaquin fall run chinook salmon migrate up river between September and December to spawn in the Merced, Tuolumne, and Stanislaus Rivers (Mills and Fisher, 1994). The Basin Plan dissolved oxygen water quality objective was increased from 5.0 to 6.0 mg/l between 1 September and 30 November to aid in upstream migration. The San Joaquin population has experienced severe declines and is considered a "species of concern" by the U.S. Fish and Wildlife Service. Low dissolved oxygen may act as a barrier preventing upstream spawning migration. Also, low dissolved oxygen can kill or stress other aquatic organisms present in this portion of the Delta.

In conclusion, the San Joaquin River near the City of Stockton annually experiences dissolved oxygen concentrations below the Basin Plan water quality objective in late summer and fall. A model has been developed which identifies river flow and temperature, upstream algal blooms, SOD, and discharge from the Stockton RWCF as controlling variables. Only the latter variable

is within the ability of the plant to influence. Fall run chinook salmon migrate upstream during this critical time period.

Areal Extent

The areal extent of the water quality exceedance is variable but may in some years be as much as 10 miles of mainstem River. The temporal extent is also variable but can be for as long as 4 months. Dissolved oxygen concentrations are often less than 2.5 mg/l in the mainstem River.

Sources

A computer model developed for the Stockton RWCF identified ammonia and BOD as the primary cause of the low dissolved oxygen concentration. The sources are discharges from the Stockton RWCF and surrounding point and nonpoint source discharges. River flow and water temperature were identified as two other variables strongly influencing oxygen concentrations.

Pesticides

Background

“Diazinon in orchard dormant spray runoff” was identified in the Central Valley Cleanup Plan as constituting a candidate hot spot in the Sacramento-San Joaquin Delta Estuary. Staff briefed the Central Valley RWQCB on 23 October 1998 on pesticide detection patterns in the Central Valley and requested guidance on whether these should be considered “frequent” as required by the BPTCP in order to be considered as a candidate high priority toxic hot spot. In addition, guidance was sought on whether to prepare cleanup plans under Bay Protection or seek a variance and prepare a control program under section 303(d) of the Clean Water Act as the same pesticide excursions were also listed as a high priority 303(d) impairment. The RWQCB unanimously determined that the pattern of pesticide detections observed in the Sacramento and San Joaquin Rivers and in the Bay-Delta were frequent and merited consideration as a high priority candidate toxic hot spot. The RWQCB also directed staff to seek a variance and regulate pesticides under the Clean Water Act. Outlined below are all required elements of the Bay Protection Clean Up Plan except sections D through G which address the assessment of the necessary control actions and their associated cost. The activities covered by these latter sections will be addressed by the RWQCB as it develops a waste load allocation program under section 303(d) of the Clean Water Act.

About a million pounds of insecticide active ingredient are applied each January and February in the Central Valley on about half a million acres of stonefruit and almond orchards to control boring insects (Foe and Sheipline, 1993). The organophosphate insecticide diazinon accounts for about half the application. Numerous bioassay and chemical studies have measured diazinon in surface water samples in the Central Valley during winter months at toxic concentration to sensitive invertebrates (Foe and Connor, 1991; Foe and Sheipline, 1993; Ross 1992; 1993; Foe, 1995; Domagalski, 1995; Kratzer, 1997). The typical pattern is that the highest concentrations and longest exposures are in small water courses adjacent to high densities of orchards. However, after large storms in 1990 and 1992 diazinon was measured in the San Joaquin River at the entrance to the Delta at toxic concentrations to the cladoceran invertebrate *Ceriodaphnia dubia* in U.S. EPA three species bioassays (Foe and Connor, 1991; Foe and Sheipline, 1993). Following up on these findings, the U.S. Geological Survey and RWQCB traced pulses of diazinon from both the Sacramento and San Joaquin Rivers across the Estuary in 1993 (Kuivila and Foe, 1995). Toxic concentrations to *Ceriodaphnia* were observed as far west in the Estuary as Chipps Island, some 60 miles downstream of the City of Sacramento and the entrance to the Delta.

Concern has been expressed that other contaminants might also be present in winter storm runoff from the Central Valley and contribute to invertebrate bioassay mortality. Therefore, in 1996 TIEs were conducted on three samples testing toxic in *Ceriodaphnia* bioassays from the San Joaquin River at Vernalis (Foe *et al.*, 1998). The results confirm that diazinon was the primary contaminant although other unidentified chemicals may also have contributed a minor amount of toxicity. The study was repeated in 1997 with the exception that samples were taken further upstream in the Sacramento and San Joaquin watersheds in the hope of collecting water with greater concentrations of unknown toxicants thereby facilitating their identification. TIEs were conducted on samples from Orestimba Creek in the San Joaquin Basin on 23 and 25 January and from the Sutter Bypass on 23, 25, and 26 January. Again, diazinon was confirmed as the primary toxicant (Foe *et al.*, 1998). No evidence was obtained suggesting a second contaminant.

No biological surveys have been undertaken to determine the ecological significance of toxic pulses of diazinon. However, Novartis, the Registrant for diazinon, has completed a diazinon probabilistic risk assessment for the Central Valley (Novartis Crop Protection, 1997). Little data were available for the Delta. The risk assessment, like chemical and bioassay studies, suggest that the greatest impacts are likely to occur in water courses adjacent to orchards. Lower concentrations are predicted in mainstem Rivers. The report predicts that the Sacramento and San Joaquin Rivers will experience acutely toxic conditions to the 10% of most sensitive species 0.4 and 11.6% of the time in January and February, the period of most intensive diazinon off site movement¹¹. Novartis concludes that the risk of diazinon alone in the Sacramento-San Joaquin River basin is limited to the most sensitive invertebrates, primarily cladocerans. Furthermore, the report notes that cladocerans reproduce rapidly and their populations are therefore predicted to recover rapidly. Also, the report predicts that indirect effects on fish through reductions in their invertebrate prey are unlikely as the preferred food species are unaffected by the diazinon concentrations observed in the rivers. The study recommends though, that the population dynamics of susceptible invertebrate species in the basin be evaluated along with the feeding habits and nutritional requirements of common fish species.

In conclusion, the only major use of diazinon in the Central Valley in January and February is on stonefruit and almond orchards. In 1990, 1992, 1993, and 1996 diazinon was observed entering the Estuary from either the Sacramento or San Joaquin Rivers at toxic concentration in *Ceriodaphnia* bioassays. In 1993 the chemical was followed at toxic concentrations across the Estuary. On each occasion diazinon was confirmed as being present in toxic water samples by GC/MS analysis. In 1996 and 1997 TIEs implicated diazinon as the primary contaminant responsible for the toxicity. Finally, sensitive organisms like *Ceriodaphnia* are predicted to experience acutely toxic conditions in the Sacramento and San Joaquin Rivers about 0.5 and 12 percent of the time in January and February of each year. These frequencies translate to about 1 day every four years in the Sacramento River and 7-8 days per year in the San Joaquin River.

¹¹ Unfortunately, many agricultural pesticides are applied in the Central Valley and measured in the Rivers. When the risk assessment is repeated with multiple chemicals, the mainstem San Joaquin River is predicted to experience acutely toxic conditions about 20 percent of the year to the 10 percent of most sensitive species. Diazinon is only one of the chemicals present in the River at toxic concentrations.

BPTCP guidance recommends that a site or situation be considered a candidate toxic hot spot for pesticides if toxicity in bioassays can be demonstrated, bioassay results are corroborated by both chemical analysis and TIEs, and the pesticide residues reoccur in a pattern of frequent pulses. On 23 October 1998 the Central Valley RWQCB reviewed the dormant spray data and unanimously concluded that the Sacramento and San Joaquin Rivers and Delta-Estuary fit the recommended criteria for listing as a high priority candidate toxic hot spot.

Areal Extent

Studies demonstrate that the potential areal extent of diazinon water column contamination from orchard runoff is variable by year but may include in some years the entire Sacramento San Joaquin Delta Estuary. The Delta Estuary is a maze of river channels and diked islands covering some 78 square miles of water area and 1,000 linear miles of waterway.

Sources

The only major use of diazinon in agricultural areas in the Central Valley in winter is as a dormant orchard spray. Virtually every study investigating off site movement into the Rivers and Estuary have concluded that the primary source of the chemical is from agriculture (Foe and Connor, 1991; Foe and Shepline, 1993; Ross, 1992; 1993; Domagalski, 1995; Kratzer, 1997).

Farmers must obtain a permit to apply diazinon as a dormant spray and their names and addresses are available through the County Agricultural Commissioner's Office. However, not known at this time is the relative contribution of each application to total offsite movement. More information is needed on the primary factors influencing off site movement and the relative contribution of different portions of the Central Valley watershed. Such information is essential not only for assessing responsibility but also for successful development and implementation of agricultural Best Management Practices (BMPs).

