Los Angeles Regional Contaminated Sediments Task Force:

Long-Term Management Strategy

Los Angeles Region
CONTAMINATED
SEDIMENTS
TASK FORCE

California Coastal Commission

Los Angeles Regional Water Quality Control Board

U.S. Environmental Protection Agency, Region 9

U.S. Army Corps of Engineers, Los Angeles District

Los Angeles County Department of Beaches and Harbors

Southern California Coastal Water Research Project

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The Los Angeles Region Contaminated Sediment Long-Term Management Strategy was prepared for the Contaminated Sediments Task Force in a collaborative forum by staff from Federal, State, and local agencies, ports, research organizations, environmental advocacy groups, and private consulting firms. The members of the CSTF include representatives from the following organizations:

- California Coastal Commission
- Los Angeles Regional Water Quality Control Board
- U.S. Environmental Protection Agency, Region 9
- U.S. Army Corps of Engineers, Los Angeles District
- Los Angeles County Department of Beaches and Harbors
- Southern California Coastal Water Research Project
- California Department of Fish & Game
- NOAA Fisheries
- Port of Los Angeles
- Port of Long Beach
- City of Long Beach
- Heal the Bay

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AC/DC	Alternating Current/Direct Current
AET	Apparent Effects Threshold
ARSSS	Anchorage Road Soil Storage Site
BMP	Best Management Practice
B.P.	Before Present
BPTCP	Bay Protection Toxic Cleanup Program
CAD	Confined Aquatic Disposal
CBSQG	Consensus Based Sediment Quality Guideline
CCC	California Coastal Commission
CDF	Confined Disposal Facility
CDFG	California Department of Fish and Game
CDS	Continuous Deflection Separator
CEQA	California Environmental Quality Act
CLAEMD	City of Los Angeles – Environmental Monitoring Division
cm	centimeters
cm/s	centimeters per second
CO	Carbon Monoxide
COBRA	California Outdoor Motor Racing Association
Corps	U.S. Army Corps of Engineers
County	Los Angeles County
CSTF	Contaminated Sediments Task Force
CSWH	Cabrillo Shallow Water Habitat
CWA	Clean Water Act
cy	cubic yards
cy/yr	cubic yards per year
DAF	dissolved air floatation
dBA	A- weighted decibel
DDT	dichlorodiphenyltrichloroethane
DMMP	Dredged Material Management Plan
DMODSD	dredged material ocean disposal site designation
EA	Environmental Assessment
EIS/EIR	Environmental Impact Statement/Environmental Impact Report
EMAP	Environmental Monitoring and Assessment Program
EPA	U.S. Environmental Protection Agency
ERDC	Engineering Research Development Center
ERL	Effects Range Low
ERM	Effects Range Median
ERMq	Effects Range Median Quotient
EqP	Equilibrium Partitioning
ESA	Endangered Species Act
FP	floating percentile
ft/s	feet per second
IPs	Individual Permits

ITM	Inland Testing Manual
LA/LB	Los Angeles/Long Beach
LACDPW	Los Angeles County Department of Public Works
LAHD	Los Angeles Harbor District
LARE	Los Angeles River Estuary
LARWQCB	Los Angeles Regional Water Quality Control Board
LASQC	Los Angeles Regional Sediment Quality Guideline
LBSWMP	Long Beach Storm Water Management Program
LCP	Local Coastal Program
LRM	Logistic Regression Model
m^3	cubic meters
m^3/yr	cubic meters per year
μg	micrograms
mgd	million gallons per day
mg/L	milligrams per liter
MCL	Maximum Contaminant Levels
MEC	Median Effects Concentration
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
mph	miles per hour
MLLW	mean lower low water
MPRSA	Marine Protection, Research and Sanctuaries Act
MRP	Monitoring and Reporting Program
NEIBP	North Energy Island Borrow Pit
NEPA	National Environmental Policy Act
NOAA	National Oceanic Atmospheric Administration
NOx	Nitrogen Oxides
NPDES	National Pollutant Discharge Elimination System
NPS	Non-Point Source
NSI	National Sediment Inventory
OAL	Office of Administrative Law
OEHHA	Office of Environmental Health Hazard Assessment
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PEC	Probable Effect Concentration
PM10	Particular Matter (10 Micron)
PMP	Port Master Plan
POLA	Port of Los Angeles
POLB	Port of Long Beach
POTW	publicly owned treatment works
RCRA	Resource Conservation Recovery Act
Region	Los Angeles Region
RGP	Regional General Permits

RHA	Rivers and Harbors Act
ROC	Receiver Operating Characteristic
ROG	Reactive Organic Gases
RTDF	Remediation Technology Development Forum
RTK	Real Time Kinematic
RWQCB	Regional Water Quality Control Board
SCAQMD	South Coast Air Quality Management District
SCCWRP	Southern California Coastal Water Research Project
SMBRC	Santa Monica Bay Restoration Commission
SMBRP	Santa Monica Bay Restoration Project
SMURRF	Santa Monica Urban Runoff Recycling Facility
SOx	Sulphur Oxides
SPLP	Synthetic Precipitation Leaching Procedure
SQD	Sediment Quality Database
SQGs	Sediment Quality Guidelines
STAR	Storage, Treatment and Reuse
STLC	Soluble Threshold Limit Concentrations
SUSMP	Standard Urban Storm Water Mitigation Plan
SWH	Shallow Water Habitat
SWRCB	State Water Resources Control Board
TBT	tributyltin
TCLP	Toxic Concentration Leach Potential
TDS	total dissolved solids
TEC	Threshold Effect Concentration
TMDL	Total Maximum Daily Load
TOC	total organic carbon
TRPHs	total recoverable petroleum hydrocarbons
TSS	total suspended solids
ULARW	Upper Los Angeles River Watershed
USACE	U.S. Army Corps of Engineers, Los Angeles District
USFWS	U.S. Fish and Wildlife Service
WDRs	Waste Discharge Requirements
WES	Waterways Experiment Station
WET	Waste Extraction Test
WMA	Watershed Management Area
WMI	Watershed Management Initiative
WQC	Water Quality Certification

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EXECUTIVE SUMMARY

The Contaminated Sediments Task Force (CSTF) was formed to create a long-term strategy for managing contaminated sediments within parts of Los Angeles and Long Beach, as authorized by California Senate Bill (SB 673) sponsored by former state Senator Betty Karnette of Long Beach. Since 1997, the CSTF has provided a forum for discussion and a process whereby dredging proponents, state and federal regulators and representatives of environmental organizations work together to minimize potential adverse environmental impacts associated with the dredging and disposal of contaminated sediments. The resulting CSTF Long-Term Management Strategy (Strategy) includes recommendations on regional coordination of sediment management efforts, a process for evaluating contaminated sediment dredging projects, a proposed long-term goal of beneficially reusing all contaminated sediments and a commitment to continue working on future treatment and reuse issues. The CSTF Strategy seeks to ensure protection of aquatic resources from the discharge of contaminated dredged materials into the water, as well as to provide the dredging community with greater certainty and predictability about the results and the decision-making process.