Urban Stormwater Pesticide Cleanup Plan for the Delta

Background

“Diazinon and chlorpyrifos in urban stormwater runoff” was identified in the Cleanup Plan as constituting a candidate toxic hot spot in several Delta backsloughs. Staff briefed the Central Valley

Regional Board on 23 October 1998 on pesticide detection patterns in the Central Valley and requested guidance on whether these should be considered "frequent" as required by the BPTCP to be considered as a candidate high priority toxic hot spot. In addition, guidance was sought on whether to prepare cleanup plans under Bay Protection or seek a variance and prepare a control program under section 303(d) of the Clean Water Act as the same pesticides excursions were also listed as a medium priority 303(d) impairment. The RWQCB unanimously determined that the pattern of pesticide detections observed in urban runoff around the Delta were frequent and merited consideration as high priority candidate Bay Protection Hot Spots. The RWQCB also directed staff to seek a variance and regulate pesticides under the Clean Water Act. Outlined below are all required elements of the Bay Protection Cleanup Plan except sections D through G which address the assessment of the necessary control actions and their associated cost. The activities covered by the latter sections will be addressed by the RWQCB as it develops a waste load allocation program under section 303(d) of the Clean Water Act.

Three hundred and forty thousand pounds of diazinon and 775 thousand pounds of chlorpyrifos active ingredients were used in reported landscape and structural pest control in California in 1994 for control of ants, fleas and spiders (Scanlin and Cooper, 1997; Department of Pesticide Regulation, 1996). The figure likely underestimates by about half the total use as it does not include unreported homeowner purchases. In February and again in October 1994 *Ceriodaphnia* bioassay mortality was reported in Morrison Creek in the City of Sacramento and in Mosher Slough, 5 Mile Slough, Calaveras River, and Mormon Slough in the City of Stockton (Connor, 1994; 1995). All these water bodies are within the legal boundary of the Delta. A modified phase I TIE was conducted on samples from each site which implicated metabolically activated pesticide(s) (such as diazinon and chlorpyrifos). Chemical analyses demonstrated that diazinon and occasionally chlorpyrifos was present at toxic concentrations. A phase III TIE was conducted on water collected from Mosher Slough on 1 May 1995 which confirmed that the primary cause of acute toxicity was a combination of diazinon and chlorpyrifos.

It was not known at the time that the Bay Protection samples were being collected that an assessment of the frequency of pesticide excursions would be needed to determine whether a location should be considered as a candidate toxic hot spot. Therefore, no

intensive sampling was conducted at Mosher, Five Mile, and Mormon Sloughs, or the Calaveras River or Morrison Creek. However, in other testing 230 samples were collected from urban dominated waterways in the Sacramento and Stockton areas (Bailey *et al.*, 1996). These sites are thought to exhibit water quality similar to those locations being considered here as candidate hot spots. All 230 samples were analyzed for diazinon. Eighty-five percent of the measured values (195 samples) exceeded Fish and Game recommended acute hazard criteria. Ninety samples were analyzed for chlorpyrifos. Eighty percent of the values (72 samples) also exceeded the recommended chlorpyrifos acute hazard criteria. Finally, *Ceriodaphnia* bioassays were run on 47 samples. Seventy-seven percent of these (36 samples) produced total mortality within 72 hours. Modified Phase I TIEs suggested that the toxicity was due to metabolically activated pesticides, such as diazinon and chlorpyrifos. Chemical analysis was consistent with these conclusions suggesting that the two organophosphate insecticides were the major contaminants.

In a second set of data, the Sacramento River Watershed Program has monitored Arcade Creek in Sacramento monthly since 1996 for toxicity. Arcade Creek was selected to represent a typical urban creek. In the 1996-97 sampling period, Arcade Creek was monitored 13 times during 12 months. Seventy-seven percent of those samples exhibited significant *Ceriodaphnia* mortality. Diazinon and chlorpyrifos concentrations were measured in the seven samples causing 100% mortality. TIEs and pesticide detections in the seven samples confirm that both pesticides contributed to the observed toxicity. Toxicity was detected during both wet and dry weather (Larson *et al.*, 1998a). The 1997-98 sampling period data has been summarized for only five dates. In four of the five samples (eighty percent), 100% *Ceriodaphnia* mortality was detected and linked through TIEs to the presence of diazinon and chlorpyrifos. Again, toxicity was detected during wet and dry periods (Larson *et al.*, 1998b).

Background concentrations of diazinon in urban stormwater runoff in the Central Valley increase after application on orchards in January and February suggesting that urban use might not be the sole source of the chemical at this time (Connor, 1996). Volatilization following application is known to be a major diazinon dissipation pathway from orchards (Glotfelty *et al.*, 1990) and a number of dormant spray insecticides have previously been reported in rain and fog in the Central Valley (Glotfelty *et al.*,

1987). Therefore, composite rainfall samples were collected in South Stockton in 1995 which demonstrated that diazinon concentrations in rain varied from below detection to about 4,000 ng/l (ten times the acute *Ceriodaphnia* concentration). The rainfall study was continued through March and April of 1995 to coincide with application of chlorpyrifos on alfalfa for weevil control. Chlorpyrifos concentrations in composite rainfall samples increased, ranging from below detection to 650 ng/l (again 10 times the acute *Ceriodaphnia* concentration). However, unlike with diazinon, no study was conducted to ascertain whether chlorpyrifos concentrations in street runoff increased suggesting that agricultural inputs might be a significant urban source.

Similar invertebrate bioassay results coupled with TIEs and chemical analysis from the San Francisco Bay Area suggest that diazinon and chlorpyrifos may be a regional urban runoff problem (Katznelson and Mumley, 1997). This finding prompted the formation of an Urban Pesticide Committee (UPC). The UPC is an *ad hoc* committee formed to address the issue of toxicity in urban runoff and wastewater treatment plant effluent due to organophosphate insecticides, in particular diazinon and chlorpyrifos. The UPC is composed of staff from the U.S. EPA, the San Francisco Bay and Central Valley Regional Water Quality RWQCBs, the Department of Pesticide Regulation, Novartis and Dow Elanco, municipal storm water programs, the Bay Area Stormwater Management Agencies Association, County Agricultural commissions, Wastewater treatment plants, the University of California, and Consultants. The members of the UPC are committed to working in partnership with the various stakeholders to develop effective measures to reduce the concentrations of organophosphate insecticides in urban runoff and wastewater treatment plant effluent.

In conclusion, a combination of bioassay, chemical, and TIE work demonstrate that diazinon and chlorpyrifos are present in urban stormwater runoff discharged to urban creeks and back sloughs around the Cities of Sacramento and Stockton at concentrations toxic to sensitive invertebrates. The source of the diazinon appears to be primarily from urban sources although agricultural orchard use may also be important. Chlorpyrifos appears to be predominately of urban origin but the impacts from agricultural use need to be evaluated. Finally, bioassay and chemical analysis suggest that about 75 percent of the samples collected from urban runoff dominated water bodies will test toxic in *Ceriodaphnia*

bioassays while eighty to eighty-five percent of the samples will contain diazinon and chlorpyrifos at concentrations exceeding the acute California Department of Fish and Game Hazard Assessment criteria.

BPTCP Guidance recommends that a site or situation be considered a candidate toxic hot spot for pesticides if toxicity in bioassays can be demonstrated, bioassay results are corroborated by both chemical analysis and TIEs, and the pesticide residues reoccur in a pattern of frequent pulses. On 23 October 1998 the Central Valley RWQCB reviewed the data and unanimously concluded that pesticides in urban runoff dominated backsloughs around the Delta fit the recommended criteria for listing as a high priority candidate toxic hot spot.

Areal Extent

The potential threat posed by diazinon and chlorpyrifos in urban storm runoff is localized to Morrison Creek in the City of Sacramento and Mosher Slough, 5 Mile Slough, the Calaveras River, and Mormon Slough in the City of Stockton. Together the areal extent of impairment may be up to 5 linear miles of back sloughs within the legal boundary of the Delta.

Sources

Detailed information on urban sources are not available for the Central Valley. However, source information has been obtained for the Bay Area and the conclusions are thought to also apply in the Valley with the caveat that the Bay area does not receive significant amounts of diazinon in rainfall as appears to occur in the Central Valley (personal communication, Connor). Confirmatory studies are needed to verify that the Bay Area conclusions also apply in the Valley.

The primary source of diazinon and chlorpyrifos in Bay Area creeks is from urban runoff. Sampling in urbanized areas in Alameda County indicated that residential areas were a significant source but runoff from commercial areas may also be important (Scanlin and Feng, 1997). It is not known what portion of the diazinon and chlorpyrifos found in creeks is attributable to use in accordance with label directions versus improper disposal or over application. However, a preliminary study of runoff from residential properties suggest that concentrations in creeks may be attributable to proper use (Scanlin and Feng, 1997).

Irrigation Return Flow Pesticide Cleanup Plan For the Delta

Background

“Chlorpyrifos in irrigation tailwater” has been identified in the Cleanup Plan as constituting a candidate hot spot in various agriculturally dominated backsloughs within the Delta. Staff briefed the Central Valley RWQCB on 23 October 1998 on pesticide detection patterns in the Central Valley and requested guidance on whether these should be considered “frequent” as required by the Bay Protection Program to be considered as a candidate high priority toxic hot spot. In addition, guidance was sought on whether to prepare cleanup plans under Bay Protection or seek a variance and prepare a control program under section 303(d) of the Clean Water Act as pesticide excursions in the San Joaquin River and Delta-Estuary were also listed as a high priority 303(d) impairment. The Board unanimously determined that the pattern of pesticide detections observed in various Delta backsloughs from irrigated agriculture was frequent and merited consideration as a high priority candidate Bay Protection Hot Spot. The RWQCB also directed staff to seek a variance and regulate pesticides under the Clean Water Act. Outlined below are all required elements of the Bay Protection Clean Up Plan except sections D through G which address the assessment of the necessary control actions and their associated cost.

One and a half million pounds of chlorpyrifos active ingredient were used in the Central Valley on agriculture in 1990 (Sheipline, 1993). Major uses in March are on alfalfa and sugarbeets for weevil and worm control and between April and September on walnuts and almonds for codling moth and twig borer control. Two minor uses are on apples and corn. A bioassay study was conducted in agriculturally dominated waterways in the San Joaquin Basin in 1991 and 1992. Chlorpyrifos was detected on 190 occasions between March and June of both years, 43 times at toxic concentrations to *Ceriodaphnia* (Foe, 1995). Many of the crops grown in the San Joaquin Basin are also cultivated on Delta Tracts and Islands. Not known was whether these same agricultural practices might also contribute to instream toxicity in the Delta. BPTCP resources were used between 1993 and 1995 to conduct a bioassay monitoring program in the Delta. Chlorpyrifos toxicity was detected on nine occasions in surface water from four agriculturally dominated backsloughs (French Camp Slough, Duck Slough, Paradise Cut, and Ulati Creek; Deanovic *et al.*, 1996;1997). In each instance the *Ceriodaphnia* bioassay results

were accompanied by modified phase I and II TIEs and chemical analysis which implicated chlorpyrifos. On four additional occasions phase III TIEs were conducted (Ulati Creek 21 March 1995, Paradise Cut 15 March 1995, Duck Slough 21 March 1995, and French Camp Slough 23 March 1995). These confirmed that chlorpyrifos was the primary chemical agent responsible for the toxicity. Analysis of the spatial patterns of toxicity suggest that the impairment was confined to backsloughs and was diluted away upon tidal dispersal into main channels. The precise agricultural crops from which the chemicals originated are not known because chlorpyrifos is a commonly applied agricultural insecticide during the irrigation season. However, the widespread nature of chlorpyrifos toxicity in March of 1995 coincided with applications on alfalfa and subsequent large rainstorms. Follow up studies are needed to conclusively identify all responsible agriculture practices.

It was not known at the time that the Bay Protection samples were being collected that an assessment of the frequency of pesticide excursions would be needed to determine whether a location should be considered as a candidate toxic hot spot. Therefore, no intensive sampling was conducted in French Camp and Duck Sloughs or in Paradise Cut or Ulati Creeks to determine the precise frequency of irrigation induced pesticide toxicity. However, as has been previously mentioned, the same agricultural crops and pesticide application patterns occur in the Delta as in the San Joaquin Basin. Novartis (1997) conducted an ecological risk assessment using all the available pesticide data and concluded that the mainstem San Joaquin River should experience acutely toxic conditions about 20 percent of the time (approximately 70 days/year) from a mixture of insecticides but predominately diazinon and chlorpyrifos. Diazinon was most commonly observed during the dormant spray season (January and February) while chlorpyrifos explained most of the toxicity during the irrigation season (March through September). It has previously been calculated that the mainstem San Joaquin River is expected to experience acutely toxic conditions for about 7 days in January and February from off site movement of diazinon. Therefore, it is estimated that acute toxicity will occur for about 63 days during the remaining year ($70-7=63$). Most of this toxicity is predicted to be from chlorpyrifos excursions.

In a more recent study, Dow AgroSciences, the primary registrant for chlorpyrifos, monitored diazinon and chlorpyrifos

concentrations daily in Orestimba Creek for one year (1 May 1996-30 April 1997). Orestimba Creek is about 25 miles south of the Delta in the San Joaquin Basin. The water body was selected for study as its water quality is thought to be typical of a local agriculturally dominated watershed. Diazinon and chlorpyrifos were measured at acutely toxic conditions to sensitive organisms like *Ceriodaphnia* for 50 days during the irrigation season (15 March-30 September; Dow AgroSciences, 1998). Forty-four of the fifty events (88%) were from elevated chlorpyrifos concentrations.

In conclusion, the frequency of toxicity from pesticides was not measured in agriculturally dominated back sloughs in the Delta. However, estimates of the frequency of toxicity from chlorpyrifos excursions in similar nearby watersheds range between 44 and 63 days per irrigation season. Similar frequency rates are expected in Delta backsloughs.

BPTCP guidance recommends that a site or situation be considered a candidate toxic hot spot for pesticides if toxicity in bioassays can be demonstrated, bioassay results are corroborated by both chemical analysis and TIEs, and the pesticide residues reoccur in a pattern of frequent pulses. On 23 October 1998 the Central Valley RWQCB reviewed the above data and unanimously concluded that Ulati Creek, Paradise Cut, French Camp and Duck Sloughs fit the recommended criteria for listing as a high priority candidate toxic hot spot because of elevated concentrations of chlorpyrifos.

Areal Extent

The potential aquatic threat posed by chlorpyrifos in agricultural return flow is confined to the four previously named Creeks and Sloughs. The areal extent of the impairment may be up to 15 linear miles of waterway within the legal boundary of the Delta.

Sources

The only major use of chlorpyrifos in these four drainage basins is on agriculture. Detailed follow up studies are needed to determine the crop and precise agricultural practice which led to the off site movement.

Santa Ana Region (Region 8)

Lower Newport Bay Rhine Channel

Site Description

Newport Bay is one of the largest small craft harbors in southern California. It is adjacent to the cities of Newport Beach, and Corona Del Rey and it is divided into an upper and a lower portion, and Upper Newport Bay is owned and managed by the State Department of Fish and Game as a State Ecological Reserve. Lower Newport Bay is heavily developed with housing, hotels, restaurants, marinas, and light marine industry such as boatyards and fuel docks. The Bay harbors approximately 10,000 small craft. Tributaries draining into the system include the San Diego Creek, and among other smaller tributaries, the Santa Ana-Delhi Channel and Big Canyon Wash. The entire Newport Bay watershed encompasses 154 square miles.

Background

The pollutants of concern found at the site are Arsenic, Copper, Lead, Mercury, Zinc, DDE, PCB, and TBT.

The area was historically a small inlet in the larger marsh system of Lower Newport Bay. In 1918, the first boat yard was built on the channel. A fish cannery was built in 1919, but was used predominately after 1935. The dredging of Lido Channel South occurred in 1920, with large scale dredging of Lower Newport Bay occurring in 1934-35 to provide safe harbor navigation. During the 1940's and 1950's the channel supported boat building activity for both the US Navy and the Mexican Navy during World War II and the Korean War. The boat yards produced midsize boats, mainly mine sweepers, subchasers, and rescue boats in the 45 to 135 feet. length range. In 1964, there were 19 boat yards operating in the Lower Bay. Currently six boat yards operate along Rhine Channel. The boat yards are currently regulated by General Waste Discharge Requirements. Historic practices at the boat yards are the most likely source of pollutants in Rhine Channel, although a thorough characterization of the depth of pollution has never been undertaken. An investigation of the extent of pollution depth and area would help to either eliminate or include likely historic sources.

The RWQCB currently regulates the discharge of process wastewater and stormwater from all boat yard facilities in Lower

Newport Bay and Huntington Harbor through General Waste Discharge Requirements (Order No. 94-26, as amended by Order No. 95-60 and 96-52). The boat yards were initially issued individual NPDES permits beginning in 1975. The main feature of Order No. 94-26, as amended, is the elimination of the discharge of process wastewater in accordance with the requirement of the Water Quality Control Policy for the Enclosed Bays and Estuaries of California. Process wastewater is defined by the Order to include the first one tenth of an inch of rain that is preceded by seven days of dry weather. This permit requirement was to be implemented by April, 1996. Presently, five of the six boat yards in Rhine Channel have complied with this requirement.

The Newport Bay watershed is one of two watersheds within the Santa Ana Region that are the focus of intensive watershed management activities. The expected outcomes of this planning and management effort includes a further refinement of water quality problems, both in the Bay and watershed, the development and implementation of a watershed management plan that addresses these problems, and mechanisms for measuring the success of the plan and improvements in water quality.