The CSTF has made significant progress in the coordination of regulators, those who need to manage contaminated sediments and other stakeholders through the working committees of the task force, especially the Management Committee – responsible for the development of this document and the Advisory Committee – responsible for evaluating and resolving issues related to specific contaminated sediments dredging projects. The task force has developed procedures for consolidated project review in anticipation of necessary regulatory review, tools for project development and evaluation, and recommended policies for responsible agencies. The CSTF Advisory Committee has adopted guidelines for initiating project reviews, addressing conflicts and reporting results. Tools include a database of regional sediment quality information, a catalog of best management practices (BMPs) appropriate for local projects, and a decision tree clarifying the factors regulators use to make decisions about contaminated sediments projects. One policy recommended by the task force is the promotion of the beneficial reuse of contaminated sediments in order to minimize or eliminate the environmental threats associated with aquatic disposal. Another recommendation is that all task force participants work towards development of a contaminated sediment Storage, Treatment and Reuse (STAR) facility in the Los Angeles Region (Region). The task force expects that a STAR facility would reduce startup costs for beneficial reuse projects, provide initial drying common to most beneficial reuse projects, and provide temporary storage space so dredging and reuse projects can be better coordinated. In addition, the CSTF has recommended several improvements to the standard Monitoring and Reporting Program developed by the Los Angeles Regional Water Quality Control Board (LARWQCB) for Waste Discharge Requirements (WDRs) issued for dredging and disposal of clean and contaminated sediments that will be incorporated by the LARWQCB.

Additional planning and evaluation of a STAR facility will be needed over the next year. While the task force supports this approach to promoting beneficial reuse, the detailed information necessary to plan and develop a STAR site has not yet been produced. This missing information includes the capital costs of establishing a site, the identification of one or more potential locations for the STAR facility, the potential impacts on neighboring communities, and the willingness of property owners to make high value lands near the ports available for a STAR facility. The CSTF Executive Committee has agreed that a separate process may be necessary to bring decision makers from the CSTF participating agencies and other local government representatives to the table. Information on port priorities, property values, potential environmental impacts of a STAR site, impacts to the regional economy of delays in channel dredging, potential for inland storm water programs to reduce contaminated sediment discharges, and refined cost estimates for upland disposal options are needed to develop an accurate description of the potential costs and benefits of a STAR facility. While there is at least one private entity investigating the viability of beneficial reuse of contaminated sediments, the viability of reuse will depend on the sharing of the costs and benefits of that beneficial reuse among local, state, and federal entities.

The CSTF participants recognize that while recent conditions have allowed for beneficial reuse of contaminated sediments in constructed landfills, such opportunities will be reduced within a few years as the ports run out of potential fill locations. The Strategy proposes a plan to develop a site in the Region for sediment treatment and reprocessing of contaminated sediments, so that reuse of these materials can compete favorably with lower cost alternatives such as aquatic disposal.

While the CSTF evaluated a pilot study for confined aquatic disposal (CAD) of contaminated sediments and found no short-term adverse environmental impacts, it determined that this is one of the least preferred methods of managing with contaminated sediments due to uncertainties relative to the long-term environmental consequences. While the majority of CSTF participants found that the CAD site could be an acceptable discharge alternative under limited circumstances, Heal the Bay, an active participant in the CSTF, continues to oppose development of a multi-user CAD within San Pedro Bay.

In spite of the progress towards improved management of contaminated sediments, a significant amount of work remains to be done to implement the CSTF long-term management strategy. Over the next year the CSTF Management Committee will continue to meet on a quarterly basis to coordinate dredging projects and seek out beneficial reuse opportunities, evaluate progress in implementing the CSTF Strategy (including planning for a STAR facility) and continue refinement of management tools (BMP toolbox, water quality monitoring, sediment quality guidelines, etc.) developed by the task force. The CSTF participants have also agreed to conduct meetings of the Advisory Committee as needed to address more difficult contaminated sediment dredging projects.

<u>Background</u>

The CSTF is led by the California Coastal Commission (CCC) and the LARWQCB and regular participants include the U.S. Army Corps of Engineers, Los Angeles District (USACE), U.S. Environmental Protection Agency (EPA), California Department of Fish and Game (CDFG), National Oceanic Atmospheric Administration Fisheries (NOAA Fisheries), Southern California Coastal Water Research Project (SCCWRP), City of Long Beach, Los Angeles County Department of Beaches and Harbors, Port of Long Beach (POLB), Port of Los Angeles (POLA), and Heal the Bay.

Structurally, the CSTF is comprised of Executive and Management committees, and a series of technical subcommittees (Upland Disposal and Beneficial Reuse, Aquatic Disposal and Dredge Operations, Watershed Management and Source Reduction, Implementation, and Sediment Screening Threshold Development), each charged with developing specific recommendations to form the basis of an overall management approach. The result of this seven-year process is the development of a Los Angeles Contaminated Sediment Long-Term Management Strategy, which is summarized in this document. Copies of the numerous technical studies and reports prepared during this process are provided as appendices to the Strategy Document.

The Management Committee, made up of dredgers, regulators and Heal the Bay, considered information generated by technical studies and recommendations of the subcommittees during a two-year long report development process. The result is a long-term management strategy that recognizes the environmental benefits, as well as the potentially high cost, of treating and beneficially reusing dredged material. The strategy provides guidance to dredgers and regulators that allows for upland or aquatic disposal, but promotes and prefers beneficial reuse. In addition, the Management Committee reached consensus that 100 percent beneficial reuse of contaminated sediments is a reasonable long-term goal. To meet this long-term goal, several key initiatives were identified for development, and are discussed below.

The members of the task force agreed in 1999 that the CSTF Strategy would consider confined aquatic and upland disposal, sediment treatment, beneficial reuse, other management techniques, and contaminant source control. The task force identified five basic goals to be accomplished in preparing the Strategy. These goals are as follows:

1. Characterize contaminated sediments of the Los Angeles Region.
2. Identify environmentally preferable and feasible management alternatives for contaminated sediments.
3. Develop unified policies to evaluate and manage contaminated sediments.
4. Promote and implement region-wide efforts at source reduction.
5. Fund investigations to develop and implement the Strategy.

The Strategy addresses each of these goals. The Task Force was able to go beyond expectations in addressing some goals. For example, the initial project objectives did not include the pilot studies of beneficial reuse alternatives that were funded by the U.S. Army Corps of Engineers, the market studies of beneficial reuse products, commitments to ongoing coordination among the Task Force members and a long term goal of 100 percent beneficial reuse of contaminated sediments.

Other elements of the Strategy, despite significant efforts, have not met expectations. For example, the CSTF sponsored work for staff at the SCCWRP to conduct extensive evaluations of regional sediment chemistry and toxicity data in an attempt to develop regional contaminated sediment screening thresholds. Unfortunately, it was found that the available data did not provide a definitive tool for directing contaminated sediment disposal or reuse alternatives.