Additionally, Lower Newport Bay is currently listed as water quality limited for metals and pesticides pursuant to Section 303(d) of the Clean Water Act. A TMDL for metals and pesticides will be developed by the RWQCB to address this impairment. The control of pollutant sources occurring in Rhine Channel will be a component of the TMDLs.

Areal Extent

The areal extent of the Toxic Hot Spot (THS) is assessed to be between 1.5 to 2.5 acres.

Source

The source of the problem are pesticides, and toxicants associated with sedimentation from urban and agricultural erosion entering the system from the tributary creeks. Other pollutant sources include boatyard and fueling operations of small craft discharges and stormwater runoff.

San Diego Region (Region 9)

Seventh Street Channel, National City

Site Description

The San Diego Region is located along the coast of the Pacific Ocean from the Mexican border to north of Laguna Beach in Orange County. The Region is rectangular in shape and extends approximately 80 miles along the coastline and 40 miles east to the crest of the mountains. The Region includes portions of San Diego, Orange, and Riverside Counties. The population of the Region is heavily concentrated along the coast.

In the southern portion of the Region two harbors, Mission Bay and San Diego Bay, support major recreational vessel and ship traffic. San Diego Bay is long and narrow, 15 miles in length averaging approximately one mile across. A deep-water harbor, San Diego Bay has experienced waste discharge from former sewage outfalls, industries, and urban runoff. Up to 9,000 vessels may be moored in the Bay. San Diego Bay also hosts four major U.S. Navy bases with approximately 50 surface ships and submarines home-ported in the Bay.

Areal Extent of the Toxic Hot Spot

Approximately three acres appear affected in San Diego Bay (Stations 90009, 93227, 93228); however, the area affected could be substantially larger or smaller. Dredging activities could have occurred in this area since San Diego Bay was sampled during the period 1992 to 1994. If so, this area or parts of this area may no longer be considered for designation as a candidate toxic hot spot.

Most Likely Sources of Pollutants (Potential Discharger)

Because benthic community analysis does not directly measure cause and effect relationships between chemicals and fauna living in the sediment, it is possible that some of the degraded benthic communities could have been caused by physical disturbance of the bottom from tug and ship propellers, or from disturbance caused by recent dredging.

Persistent chemicals, such as PAHs and Chlordane, could also have caused benthic community degradation and sediment toxicity at the Seventh Street Channel. Possible sources include industrial activities, atmospheric fallout, pesticides from lawns, streets, and buildings, and runoff from pest control operations.

PROPOSED REMEDIATION APPROACH AND ALTERNATIVES AT TOXIC HOT SPOTS

The RWQCBs and their staff have developed Regional Toxic Hot Spots Cleanup Plans that present preliminary lists of actions necessary to begin improvement of the identified toxic hot spots.

The remediation alternatives for each proposed known toxic hot spot is formatted consistently to provide the SWRCB with a summary of the actions proposed by the RWQCBs as well as alternatives for their action on the sites. A complete listing of the preliminary actions is listed in Appendix B.

For each high priority known toxic hot spot the following information is provided:

- Site: The name of the Region where the proposed toxic hot spot is located and the name of the site as used in the list of known toxic hot spots.
- Site Description: A brief description of the site including the actions initiated by the RWQCB and descriptions of any related programs.
- Approach/Alternatives: For each site, the approach proposed by the RWQCB is presented. For sites where a discharger has been identified, the RWQCB approach for addressing the site using its existing Water Code authorities is presented. Where no discharger is identified, alternatives for addressing the site are presented.
- In each case, the costs of remediation, costs recoverable from potential dischargers and an expenditure plan are presented.
- Staff Recommendation: A suggestion is made for combination of alternatives or approaches that should be adopted by the SWRCB.

Site 1.1: North Coast region, G&R Metals at the foot of "H" Street between First street and the Humboldt Bay shore

Site Description: The North Coast RWQCB identified one high priority toxic hot spot in their Regional Toxic Hot Spots Cleanup Plan. The RWQCB has identified several actions that are underway at the site.

Description of the Site

The candidate toxic hot spot site is located on the shore of Humboldt Bay and has been used for industrial activities since the early part of the century. It has been operated as a scrap metal facility since the early 1950s. All industrial activities have ceased at the site but the historic uses have resulted in an area polluted with PCBs, PAHs, lead, arsenic, chromium, cadmium, cobalt, copper, mercury, zinc and Methoxychlor. The areal extent of the toxic hot spot has been estimated to be 3.5 acres with an average depth of pollution of 2 feet. The total polluted soil quantity is about 10,000 cubic yards.

Summary of actions initiated by the RWQCB

The site has not been used since 1980. On-going activity is limited to site assessment work to determine the extent of the pollution and the appropriate remediation needed to clean up the site. The RWQCB issued a draft Cleanup and Abatement Order on June 4, 1998 requiring cleanup of the site. The final order will be issued sometime in fiscal year 1998-99.

Approach/Alternatives: The cleanup alternatives are limited to the removal of highly polluted soils and capping of the site to prevent migration of metals to ground and surface waters. Dredging of the offshore area may be necessary for a complete cleanup.

Estimate of the total cost to implement the Cleanup Plan.

It is estimated that the cost to implement the chosen cleanup plan will be between \$500,000 and \$5 million dollars. These costs are based on a \$500 per ton cost for hauling and tipping fees at a hazardous waste disposal site. The exact amount of material that will be removed from the site will be determined at a later date when the assessment work is completed.

Estimate of recoverable costs from potential Dischargers.

The responsible parties will be required to pay for the cleanup. It appears that the responsible parties have the ability to pay for the entire cleanup effort.

Recommendation: Adopt the cleanup action as presented.

Site 2.1: San Francisco Bay Region, San Francisco Bay

Site Description: The San Francisco Bay RWQCB identified several high priority toxic hot spots in their Regional Toxic Hot Spots Cleanup Plan.

Description of the Site

San Francisco Bay is part of an estuarine system which conveys the waters of the Sacramento and San Joaquin rivers to the Pacific Ocean. This is a highly complex system that includes large brackish marshes, tidal lagoons and freshwater rivers and creeks. The diversity of these ecosystems support a wide variety of organisms. While the upper part of the estuary has been widely used for mining and agricultural activities the San Francisco Bay region has been heavily urbanized and is the site of many industrial activities and ports.

The San Francisco estuary has high concentrations of metals due to contributions from numerous sources, both natural and anthropogenic. Natural sources include drainage of water from formations that are naturally enriched in some metals, such as the Franciscan Formation that is exposed throughout the Bay area, and the rocks that make up the Sierra Nevada Mountains. This drainage flows into the streams that empty into the Bay. Localized concentrations of these metals were exploited in a great wave of mining activity from the 1820's continuing, in some cases, into the 1970s.

Mercury was mined at numerous locations in the Coastal Range and then transported to the Sierra Nevada foothills to be used in the amalgamation of gold in placer and hydraulic mining. Drainage from natural mercury deposits, mine tailings, and directly from mining activities have had a major impact on the San Francisco Bay and estuary.

San Francisco Bay is an extremely dynamic depositional environment. Sediments flow from the major river systems and are deposited in the Bay. Strong winds and tidal currents resuspend and redeposit these sediments resulting in a system where sediments are well mixed. Bioaccumulative contaminants attach to sediments and are distributed and mixed by the same physical processes. Therefore, the sediment acts as a sink for contaminants. The sediment, however, is also a source of contaminants to organisms in the aquatic food chain and ultimately to humans.

Although the San Francisco estuary extends from the ocean up through the river systems, the jurisdiction of the San Francisco Bay RWQCB only extends to the area just west of Antioch. The Central Valley RWQCB includes the Delta and extends through the river systems. Since the health advisory on fish consumption affects both Regions, it is important that a coordinated strategy is developed, especially in regard to mercury contamination.

Actions Initiated at the Site

Mercury

The RWQCB has developed a draft regulatory policy and program for mercury in the Region. The proposed strategy would, in the long term, reduce mercury concentrations in the estuary. It is not feasible to clean up the diffuse, historic sink of mercury in Bay sediments. Natural processes such as outflow through the Golden Gate and capping by the natural deposition of cleaner sediments may effectively isolate this mercury. Therefore, the proposed mercury strategy emphasizes the need to control all controllable sources. The two goals of the strategy are to: (1) reduce the inflow of controllable sources so that natural cleanup rates will be maximized and (2) identify human activities that may increase the rate of mercury methylation in the system and to prevent the creation of environments that may increase that rate.

To ensure that controllable sources are controlled, the strategy sets up a process to focus on the most cost-effective measures first. A preliminary evaluation indicates that the most cost-effective measures are to: (1) remediate abandoned mine sites on the western side of the Central Valley and the New Almaden district in the South Bay, (2) step up recycling programs for mercury users such as miners on the east side of the Central Valley, dentists and hospitals, (3) improve household product substitution such as products produced by the mercury caustic cell process and (4) verify the status of the use of scrubber systems on sludge incinerators. Many permitted entities in the San Francisco and Sacramento Regions have already implemented these measures. In addition, as part of the mercury strategy dischargers are implementing clean sampling and analytical techniques. This will result in improved loading estimates and improve the evaluation of the most cost-effective remedial alternatives.

The RWQCB has worked with dischargers to set up programs for pollution prevention and source control of mercury and other chemicals of concern. The Palo Alto Regional Water Quality Control Plant and the City and County of San Francisco have devoted significant resources in their service areas into identifying sources of these contaminants and determining methods of decreasing loads to their facilities.

In addition to these control measures, the draft strategy includes a provision for a pilot offset program for point source dischargers. If successful, the pilot offset program would create an administrative tool that can help direct regulatory efforts toward cost-effective measures first.

The initial step has been taken to begin implementation of this strategy with the formation of watershed council for mercury. This council includes broad representation from dischargers and public interest groups. The first phase has been the establishment of three workgroups. One work group is focused on pollution prevention and the identification of opportunities to remove or replace products or practices that may contain or generate mercury. A second group is reviewing a separate workplan developed by Regional Board staff for the completion of a total maximum daily load for mercury for San Francisco Bay. The third group is investigating the possibility of including pollution credit trading as part of the overall control strategy.

The second goal of the proposed mercury strategy, to minimize the environmental risk associated with existing levels of mercury in the Bay system, requires a better understanding of the processes that control mercury methylation and the subsequent bioavailability of mercury to the food chain. This understanding is necessary in order to determine whether methylation can be managed. The proposed regional pollutant policy includes provisions for defining water quality based effluent limits for point source discharges, and a series of actions to be taken by nonpoint source control agencies and entities. These provisions may serve as a TMDL for all segments of San Francisco Bay except possibly the extreme South Bay where a separate TMDL may be developed. Adequate funding to complete both the TMDL Basin Planning process and the methylation research and management efforts has not been identified. However, a grant from CALFED that has been awarded with the Department of Fish and Game as the principal

investigator will provide significant information to assist in resolving these questions.

In order to identify and cleanup mercury sources under the jurisdiction of the Central Valley RWQCB, interregional coordination is necessary. Because these sources contribute such a high proportion of the load to the estuary, control of these sources as part of the San Francisco Bay Region's mercury strategy is essential. However, due to liability issues the State and interested private parties are limited in their ability to clean up mines in which there are no responsible parties. An amendment to the Federal Clean Water Act is needed in order to resolve this issue.

In April 1998, the RWQCB completed a survey of all of the region's abandoned mines. In total, 41 mines were surveyed and mines that had actual or potential impacts to water quality were identified. The survey documented conditions at the mines through field inspections, photographs and chemical analyses. Five mercury mines with drainages to the San Francisco estuary were identified as having actual or potential impacts to water quality. The New Almaden mine was one of these mines and was by far the largest with the highest water quality impact. Recommendations were made for monitoring or controlling waste in these mines. The RWQCB is currently monitoring all of the North Bay tributaries to the Bay to identify areas with elevated mercury concentrations.

The New Almaden mercury mine was the second largest mercury mine in the world during its operation. The mine consists of several mines: those located within Santa Clara Almaden Quicksilver Park and those located outside the Park. Those mines located within Santa Clara County Almaden Quicksilver Park are currently being remediated under CERCLA. The Department of Toxic Substances Control is the lead agency, while the RWQCB provides input on water quality issues on this project.

Remediation of the mines within Santa Clara Almaden Quicksilver Park was divided into two phases: Phase 1: remediation of Hacienda Furnace Yard, and Phase 2: remediation of the rest of the Park. The Hacienda Furnace Yard was identified as the highest priority area, from a water quality perspective, of six areas in need of cleanup. In this location mine tailings were eroding directly into Los Alamitos Creek, a tributary to San Francisco Bay. Cleanup of this area began in the spring of 1996 and was completed in

December 1997. Phase 2 of the project, which includes remediation of Mine Hill, San Francisco Open Cut, Enriquita Mine, San Mateo Mine, and Senator Mine was started in August 1998 and is scheduled to be completed January 1999. Mine Hill, San Francisco Open Cut and Enriquita Mine were identified as potential sources of mercury laden sediment that flow directly to Guadalupe and Almaden Reservoirs with surface runoff. Because mercury strongly binds to particulates, these reservoirs may be serving as a sink for mercury, therefore minimizing fluxes to the Bay. However, these reservoirs are currently posted with a health advisory on consuming fish because of mercury contamination.

With the completion of Phase 2 of the project, all known mine waste piles located within Santa Clara County Almaden Quicksilver Park will be either capped in place or moved to somewhere else in the Park and capped. However, other remaining sources of potential mercury contamination, i.e. those mines located outside the Park and mercury laden sediment from the overburden natural formations within the greater watershed areas of Guadalupe and Almaden Reservoirs, are yet to be addressed.

PCBs

PCBs are ubiquitous and diffuse in the sediments throughout San Francisco Bay. Although several areas have been identified that have elevated sediment concentrations (see Sites of Concern and Candidate Toxic Hot Spots in Appendix B), these levels do not approach sediment concentrations that have been measured in the Great Lakes or many East Coast harbors. Yet, the mass of PCBs in the estuary's sediment and possible ongoing sources have contributed to levels in fish that are a potential threat to human health. Sites with historically elevated levels of PCBs should be evaluated for cleanup, however, identification and cleanup of ongoing sources is extremely important.

The RWQCB has been working with dischargers, both point and nonpoint, and the RMP to identify sources of PCBs to the estuary. An article in the 1996 RMP annual report (SFEL, 1997) indicates that ongoing sources of PCBs are discharging to the Bay. To further this evaluation a RMP workgroup has been set up to evaluate PCB data from the Bay, perform a preliminary model of loadings and come up with conclusions and recommendations for future monitoring and studies. Preliminary results indicate that there may be significant ongoing sources. Results of a 1997 RMP fish pilot study indicate that fish from Oakland Harbor have

distinctly higher levels of contaminants than at other areas monitored in the Bay. This was particularly true for mercury, PCBs, DDTs and dieldrin. Additional monitoring needs to be conducted in Oakland Harbor, particularly of stormwater runoff, to identify sources of these contaminants. A study was recently conducted by SFEI, with funds from an ACL from the Port of Oakland, in San Leandro Bay, a toxic hot spot just south of Oakland Harbor. Contaminants from San Leandro Bay may accumulate in the fish from Oakland Harbor that were sampled. The purpose of the study was to identify the extent and general sources of contamination. The results of this study are not yet available.

Chlorinated Pesticides

Lauritzen Canal is an area in Richmond Harbor that had extremely elevated levels of DDT. This site was recently cleaned up under CERCLA. Although U.S. EPA was the lead agency, the RWQCB coordinated with U.S. EPA and other agencies to implement the cleanup.

As with the other chemicals previously discussed, it is important to monitor discharges (both point and nonpoint) to the estuary for the identification and cleanup of sources of chlorinated pesticides. The Regional Board is working with dischargers and the RMP to identify sources of these contaminants. However, as was discussed under Future Needs, increased resources for watershed monitoring and assessment are needed to address this issue in a significant manner.

Dioxins

The RWQCB has requested the assistance of the California Environmental Protection Agency in addressing the problem of dioxin contamination, due to the cross-media issues that are involved in identifying and controlling any ongoing dioxin sources. Coordination with the Bay Area Air Quality Management District and the State Air Resources Board is essential in addressing this issue since the predominant source of this contaminant is through aerial deposition. A meeting was held in 1997 for scientists to present information on dioxin to the RWQCB. Since the majority of dioxins in the Bay Area is likely generated by fixed and mobile combustion of diesel fuel and emission into the air, regulation of point source discharges into the Bay is unlikely to have an impact on the concentration of dioxin in sediment or organisms. Since even areas removed from sources

contain background levels of dioxins that are potentially harmful to humans and other organisms, and since this group of contaminants are very persistent and can be spread great distances through aerial deposition, a global strategy is truly needed. This will probably require that the U.S. EPA take the lead in cooperation with the California Environmental Protection Agency in addressing this problem including instituting any additional control measures.

Summary of actions by government agencies in response to health advisory

Due to the large reservoir of mercury and PCBs in the estuary it may take decades for contaminant levels in fish to reach acceptable levels, even with full implementation of the cleanup plan. Therefore, interim measures should be taken to: (1) determine the rate of change in chemical concentrations in fish to determine if natural processes and required cleanup measures are having an effect, and over what time scale, (2) determine the risk of consuming fish from the Bay and identify high risk populations and (3) conduct public outreach and education programs, especially to high risk populations, in order to minimize their risk.