Additional work is needed to determine how monitoring of dredging operations can be used to identify when enhanced BMPs are needed to prevent adverse environmental impacts. And many aspects of the development of a STAR facility (e.g., ownership, liability, operations and management, monitoring, fee structure) remain uncertain. The following is a summary of the results that were achieved by the CSTF, specific to each of the five goals referenced above.

Goal 1: Characterize contaminated sediments of the Los Angeles Region.

One of the key objectives completed by the CSTF was the development of a regional sediment quality database containing the physical, biological, and chemical test results for all sediments collected within the Region for disposal suitability determinations over the last decade. The database has been used to investigate the suitability of various sediment quality guidelines for application in the Region and to help with development of plans to beneficially reuse contaminated sediments. Although development of regional sediment quality guidelines was another important objective of the Task Force and in spite of significant efforts by CSTF contractors, it was determined that sediment chemistry alone could not be used to accurately predict toxicity for the majority of dredging projects in the Region. As a result, the regulatory agencies primarily responsible for determining if a dredged material can be disposed in an aquatic environment (USACE, EPA, and LARWQCB) concluded that the guidelines developed could only be used in conjunction with other lines of evidence (e.g., toxicity testing).

Another initial objective of the CSTF was to predict amounts of contaminated sediments requiring dredging over a five-year period in order to plan for reuse or disposal. At the request of the CSTF, the USACE and the Los Angeles regional ports and harbors have projected contaminated sediment disposal needs over the next five years. They have also projected potential port fill projects where those sediments could be reused. This schedule is dependent on many factors and is expected to change over time; nevertheless it is expected to promote better planning for beneficial reuse opportunities. It may also prompt early actions to develop new alternatives for contaminated sediment management. Although the initial goal was to develop these estimates on an annual basis, the CSTF now plans to update them twice per year to better track upcoming reuse opportunities and potential conflicts.

Goal 2: Identify environmentally preferable and feasible management alternatives for contaminated sediments.

The CSTF, in cooperation with the USACE, investigated the feasibility of a wide variety of contaminated sediment management alternatives including treatment, disposal and reuse alternatives. The investigations ranged from literature reviews to testing of treatment and disposal alternatives at a pilot scale level. The CSTF considered reuse alternatives ranging from landfill daily cover, stabilized fill material, manufactured soil, construction aggregate and cement-based products. A market evaluation study was conducted to review potential regional opportunities related to upland reuse of dredge materials, including a survey of potential vendors. This study found that several hurdles limit reuse opportunities such as the cost of contaminated sediment treatment, general liability issues surrounding transfer of ownership of the contaminated material, cost of permitting, and potential impacts of placing saline marine sediments in upland reuse locations.

While these hurdles may be overcome in the future, at present most contaminated sediments dredged in the Region are of a quality that can be safely isolated within port fill projects and for the last few years these projects have been available for this purpose. As such, there has been little motivation to develop other, more costly treatment or reuse alternatives. In an effort to promote the development of additional beneficial reuse opportunities, the CSTF has recommended that a STAR facility be developed in the Region. The STAR facility would be a centrally located facility where initial treatment steps (i.e., drying) could occur as a precursor to other treatment or reuses. And by allowing temporary storage the STAR facility would help to provide a steady stream of material to reuse projects or other treatment processes.

There are several challenges with developing a STAR facility in the Region. First, such a facility will require open space in close proximity to dredging activities and property near ports and harbors is typically very valuable and in short supply. The ports are reluctant to dedicate land that could be used for shipping to treatment and storage of sediments. Development of STAR facilities can require high capital expenditures and the costs for constructing, operating, and maintaining such a facility have not yet been determined. In addition, treatment and marketing of contaminated sediments is untested in the Region and so it is difficult to determine the rate that the treated materials can be transported off of the STAR site.

The CSTF evaluated a list of upland and aquatic disposal alternatives for use in the Region, including CAD, nearshore confined disposal facility (CDF), upland CDF, and landfill disposal. To provide additional information on CAD, the USACE sponsored a full-scale field pilot study to test the effectiveness of CAD using a borrow pit located in Long Beach Harbor.

Approximately 100,000 cubic meters (m3) of contaminated sediment from the Los Angeles River Estuary (LARE) were deposited in the North Energy Island Borrow Pit (NEIBP) and capped with a 1 to 1.5-meter layer of clean sand from an adjacent borrow pit. The preliminary results of a three-year monitoring study indicate that the CAD site appears to be successfully isolating the contaminated sediments and providing a clean surface area suitable for recolonization by benthic organisms. Nevertheless, placing contaminated sediments in a CAD facility is the least preferred management alternative because of the difficulty of designing, building, permitting and monitoring an aquatic disposal site that adequately reduces the long-term risks to the aquatic environment. As such, the CSTF has recommended that aquatic disposal of either clean or contaminated sediments be considered only as a last option, after attempts have been made to beneficially reuse or treat the material. Heal the Bay, an active participant in the CSTF, continues to oppose development of a multi-user CAD within San Pedro Bay

Goal 3: Develop unified policies to evaluate and manage contaminated sediments.

The work of the CSTF has led to the development of a number of recommended policy changes for the participating state, federal and local agencies. One policy change developed early in the work of the CSTF was to bring agencies, dredgers and other stakeholders together to conduct concurrent review of contaminated sediment permit applications through the CSTF Advisory Committee. Concurrent review and face-to-face discussions ensure that all concerned parties have the same information and understand the tradeoffs in different operational solutions. The CSTF approved guidelines for the operation of this Advisory Committee that indicate who can call a meeting, how disputes are managed and how the results are communicated. The guidelines also clarify the dredger's responsibilities for managing contaminated sediment projects; including use of the CSTF BMP toolbox to appropriately design their project to minimize aquatic impacts. Based on the infrequent need for intensive review of contaminated sediments projects (less than 6 times per year) the CSTF decided to call meetings of the Advisory Committee as needed, rather than on a fixed schedule.

The CSTF also developed a BMP toolbox to assist in selecting appropriate dredge equipment and operational methods to minimize water quality impacts associated with dredging. Potential dredgers can use this toolbox to evaluate which management practices (e.g. silt curtains, operational controls, enclosed buckets) are most suitable given their specific location and/or site conditions for minimizing impacts. The CSTF has recommended that dredgers with contaminated sediments use the BMP toolbox to help design a program of BMPs that are appropriate for the reuse or disposal location and the contaminated sediment characteristics. The CSTF Management Committee will continue to modify this toolbox as new information becomes available and will consider developing more dredge location-specific guidance on the use of BMPs.

In order to clarify the process used by regulators in evaluating disposal and reuse alternatives and to promote beneficial reuse, the CSTF developed a Decision Tree for Contaminated Sediment Management. The Decision Tree shows that, while seeking the least environmentally damaging alternative through the Clean Water Act (CWA) Section 404(b)(1) Guidelines, regulators will typically consider beneficial reuse of contaminated sediments in a manner that provides little risk to the environment as the preferred alternative. Where reuse is not possible, either treatment to stabilize the contaminants or disposal in an approved upland location would usually be recommended for contaminated sediments. While aquatic disposal of contaminated sediments has been used in the past, it is the least preferred alternative, because of the uncertainty in designing, building, permitting, and monitoring an aquatic disposal site that adequately reduces the long-term risks to the aquatic environment. As such, aquatic disposal of either clean or contaminated sediments is considered only as a last option, after other alternatives such as treatment, beneficial reuse or land disposal have been eliminated.

In 2003, the CSTF decided to develop and promote treatment and beneficial reuse of contaminated sediments, so that these alternatives could compete with aquatic disposal alternatives. This effort to create a better balance between disposal and reuse options is called the "balanced approach" and is recommended as an initial step in reducing the need for aquatic disposal. The long-term goal of the CSTF is to achieve 100 percent beneficial reuse of contaminated sediments, eliminating the need for aquatic disposal. Achieving this goal, however, will require that several key initiatives be implemented. These initiatives include promotion of effective upland source control programs, ongoing tracking of contaminated sediment dredging and beneficial reuse efforts, and development of one or more regional STAR facilities for contaminated sediments.

One of the steps identified by the CSTF as a critical need for successfully achieving the goal of providing 100 percent beneficial reuse of contaminated dredged materials is to locate and construct one or more STAR facilities for contaminated marine sediments. The concept is to create a centrally located facility where dredge materials can be stored and/or treated as a precursor for beneficial reuse. The CSTF investigated the development needs for a new multi-user disposal or reuse site in the Region and determined that critical characteristics (ownership, liability, operations and management, monitoring, fee structure) for each of these types of sites would determine their feasibility and environmental effectiveness. Unfortunately, given the opportunities for using contaminated sediments in port fill projects over the last few years, there has been little incentive for potential responsible parties to come forward and begin work on these complex issues.

The CSTF Management Committee reached consensus that development of a STAR facility was critical for achieving the goal of 100 percent beneficial reuse. As such, the CSTF prepared an action plan for development of a STAR site with specific milestones and proposed completions dates. The sediment STAR Action Plan proposes to complete the initial planning and coordination necessary to create a STAR facility by the end of June 2006. Although the time needed to begin use of a STAR facility will depend on the specific dredging needs and reuse opportunities at that time, the CSTF strongly recommends the initial steps of the STAR Action Plan be completed, so that long delays of needed future dredging projects are avoided. The CSTF has also considered several interim facilities that could be used to process contaminated sediment, in lieu of a permanent STAR facility (short-term land-based or floating barge facilities). The Management Committee will be tracking and promoting the progress in development of a STAR site or sites for the Region, since delays in their development could result in efforts to dispose of contaminated sediments in the aquatic environment.

Goal 4: Promote and implement region-wide efforts at source reduction.

In order to minimize future needs for contaminated sediment management, the CSTF strongly supports ongoing source control and treatment activities in the watershed to reduce the discharge of contaminants to Region ports and harbors, as well as discharges to Santa Monica and San Pedro bays. Fortunately, since the formation of the CSTF, there have been significant advances in source control efforts in the watersheds upstream from the ports and harbors of the Region. The municipal storm water program has held the inland communities more accountable for the polluted runoff discharged through their stormdrain systems and currently requires implementation of structural and nonstructural BMPs to reduce non-point source (NPS) pollution impacts. In addition, the LARWQCB has approved several Total Maximum Daily Load plans (TMDLs) for the Region that will require communities to reduce the discharge of trash, pathogens, metals and other pollutants. The CSTF has agreed to continue to review and comment on storm water permits and TMDLs that may have a significant impact on sediment quality in Region port and harbors.

Goal 5: Fund investigations, as needed, to develop and implement the Strategy.

The State of California has provided $3 million to fund technical studies and staff support for development of the Long-Term Management Strategy. This commitment by the state attracted funding and/or in-kind services from each of the CSTF participants. For example, the USACE spent several million dollars conducting baseline studies for the Los Angeles regional Dredged Material Management Program and these studies had direct applicability to the CSTF Long-Term Strategy development. In addition, the USACE has estimated that the POLA, Los Angeles County, and the City of Long Beach have provided in-kind services valued at $2 million towards the Dredged Material Management Plan (DMMP) studies. In addition, the POLB and POLA each provided $100,000 to support completion of the CSTF Strategy Report in 2002, when legislatively appropriated funds were exhausted.

<u>Next Steps</u>

The CSTF Strategy includes recommendations for ongoing work to minimize the impacts of contaminated sediments on water quality and coastal resources. This work will require funding and staff work from the CSTF participants and possibly additional legislative support. The ongoing coordination through the CSTF Management Committee will initially require quarterly meetings to support strategy implementation through continuing work on technical issues, updates on implementation progress and consideration of new contaminated sediment issues. Technical issues requiring further work include: determining how monitoring of dredging operations can trigger the use of enhanced BMPs; further evaluation of the use of the sediment quality database for making regulatory decisions; evaluation of the third year of monitoring at the pilot CAD site; and recommendations on turbidity monitoring methods. Updates on implementation progress will include information on tracking of contaminated sediments dredging and port fill projects; development of beneficial reuse opportunities; and contaminated sediment treatment methods. The Committee will also promote the development of a STAR facility, initially by addressing remaining issues such as ownership, liability, operations and management, monitoring, fee structure. In addition, the Management Committee will track and comment on other regional watershed source control efforts to encourage full consideration of the impacts of the urban watershed on the coastal water and sediment resources.

The CSTF Advisory Committee meetings will be held as-needed to review contaminated sediment dredging or aquatic disposal projects that CSTF participants find to need site-specific oversight to minimize adverse environmental impacts. The CSTF expects to hold Advisory Committee meetings from two to four times per year.

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1 INTRODUCTION

Within the Los Angeles Basin, it is estimated that approximately 6.8 million cubic meters (m^3) (8.8 million cubic yards [cy]) of contaminated sediments will need to be dredged from the ports and harbors of Los Angeles County (County) over the next six years (2004 to 2009). Disposal of contaminated sediments requires special management to prevent potential adverse ecological impacts and unacceptable health risks. Aside from port land development projects, there is currently a lack of readily available cost effective disposal options for these sediments. Thus, the need for a regional management plan exists. In addition, contaminated sediments and other dredged materials can be a resource when properly treated and managed. In order to maintain navigational uses and protect environmental resources, the California legislators provided funding in 1997 to develop a regional contaminated sediment management plan.

The County includes two of the nation's largest commercial ports (the Port of Long Beach [POLB] and the Port of Los Angeles [POLA]) and several major marina complexes. The two Ports, together, constitute the fastest growing major cargo center in the world. The value of import-export cargo through the Ports increased from $61.8 billion in 1986 to $1 trillion in 1990 and continues to grow. Periodic maintenance dredging is needed to ensure navigability of shipping channels and berthing areas, and capital dredging projects are needed to expand and modernize ports and harbors. Occasionally this material is contaminated, posing significant difficulties and requiring special management measures to prevent adverse impacts to water quality and promote beneficial uses in coastal areas. By law, (Marine Protection, Research and Sanctuaries Act [MPRSA]) contaminated dredge materials are prohibited from confined or unconfined ocean disposal. Thus, there is a need to identify protective and cost effective disposal alternatives or beneficial reuse techniques. There is also a desire to minimize pollutant loading through watershed source control measures. Finally, there is a need to streamline the existing regulatory process to ensure that applicants and agencies address permitting in a coordinated manner and resolve problems quickly to avoid costly delays to major navigation or port expansion projects.