The RWQCB has been leading an effort through the RMP to conduct studies to address the first two issues. Several committees have been put together with representatives from State and Federal agencies, environmental groups and dischargers (who fund the program). A five year plan has been developed to: (1) measure contaminant levels in fish throughout the Bay every three years, (2) conduct special studies on specific species, organs or chemicals of concern and (3) conduct a consumption study to quantify the parameters that would go into a risk assessment for San Francisco Bay and to identify high risk populations for public outreach and education.

The second monitoring study of contaminant levels in fish tissue in the Bay, after the BPTCP study, was carried out through the RMP in the summer of 1997 by the Department of Fish and Game. Results will be published in the RMP's 1997 Annual Report. A special study was conducted in the spring of 1998 to measure contaminant levels in resident clams that are collected by clammers. A special study will be conducted in the spring of 1999 to measure contaminant levels in crabs. The State Department of Health Services has been hired to conduct the consumption study and this study is currently underway.

The Department of Health Services has been chairing a committee for Public Outreach and Education on Fish Contamination. As a result, County Health Departments and the East Bay Regional Parks District have posted signs at public fishing areas in six different languages describing the advisory. Currently, the committee is developing a strategy to more effectively educate the public on this issue. This strategy, however, is limited due to the lack of funding for this effort and the fact that there is no legal mandate that requires any agency to address this issue. Environmental groups have been using various forums to educate people who eat Bay fish on how to decrease their risk, but their funding is also very limited.

Approach/Alternatives:

1. Finish the cleanup of the New Almaden Mine.
2. Clean up sediment at Point Potrero that is high in PCBs (see Issue 5.2.2).
3. Finalize the Basin Plan amendment process to add the proposed TMDL, pilot permit offset program, and regional requirements for ongoing mercury sources.

Once adopted, implement the two main components of the Region-wide Mercury Strategy. The first component is controlling ongoing, controllable sources, thereby enhancing the natural cleanup process and accelerating mine remediation work. The second component involves developing new technical information about mercury methylation and sediment fate and transport within different zones of the estuary. This information is needed to enable the Regional Board to manage methylation and bioaccumulation to the greatest extent possible.

4. Increase investigations into ongoing sources of mercury and PCBs and develop remediation plans for those sources.

This action would require an increase in watershed monitoring and assessment (see Future Needs) and in the case of mercury would require coordination with the Central Valley RWQCB. PCBs should be fingerprinted to distinguish the difference between historic and ongoing sources. Biomarker methods could be used to more inexpensively screen for PCBs. The highest priority for monitoring should be in areas where fish contain higher levels of contaminants (Oakland Harbor), areas where sources of PCBs or

mercury have been identified, and areas where these chemicals are or were used or produced.

5. Continue RMP studies on fish contamination issues.
6. Increase public education to:
 - a. Inform people who consume San Francisco Bay fish, especially high risk populations, about the health advisory and ways to decrease their risk and,
 - b. Inform the public on product use and replacement in order to decrease concentrations of chemicals of concern. This could include the use of dioxin free paper, the substitution or conservation of diesel fuel, limiting the use of fireplaces and wood stoves and the substitution of mercury containing products.

Endangered species consultations will take place for any part of this plan for which it is required.

Estimate of the total cost to implement the cleanup plan

1. Cleanup of New Almaden Mine - \$10 million (includes the amount already spent for cleanup, \$5 million, and the additional amount expected to be needed to complete the cleanup).
2. Point Potrero cleanup - \$800,000 - \$3,000,000
3. Implement Mercury Strategy - \$10-20 million
 - a. Finalize and implement Basin Plan amendment
 - b. Technical studies including:
 - Fate and transport of particle-bound mercury in Bay system
 - Mercury methylation studies
4. Ongoing sources
 - a. Watershed investigations to identify ongoing sources of the chemicals of concern in the San Francisco Bay and Central Valley Regions - \$4 million over 5 years
 - b. Costs of cleanup once sources are identified - Unknown

5. RMP studies (including monitoring of contaminant levels in fish every three years and special studies) - Average \$75,000/year (1998-99 special studies and consumption study are already funded)
6. Public Education
 - a. Outreach and education to people consuming fish from the Bay to reduce their health risk (including DHS staff, translations, training and educational materials) - \$150,000 for first two years then \$50,000/year
 - b. Educational efforts on source control and product substitution - \$50,000

Total to Implement Plan--Approximately \$25 to \$45 million (not including cleanup of ongoing sources that have not yet been identified)

Although there are costs to implementing this plan there are also benefits. Currently, beneficial uses are being impacted by high concentrations of mercury and PCBs in San Francisco Bay that are accumulating in fish. These concentrations have lead to a human health advisory on consuming fish but probably also impact other higher trophic organisms, such as marine mammals and birds that have a much higher consumption rate than humans, as well as possibly the fish themselves. The beneficial uses that are impacted are OCEAN, COMMERCIAL AND SPORTFISHING (COMM), MARINE HABITAT (MAR), ESTUARINE HABITAT (EST), WATER CONTACT RECREATION (REC1), NONCONTACT WATER RECREATION (REC2) and probably WILDLIFE (WILD) and SHELLFISH HARVESTING (SHELL). Implementation of this plan is intended to lower concentrations of these chemicals in fish and minimize or eliminate the impacts on beneficial uses.

Estimate of recoverable costs from potential dischargers

Ongoing RMP studies are currently funded by dischargers at approximately \$75,000/year. Cleanup of the New Almaden Mine in Santa Clara Almaden Quicksilver Park (\$5 million) and Point Potrero (\$0.8 - \$3.0 million) will be paid for in full by the responsible parties. The total equals approximately \$5.8 million to \$8 million plus \$75,000/year for RMP studies.

Two-year expenditure schedule identifying funds to implement the plans that are not recoverable from potential dischargers

Although funding is available for continuation of the RMP studies and the cleanup of Point Potrero and the part of New Almaden Mine in Santa Clara Almaden Quicksilver Park there is little or no funding for the other parts of the cleanup plan.

Recommendations:

Adopt each alternative, cost estimates and expenditure plans into the cleanup plan.

Site 2.2: San Francisco Bay Region, Peyton Slough

Site Description: The San Francisco Bay RWQCB identified several high priority toxic hot spots in their Regional Toxic Hot Spots Cleanup Plan. The RWQCB has identified several actions that are underway at Peyton Slough. A potential discharger has been identified as being responsible for this site.

Description of site

Peyton Slough is located in Martinez, northern Contra Costa County, California. The slough discharges into the San Francisco estuary at the confluence of Suisun Bay and the Carquinez strait, near Bull Head Point, just east of the Benicia Bridge.

Sediments in Peyton Slough are comprised of firm clays that do not appear to erode easily (CH2MHILL, 1986). Sediments from Peyton Slough appear to have been dredged in the past with the dredge spoils deposited on the east and west shore forming levees. There are openings in the east levee downstream of the tidal gate that provide exchange between Peyton Slough and a large brackish wetland to the east of the slough.

During the winter, Peyton Slough receives fresh water discharge from the Contra Costa Canal and stormwater runoff from the surrounding area. During the dry weather months, Peyton Slough receives fresh water treated discharge primarily from a waste water treatment plant (Mountain View Sanitary District) through a tidal gate. Some minor flow from the Contra Costa Canal may also occur during the dry months. A tidal gate had been configured such that fresh water from upstream can be released when the water level is greater on the upstream side of the gate. In 1998, this tidal gate was replaced with a newer gate which will allow water to flow from the bay into a wetland area situated upstream from Peyton Slough.

Two major historical industrial activities have taken place in the vicinity of Peyton Slough on a site currently owned and operated by Rhodia: sulfuric acid production and the smelting of copper. Historically, the first recorded industrial use near Peyton Slough was by the Mountain Copper Company (MOCOCO). This company used the site for a copper smelting operation from the early 1900s until 1966 at which time it was purchased by Stauffer Chemical Company. During the smelting of copper, a fused silicate slag was generated which was discharged over the north

and south sides of the hillside housing the smelter. MOCOCO also roasted pyrite ore to recover its sulfur. Resulting cinders remain on site.

Cinder and slag, classified as Class B Mining Waste, from the smelting operations were stored in large piles on the site. The north cinder/slag area covers 8.3 acres, while the south cinder/slag covers 7.1 acres. Due to their weights, the cinder and slag piles subsided 30 to 35 feet into the softer bay mud below the existing ground surface. Stauffer Chemical Company bought the site from MOCOCO and removed the cinder/slag piles to the depth of the water table, but it is estimated that over 500,000 tons of waste material remains below the surface. The remaining north and south cinder/slag piles have been capped with a minimum of two feet of low permeability soil in 1978 and 1980 respectively.