Current regulations for dredging and disposal activities are hampered by the lack of numerical federal or California state sediment quality criteria for trace metal and organic pollutants commonly found in contaminated sediments. In practice, differentiation between "clean" and "contaminated" sediments requires the performance of a battery of costly and time-consuming tests, and the distinction is based upon interpretation of the results by technical specialists.

Another difficulty is that contaminated sediments require special management practices during dredging and disposal activities to ensure adequate containment of pollutants and minimize release of contaminants to the environment.

In the Los Angeles Region (Region), identification of suitable disposal alternatives has been a difficult problem, sometimes resulting in contentious debates between regulators, project applicants and public representatives during public hearings for proposals to issue dredging permits. These types of conflicts have lead to costly delays and could be avoided with the development of a comprehensive contaminated sediment management plan.

In 1998, the Contaminated Sediments Task Force (CSTF) was formed to develop a long-term solution (termed the "Long-Term Management Strategy") for addressing the reoccurring problem of contaminated sediment disposal in the Region. The primary Study Area for the CSTF study is the coastal waters of the County. This area extends from Marina del Rey and Ballona Creek to the north; down past the POLA, POLB, and Los Angeles River Estuary (LARE) in San Pedro Bay; and ends at Alamitos Bay to the south (Figure 1-1).

Active participants in the CSTF includes regulatory and resource agencies, dredging community, and public members. The core regulatory agencies (U.S. Army Corps of Engineers, Los Angeles District [USACE], U.S. Environmental Protection Agency [EPA], California Coastal Commission [CCC], and Los Angeles Regional Water Quality Control Board [LARWQCB]) have signed a Memorandum of Understanding (MOU). The complete list of the CSTF participants is provided in Table 1-1.

1.1 Overview of Contaminated Sediment Problem in the Los Angeles Basin

The contaminated sediment dredging and disposal problem facing the Region and the CSTF is largely due to existing economic, environmental, technical, and political constraints. Addressing these issues became the focus of the CSTF in developing this Long-Term Management Strategy.

Figure 1-1
Los Angeles Region CSTF Study Area

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Table 1-1
CSTF Membership and Participation

Agency/Organization	CSTF Oversight Responsibilities	Meeting Participant	MOU Signatory
California Coastal Commission	√	√	√
Los Angeles Regional Water Quality Control Board	√	√	√
California Department of Fish and Game		√	
City of Long Beach		√	√
County of Los Angeles Beaches and Harbors		√	√
Heal the Bay		√	
Port of Long Beach		√	√
Port of Los Angeles		√	√
Southern California Coastal Water Research Project		√	
U.S. Army Corps of Engineers		√	√
U.S. Environmental Protection Agency		√	√
NOAA Fisheries		√	

Economic Issues

The cost to dredge and dispose of contaminated sediments can be prohibitive to project proponents depending on the disposal option chosen. Proponents in the Region can include the federal government, local governments, the POLA, the POLB, regulatory applicants and private parties. In the past, proponents have had difficulty finding suitable, cost effective sites for disposal or treatment of contaminated dredged sediments. Therefore, there is a strong desire to identify environmentally suitable, economically affordable options for contaminated sediment disposal.

Another potential economic impact of the current contaminated sediment dredging process is the degradation of the regional economy due to the inability to quickly and efficiently redevelop, modernize, or expand operational facilities at the ports and harbors within the County. Consequently, port and harbor operations could be impacted. Due to the volume of contaminated sediment projected for dredging over the next five to seven years, there is also a need to establish an economic basis and an acceptable cost benefit ratio for the dredging and disposal of contaminated sediments.

Typically, project proponents are responsible for the cost to test and dispose contaminated sediments at suitable locations. However, the source of the pollutants present in the sediments may not be a result of the proponents' operations, but may be the result of urban runoff from the Los Angeles Basin as a whole. Watershed management plans are needed to focus on identifying pollutant sources and to develop programs to reduce contaminant loading into port and harbor facilities in the Los Angeles Basin.

Environmental Issues

Potential environmental issues associated with contaminated sediment dredging and disposal projects include impacts on environmental resources from dredging and disposal operations. Potential short- and long-term impacts to biological resources can occur as a result of dredging activities. Example impacts include noise pollution, degradation of air quality, resuspension of sediment particles (turbidity) and contaminants in the water column, and chemical advection and diffusion of contaminants at aquatic disposal sites. Other potential environmental issues include bioaccumulation through the food chain through either the resuspension of contaminants during dredging operations, or by leaving contaminated marine sediments in-place.

Obtaining dredging and disposal project approvals and permits from federal, state, and local regulatory agencies can be a long process, resulting in costly delays if the applicant has not anticipated the time involved. The permitting process for contaminated sediment dredging projects can take several months to complete for a routine project to several years where site specific studies and management plans are required to address impacts from the project. One of the difficulties in obtaining permits for dredging contaminated sediments is the identification and location of environmentally safe and economically feasible disposal sites.

Technical Issues

Potential technical issues associated with contaminated sediment dredging and disposal projects include: (1) construction impacts from dredge and disposal operations on air and water quality; (2) ambient noise and vessel traffic; and (3) mechanical (engineering) and logistical modifications required to reduce environmental impacts of dredging and disposal operations. The lack of specific regional sediment thresholds criteria also impacts the ability to properly plan and identify suitable disposal sites for dredged sediments.

Another technical issue is that inland contaminant source controls are a relatively new requirement and technically immature, which results in continued deposition of contaminated sediments within the coastal environment. The CSTF conducted several studies to help provide answers to these technical issues. The results of these studies are further discussed in this report.

Political Issues

One of the major political issues related to the dredging and disposal of contaminated sediments is the lack of consensus regarding the disposal of contaminated material originating from an area outside of the political region in which the disposal site is located. There is also the potential for political opposition to aquatic disposal options for contaminated dredged material, utilization of fine-grained contaminated sediments as construction fill material, and placement of marine (salt-laden) dredged sediments within local Class III landfill sites. Identification of responsible parties for discharge and clean up of pollutants (source reduction) is also a widespread problem. In addition, the negative public perception associated with products created from contaminated dredged material, even following treatment, can lead to a lack of willing end-users for such products.

Another major political issue was the lack of coordinated review process and consensus among regulatory agencies regarding the dredging and disposal of contaminated sediments. The CSTF was formed, in part, to provide a solution to this problem. The formation of a Dredged Material Management Advisory Committee and a consolidated application for dredged material reuse or disposal has facilitated better agency coordination and provided a forum for coordination with project proponents. These developments are further discussed in Section 8 of this report.

1.2 CSTF Study Area

The CSTF Strategy Report Study Area includes the coastal areas of Los Angeles County, extending from Santa Monica Bay to San Pedro and Alamitos Bays. Specific management areas include Marina del Rey/Ballona Creek Entrance Channel, the POLA and POLB, the LARE, and the mouth of Alamitos Bay (Figure 1-1). Each is described in the following sections.

1.2.1 Marina del Rey

Formally dedicated in April 1965, Marina del Rey was constructed in the area formerly known as the Playa del Rey Estuary (Figure 1-2). In the past three decades, the harbor has become the largest recreational boating area in the U.S. with over 6000 slips available for private boaters and public fishing vessels. To protect the harbor against wave damage during winter storms, a breakwater was constructed perpendicular to the mouth of the harbor in January of 1965.

Safe navigation in Marina del Rey harbor has been impacted by shoaling at the jetties and the approach and entrance channels. Dredging at the mouth of Marina del Rey Harbor is critical to maintaining the navigability of the harbor. If dredging does not occur, subsequent storms could carry enough sediment and debris from Ballona Creek (via sedimentation) and the adjacent beaches to close the harbor, which would prevent thousands of recreational and commercial vessels from leaving or entering the port, and would preclude rescue operations by the Coast Guard stationed within the harbor.

1.2.2 Ballona Creek

Originally a natural, meandering waterway draining runoff from the hills north of Santa Monica, Ballona Creek was channelized and lined with concrete in 1935 by the USACE as a flood control measure (Figure 1-2). Much of Ballona Creek today is simply a large flood control channel, draining storm water runoff from a large, heavily urbanized area west and northwest of downtown Los Angeles of approximately 130 square miles. The lower reaches on the Creek, however, have remained unpaved and allowed to form a coastal wetland near the mouth of the Marina del Rey Harbor. During winter storm events, significant quantities of sediment are transported down Ballona Creek, where they are deposited adjacent to the breakwater constructed to protect the Marina del Rey harbor (see Section 1.2.1) instead of flowing into Santa Monica Bay. Consequently, periodic dredging at the entrance to Marina del Rey Harbor where Ballona Creek enters is required.

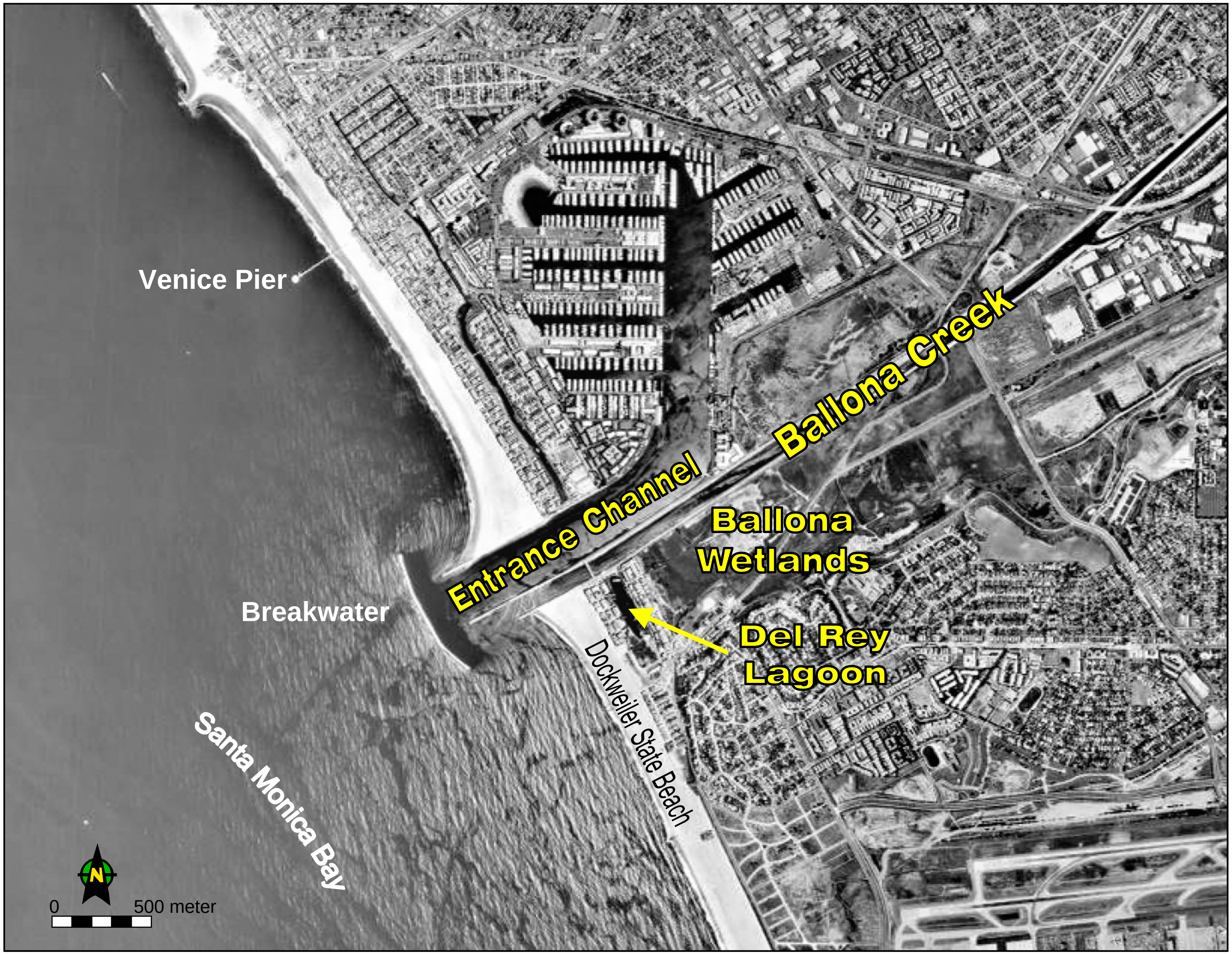

Figure 1-2
Marina del Rey and Ballona Creek

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1.2.3 Ports of Los Angeles and Long Beach

Originally a large tide flat and salt marsh, the area that was once called Bahia de los Fumos or the "Bay of Smokes" in 1542, later became known as San Pedro Bay (Figure 1-3). Around the turn of the century (1907) the POLA was created and a few years later in 1911, the POLB was created at the mouth of the Los Angeles River. Port development grew rapidly and by 1912 the first 3,399-meter (11,152-foot) section of the breakwater was constructed and the main shipping channel was dredged to a depth of 9.1 meters (30 feet) to accommodate the largest vessels of that era. Sediment input into San Pedro Bay occurs via two main upland sources: the Dominguez Channel and the LARE (discussed separately in the following section). The Dominguez Channel, previously known as the Dominguez Slough, drains an approximately 100-square mile watershed located in southern Los Angeles County.

Like other waterways in the Los Angeles Basin, The Dominguez Slough was completely channelized in the mid 1900s in an effort to provide flood protection to the County. Although not as significant, some sediment transport also occurs into San Pedro Bay via coastal currents through the openings in the breakwater that shelters the Bay.