In 1972, a leachate removal and containment system (LRCS) was installed in response to a cease and desist order No. 71-21 issued by the RWQCB (The MARK Group, 1988b). The LRCS prevented leachate from moving to Carquinez Strait and Peyton Slough by a cut-off wall consisting of compacted bay mud along the bay shoreline. Prior to 1988, the leachate from the north cinder/slag area was pumped to a north solar evaporation pond. Leachate from the south cinder/slag piles was pumped from two deep sumps to the south solar evaporation pond. Starting in 1988, the Process Effluent Purification (PEP) system was installed and began treating this leachate prior to discharge to a deep water outfall. Cutoff walls were not constructed along Peyton Slough. However, to date there is no evidence that leachate is being discharged into the slough.

Currently, the Contra Costa Mosquito Vector Control District (CCMVCD) is planning a restoration project in Shell marsh. This project intends to restore the marsh south of Peyton Slough back to a brackish marsh with regular inputs of salt water from San Francisco Bay. As part of this project, the CCMVCD has replaced the tidal gate in Peyton Slough and is proposing to dredge Peyton Slough to allow for higher flows of saline water up the slough into Shell marsh. This project is partially funded by Caltrans to mitigate for discharge from Route 680 and to prevent flooding of the highway. Rhodia is also working with CCMVCD to coordinate the dredging of Peyton Slough. Regional Board staff has been helping to coordinate completion of the marsh restoration

project in order to remediate the toxic hot spot, restore Shell marsh and alleviate flooding on Route 680.

Summary of actions initiated at the site

In 1972, a leachate removal and containment system (LRCS) was installed in response to a cease and desist order No. 71-21 issued by the RWQCB (The MARK Group, 1988b). The LRCS prevented leachate from moving to Carquinez Strait and Peyton Slough by a cut-off wall consisting of compacted bay mud along the bay shoreline. Prior to 1988, the leachate from the north cinder/slag area was pumped to a north solar evaporation pond. Leachate from the south cinder/slag piles was pumped from two deep sumps to the south solar evaporation pond. Starting in 1988, the Process Effluent Purification (PEP) system was installed and began treating this leachate prior to discharge to a deep water outfall. Cut-off walls were not constructed along Peyton Slough, however, to date there is no evidence that leachate is being discharged into the slough.

Waste Discharge Requirements for Rhodia have been regulated under the National Pollution Discharge Elimination System (NPDES) Permit No. CA 0006165 and Order 93-060 in June 1993, which was amended by order 96-033 in March 1996. Recently, the SFB-RWQCB reissued Waste Discharge Requirements, under Order No. 97-121, which rescinded previous Orders. Leachate from the onsite cinder and slag piles are mixed with the treated process waste water. Until recently, this discharge was located in the tidal section of Peyton Slough about 800 yards upstream of its confluence with Carquinez Strait and 200 feet downstream of the tidal gate. Currently, this discharge goes to a deepwater outfall located in the Carquinez Strait. Another source of discharge from the Rhodia site originates from storm water runoff from the Caltrans I-680 and Benecia bridge, and from the western highlands drain collection system located on this property. This runoff flows via a pipeline into a usually submerged discharge point in Peyton Slough.

As part of the reissuance of Waste Discharge Requirements in Order No. 97-121, Rhone Poulenc, now Rhodia, was asked to submit a workplan, including a detailed schedule, for investigation of metal contamination in Peyton Slough sediments. The workplan has been submitted, and a site investigation is being completed. Results of this site investigation are provided in a previous section

(Reason for Listing). The RWQCB has asked Rhodia to provide a remedial workplan based on these results.

Mountain View Sanitary District (MVSD) discharges an average of 1.47 million gallons per day MGD to 21 acres of intensively managed marsh ponds at a location 1,000 yards upstream of the tidal gate under NPDES Permit No. CA 0037770, Order 93-001. Wet weather flows have been approximately 3.5 MGD, with wet weather peaks of 11.1 MGD allowed. Effluent in Peyton Slough backs up onto 68 acres of wetland also managed by the discharger.

Approach/Alternatives:

The CCMVCD Shell marsh restoration project needs to deepen Peyton Slough in order to enhance salt water flow into Shell marsh. Rhodia is currently coordinating their remediation plan for Peyton Slough with this project, and is studying the feasibility of various other activities. Dredging of contaminated sediments to three feet below needed depth and back filling with clean materials has been proposed for Peyton Slough since contamination has been shown to extend to at least 8 feet below the sediment surface. Dredging and capping with clean compatible fill seem to be the most feasible alternative since contamination is so deep and the slough is so narrow removal of all contaminated sediment would cause instability of the sidewalls. Follow-up monitoring would be required to make sure that the cap stays in place and is effective. Contaminated sediments to be dredged are estimated at 12,000 cubic yards and will be disposed at a regulated off site landfill. An endangered species consultation with all appropriate agencies is currently in progress.

Estimate of the total cost to implement the cleanup plan

Based on the proposed remediation, the estimated cost is for 12,000 cubic yards of sediments to be dredged and disposed, and for a three-foot cap to be put in place in the entire slough. The range of costs are approximately \$400,000 to \$1,200,000 depending on the methodology followed for the cleanup, and other potential activities such as building a subsurface cut-off wall or a cap on the sidewall along the slough to control groundwater discharge. Follow-up monitoring would cost approximately \$5,000-\$10,000/year. RWQCB staff costs are estimated at \$10,000 to \$50,000 over the entire course of the project.

Although there are costs to implementing this plan there are also benefits. Currently, beneficial uses are being impacted by high concentrations of chemicals at this site. The beneficial use that is

impacted is ESTUARINE HABITAT (EST). Sediments from this site cause toxicity to test organisms and may have an impact on the benthos. Since Peyton Slough will be the main conduit of water from Carquinez Strait to the restored Shell marsh, cleanup of this site will prevent other marsh organisms from being exposed to chemicals from the slough. Implementation of this plan will minimize or eliminate this impact on the beneficial use.

Estimate of recoverable costs from potential dischargers

The responsible party or parties are accountable for all costs incurred as a result of site cleanup at Peyton Slough as well as the cost for RWQCB and other regulatory staff oversight. However, Caltrans has budgeted \$300,000 toward the CCMVCD restoration project which can be partially used to defray the cost of dredging.

Two-year expenditure schedule identifying funds to implement the plans that are not recoverable from potential dischargers

The responsible party or parties are accountable for all costs incurred as a result of site investigations and cleanup at Peyton Slough as well as the cost for RWQCB and other regulatory staff oversight.

Recommendation: Adopt the alternative as presented.

Site 2.3: San Francisco Bay Region, Castro Cove

Site Description: The San Francisco Bay RWQCB identified several high priority toxic hot spots in their Regional Toxic Hot Spots Cleanup Plan. The RWQCB has identified several actions that are underway at Castro Cove. A potential discharger has been identified as being responsible for this site.

Description of site

Castro Cove is a protected embayment located in the southern portion of San Pablo Bay in Richmond, CA. Castro Cove is defined as the cove enclosed by a line drawn from the Point San Pablo Yacht Club breakwater to the northwest corner of the West Contra Costa Sanitary Landfill. The embayment is protected by diked margins on the west, south and most of its eastern margin. The southeastern portion, where Castro Creek enters the cove, is a salt marsh. Castro Cove is shallow with extensive mudflats and marshlands that are subject to tidal action. Castro Creek empties into a channel that is about 30 to 75 feet wide and about three to six feet deep at mean lower low water.

Summary of actions initiated at the site

RWQCB actions regarding Castro Cove have been to control the sources of contamination through NPDES permitting and ACLs. All municipal and industrial point source discharges to Castro Cove were eliminated by 1987. Process effluent discharge from the Chevron refinery into Castro Cove was prohibited after July 1, 1987 under NPDES permit CA0005134, thereby eliminating the source of contaminated effluent into Castro Cove. This NPDES permit regulates discharges from the deep-water outfall. Discharges regulated by this NPDES permit include: thermal waste, cooling tower blowdown, gas scrubber blowdown from an incinerator, treated process wastewater, cooling water, and storm water. As stated previously, the San Pablo Sanitary District discharge was relocated to an offshore deep-water site which is also under permit. The City of Richmond is required by its municipal stormwater permit to implement and document the effectiveness of best management practices to reduce or prevent pollutant discharge through the city's stormwater runoff collection system.

The RWQCB has also conducted sampling and analysis of sediments in Castro Cove as discussed in the previous section.

State Order 86-4 required Chevron to evaluate the quality of the sediments in Castro Cove resulting in the Entrix and EVS studies. In June 1998, RWQCB staff requested, under Section 13267 of the California Water Code, that Chevron submit a workplan and schedule for characterization of sediment contamination in Castro Cove due to sources from the refinery. Specific items that RWQCB staff requested the workplan to address included: (1) a delineation of sediment contamination gradients originating from refinery-related source areas, (2) an evaluation of the effects of the bioavailable layer of sediment on aquatic organisms by means of concurrent toxicity and chemistry testing, (3) a characterization of the vertical extent of sediment contamination in conjunction with an estimation of sediment deposition and erosion rates, and (4) an evaluation of the bioaccumulation/biomagnification potential for contaminants in the sediment.

Chevron submitted a workplan in August 1998 that proposed a tiered ecological risk assessment consisting of a new round of surficial sediment sampling and chemical analysis with subsequent comparison of the resulting chemical concentrations to established ecological benchmarks. If chemicals likely associated with refinery releases exceed the proposed benchmarks and complete exposure pathways exist, Chevron proposed conducting a second tier risk assessment to address specific ecological concerns. This second tier may contain bioassays and a bioaccumulation/biomagnification evaluation in addition to a refined predictive risk assessment. The workplan also proposed conducting a bathymetric survey and comparing the results to a previous survey made in 1989 to evaluate sediment accretion or erosion rates in Castro Cove. RWQCB staff conditionally approved the workplan in September 1998 with the provision that additions would be made to the plan. RWQCB staff collected five core samples in Castro Cove in November 1998 to begin characterization of the vertical contaminant profile. In December 1998 Chevron took deep core samples in Castro Cove.

Approach/Alternatives:

Corrective actions for Castro Cove sediments will require the following phases:

1. Preparation of a Sampling and Analysis Plan (SAP) in order to delineate vertical and horizontal extent of contamination,
2. Completion of a Site Investigation to complete goals of SAP,

3. Preparation of a Feasibility Study (FS) based on the findings of the Site Investigation (at a minimum the following cleanup options will be considered: natural recovery, in-place containment, dredging with various disposal options and dredging and capping),
4. Sediment clean up following option(s) selected from the FS and,
5. Follow-up monitoring to make sure that the site has been cleaned up.

An endangered species consultation with all appropriate agencies will be conducted before remediation plans are finalized.

Estimate of the total cost to implement the cleanup plan

The uncertainty regarding the horizontal and vertical extent of sediment contamination results in a range of potential cleanup costs. All options including natural recovery, dredging, dredging with upland disposal and capping will be considered for remediation. The cost is estimated based on a contaminated area ranging from a minimum of 10 acres to a maximum of 100 acres. Sediments will be assumed to be contaminated to a depth of at least three feet below the sediment surface. The cost of performing a full site investigation and feasibility study is estimated at \$2,000,000. The cost of remediating Castro Cove, depending on the chosen remedial alternative, and follow-up monitoring is estimated at \$1,000,000 to \$20,000,000. Follow-up monitoring will be required regardless of the chosen remedial alternative. RWQCB staff costs are estimated at \$200,000 over the entire course of the project.

Although there are costs to implementing this plan there are also benefits. Currently, beneficial uses are being impacted by high concentrations of chemicals at this site. The beneficial use that is impacted is ESTUARINE HABITAT (EST). Implementation of this plan will minimize or eliminate this impact on the beneficial use.

Estimate of recoverable costs from potential dischargers

The responsible party or parties are accountable for all costs incurred as a result of site investigation and cleanup at Castro Cove as well as the cost for RWQCB and other regulatory staff oversight.

Two-year expenditure schedule identifying funds to implement the plans that are not recoverable from potential dischargers

The responsible party or parties are accountable for all costs incurred as a result of site investigation and cleanup at Castro Cove as well as the cost for RWQCB and other regulatory staff oversight.

Recommendation:

Adopt the approach, estimated costs and expenditure plan as presented.

Site 2.4: San Francisco Bay Region, Stege Marsh

Site Description: The San Francisco Bay RWQCB identified several high priority toxic hot spots in their Regional Toxic Hot Spots Cleanup Plan. The RWQCB has identified several actions that are underway at Stege Marsh. A potential discharger has been identified as being responsible for this site.

Description of site

Stege marsh occupies approximately 23 acres on the western margin of San Francisco Bay in the City of Richmond, California. Eastern Stege marsh is located on property currently owned by Zeneca Agricultural Products. Western Stege marsh is currently owned by the University of California Field Station. The cinder landfill separates east and west Stege marsh. The East Bay Parks District currently owns the land south of the historic railroad track which is now a hiking trail.

Eastern Stege marsh rests directly on the alluvial fan-deltaic deposits of Carlson Creek interspersed with Bay mud. Bedrock at the site is likely to be Franciscan Formation rocks, cretaceous and younger in age, consisting of an assemblage of marine sedimentary and volcanic, and some metamorphic rocks (The Mark Group, 1988). Western Stege Marsh is fed by Meeker Creek. Between 1947 and 1969, a railroad track was constructed just south of Stege marsh resulting in siltation and thus the extension of the tidal marsh into a previously subtidal area (May, 1995).

Stauffer Chemical Company is the prior owner of the Zeneca industrial facility and associated marsh. Stauffer Chemical Company utilized the industrial portion of the site to roast pyrite ores for the production of sulfuric acid from about 1919 until 1963. This industrial process resulted in the production of cinders, which were placed on the site surface. Elevation at the bottom of the cinders is at mean sea level throughout the facility, which indicates past placement of cinders at ground level. The presence of a layer of peaty silt under the base of the cinders also supports that cinders were disposed of on the

site surface. The cinder pile extends along the north and east sides of eastern Stege marsh. The cinders were covered with a one-foot clay layer, with a permeability of 10^{-7} cm/sec or less, that was itself covered by a one-foot layer of topsoil to comply with RWQCB Order No. 73-12 and its 1974 amendment.

Besides pyrite cinders, other products that have been generated or utilized on the site include fuels, sulfuric acid, ferric sulfate, proprietary pesticides, solvents and alum. Until recently Zeneca produced proprietary agricultural chemicals on the industrial portion of the site.

Summary of actions initiated at the site

RWQCB actions regarding Stege marsh have been to control the sources of contamination through NPDES permitting. NPDES permit No. CA0006157 (Order No. 95-008) requires that wastewater from the evaporation ponds be discharged into the City of Richmond sanitary sewer. Discharge to Stege marsh is only allowed during storm events when the sanitary sewer capacity and on-site storage capacity have been exhausted. A prior NPDES permit requested that the cinders be capped and that an interceptor trench be built to limit discharges from the pyrite cinders.

Other actions by the RWQCB have included a request to Zeneca Agricultural products for sampling and analyses of sediments. In December 1996, the RWQCB requested, under section 13267 of the California Water Code, that Zeneca Agricultural Products perform sediment studies in order to propose a conceptual site model to evaluate potential impacts of contaminants including ecological and human health impacts. The studies by ICF Kaiser and Pacific Eco-Risk Laboratories were in response to this request. However, these studies are just the beginning of studies that will be required to develop a full conceptual site model.

Approach/Alternatives:

1. Completion of a Sampling and Analysis Plan (SAP) in order to finish delineating vertical and horizontal extent of contamination (in progress);

2. Completion of a Site Investigation to complete goals of SAP including development of a conceptual site model and ecological and human health risk assessments (in progress);
3. Preparation of a Feasibility Study (FS) based on the findings of the Site Investigation (at a minimum the following cleanup options will be considered: natural recovery, in-place containment, dredging with various disposal options, and dredging and capping);
4. Sediment clean up following option(s) selected from the FS and,
5. Follow-up monitoring to ensure that the site has been cleaned up to agreed levels.

An endangered species consultation with all appropriate agencies will be conducted before remediation plans are finalized.

Estimate of the total cost to implement the cleanup plan

The uncertainty regarding the horizontal and vertical extent of sediment contamination, the potentially varied nature of the sources of contamination and the cleanup options results in a range of potential clean-up costs. The cost is estimated based on a minimum of 10 acres and a maximum of 23 acres being remediated. The range of costs are \$1,500,000 to \$10,000,000 depending on the range of clean-up options selected and the areal extent remediated. RWQCB staff costs are estimated at \$100,000 to \$200,000 over the entire course of the project.

Although there are costs to implementing this plan there are also benefits. Currently, beneficial uses are being impacted by high concentrations of chemicals at this site. The beneficial use that is impacted is ESTUARINE HABITAT (EST) at a minimum. Due to high concentrations of bioaccumulative compounds, such as selenium, WILDLIFE HABITAT (WILD) and PRESERVATION OF RARE AND ENDANGERED SPECIES (RARE) may also be impacted.

Implementation of this plan will minimize or eliminate these impacts on beneficial uses.

Estimate of recoverable costs from potential dischargers

The responsible party or parties are accountable for all costs incurred as a result of site investigation and site cleanup at Stege marsh as well as the cost for RWQCB and other regulatory staff oversight.

Two-year expenditure schedule identifying funds to implement the plans that are not recoverable from potential dischargers

The responsible party or parties are accountable for all costs incurred as a result of site investigation and cleanup at Stege marsh as well as the cost for RWQCB and other regulatory staff oversight.

Recommendation:

Adopt the approaches, cost estimates and expenditure plan as presented.