1.2.4 Los Angeles River Estuary

The LARE connects the Los Angeles River with San Pedro Bay in Long Beach Harbor, and drains the highly urbanized Los Angeles River Watershed (Figure 1-4). The outlet of the Los Angeles River flood control channel was constructed during the period of 1919 to 1923 and drains approximately 834 square miles. The estuary is surrounded by recreational and commercial facilities such as Queensway Landing, Rainbow Harbor/Marina, and Shoreline Marina, all operated by the City of Long Beach. These facilities serve primarily recreational boating and also serve as part of the transportation corridor for coastal cruise liners transiting from Queensway Marina to Santa Catalina Island. Sediment discharged from the Los Angeles River has historically shoaled in the waterways of the estuary, created navigation hazards for recreational and commercial vessels using facilities along the shores of the estuary. USACE conducts maintenance dredging of the navigation channel between Queensway Marina and San Pedro Bay to maintain the designated channel dimensions for safe navigation approximately every two years. The City of Long Beach has also historically performed maintenance dredging of the estuary on an as-needed basis to support access to various facilities in the estuary.

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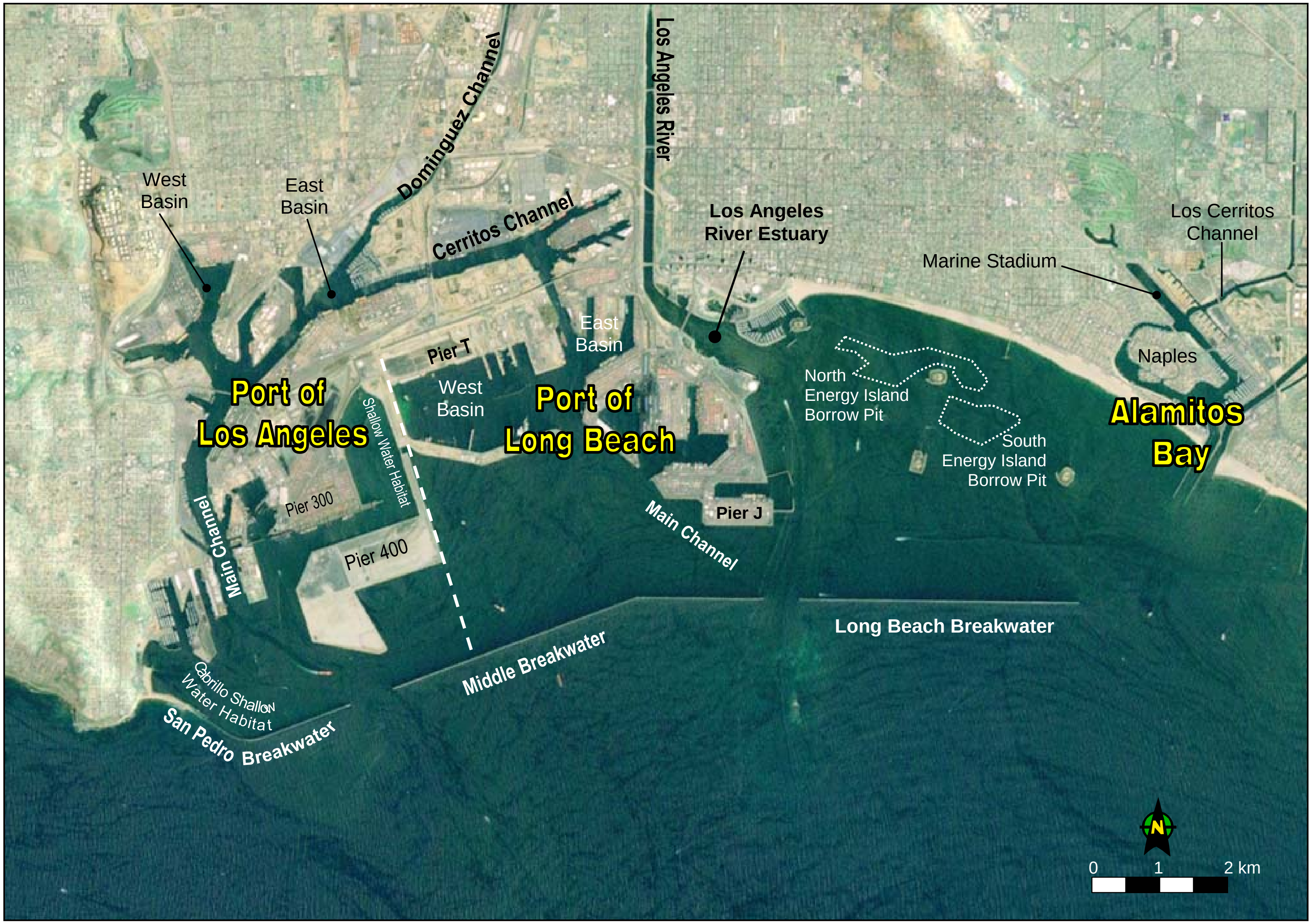

Figure 1-3
San Pedro Bay
Port of Los Angeles, Port of Long Beach, and Alamitos Bay

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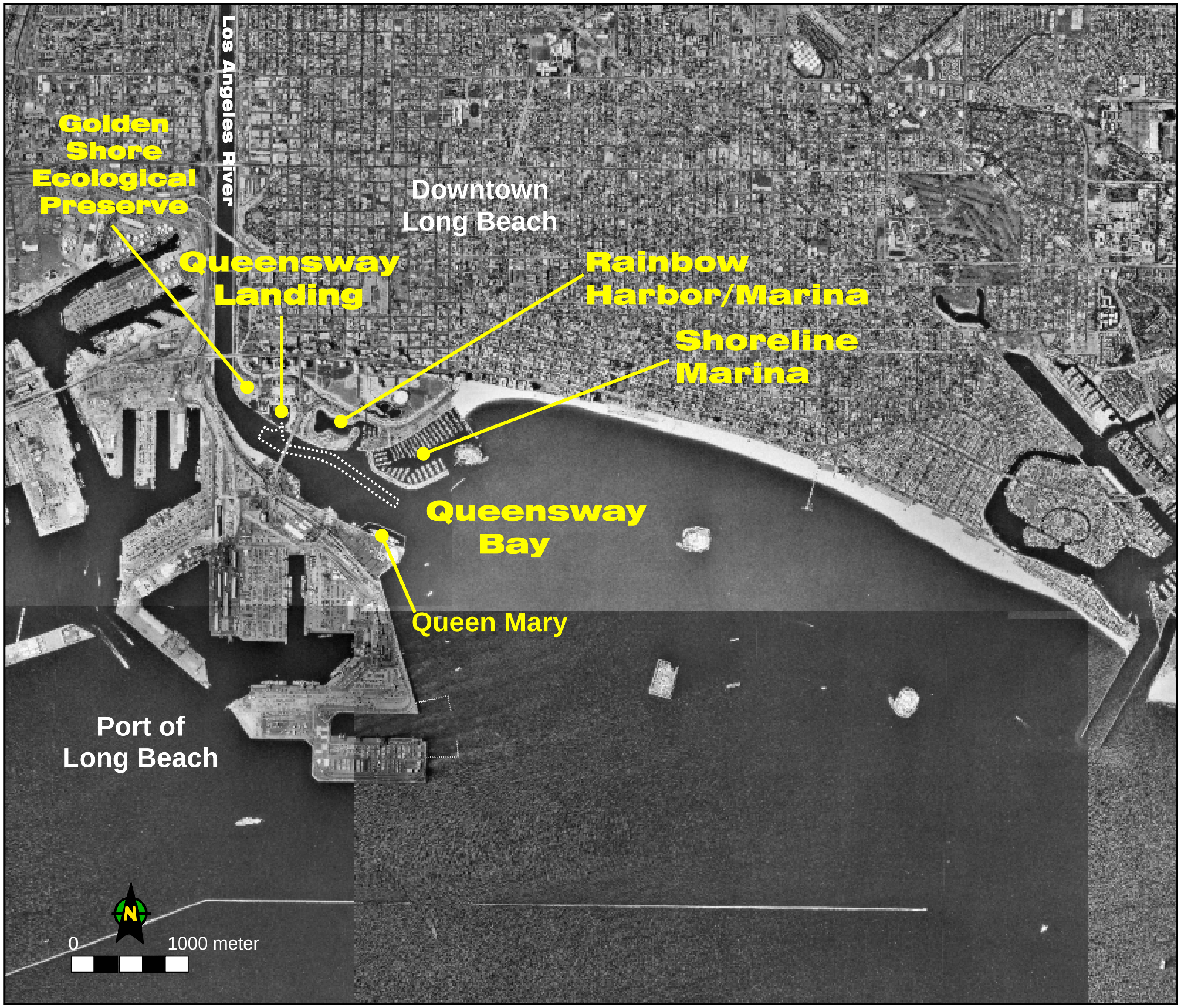

Figure 1-4
Los Angeles River Estuary

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1.2.5 Alamitos Bay

Alamitos Bay is located just southeast of the Los Angeles/Long Beach (LA/LB) Harbor Complex in Naples/Belmont Shores (Figure 1-3). The Alamitos Bay Marina was created with the dredging of marshland in 1949 and opened in the mid 1950s. Today, the marina serves primarily recreation boats and is surrounded by residential and commercial areas. Located within Alamitos Bay Marina are the islands of Naples, the Marine Stadium that was built for the 1932 Olympic rowing competition, and the Los Cerritos Channel. Recreational activities include sailing, canoeing, kayaking, board sailing, wind surfing, water skiing, and rowing.

The Alamitos Bay Marina entrance is defined by two jetties located adjacent to the San Gabriel River mouth. The City of Long Beach Department of Parks, Recreation, and Marine is responsible for maintaining the recreational navigation of the harbor entrance and marina and conducts regular maintenance dredging within the entrance channel.

1.3 Regional History of Contaminated Sediment from Dredging Operations

Dredging and disposal of sediments from the Region has been complicated over the past decades by the presence of contaminants and progressively stringent regulations governing the disposal and monitoring of dredged sediments. Contaminated sediments are a continuing issue in the Marina del Rey/Ballona Creek Entrance Channel, LA/LB Harbors, and LARE.

Contaminated sediments are primarily associated with dredging activities in the Region that consists of maintenance dredging and capital improvement dredging. Maintenance dredging is conducted for the purpose of maintaining channel navigability and harbor operations. Capital improvement dredging is conducted in association with facility improvement projects such as channel deepening, construction of new terminals, and modifications of existing facilities. Dredging and disposal records from the major sediment generating location in the County were analyzed to determine the total sediment quantity from the Region. Table 1-2 summarizes the historical dredging volumes from major dredging sites in the Region. Detailed information for each site is discussed later in Section 3.3.1.

Table 1-2
Los Angeles Regional Historical Dredging Quantities

Location	Period of Available Record	Maintenance Dredging (m^3)	Maintenance Dredging (m^3/year)	Capital Improvement Dredging (m^3)	Capital Improvement Dredging (m^3/year)
Marina del Rey	1969-1999	1,469,000	49,000	-	-
Port of Los Angeles	1978-2002	2,028,000	85,000	57,563,000	3,386,000
Port of Long Beach	1976-2003	1,851,000	71,000	14,170,000	664,000
Los Angeles River Estuary	1979-2001	1,213,000	86,000*	-	-
Alamitos Bay	1994-2002	111,000	14,000	-	-
	Regional Total	**6,672,000**	**305,000**	**71,733,000**	**4,050,000**

* Rate based on record between 1990 and 2001.

Dredging records for the region indicate that a total of approximately 6.7 million m^3 of dredged material has been generated from harbor and channel maintenance projects (an annual rate of approximately 305,000 m^3 per year). Of this amount, approximately 1.5 million m^3 was dredged from Marina del Rey due to maintenance dredging. The POLA and POLB contributed 2 and 1.9 million m^3, respectively. About 1.2 million m^3 was generated from maintenance dredging of the LARE and 111,000 m^3 from Alamitos Bay.

Historically, the regional total dredging volume associated with capital improvement projects in the POLA and the POLB is over 10 times those associated with maintenance dredging. Over the same period, approximately 71.7 million m^3 of the dredged material has been generated from capital improvement projects in the Ports, with an average annual rate of about 4 million m^3 per year.

Disposal practices in the Region include harbor infill, open ocean disposal, nearshore open water disposal, beach fill, shallow water habitat (SWH) fill, and stock piling. Table 1-3 presents the quantities by disposal methods for materials from the major dredging sites in the Region.

Table 1-3
Los Angeles Regional Disposal Method Volumes (m^3)

Disposal Method	Marina del Rey	Port of Los Angeles	Port of Long Beach	Los Angeles River Estuary	Alamitos Bay	Regional Total	Percent of Total
Harbor Infill	438,000	41,133,000	4,650,000	410,000	-	46,631,000	60%
Open Ocean	40,000	3,154,000	5,661,000	297,000	-	9,152,000	12%
Nearshore Open Water	16,000	36,000	4,970,000	395,000	-	5,417,000	7%
Beach Fill	931,000	-	-	-	111,000	1,042,000	1%
Shallow Water Habitat	44,000	2,572,000	-	-	-	2,616,000	3%
Stock Piling	-	245,000	739,000	-	-	984,000	1%
Mixed*	-	12,435,000	-	-	-	12,435,000	16%
Unspecified	-	17,000	-	111,000	-	128,000	< 1%

* Disposed as harbor infill or SWH.

The disposal data indicate that approximately 60 percent (46.6 million m^3) of the total historical volume of dredged material from the Region has been used as infill for harbor infrastructure development and expansion projects at the POLA and POLB. This is followed by 12 percent disposed offshore at EPA-designated Ocean Dredged Material Disposal Sites including LA-2 and 7 percent at nearshore disposal sites such as the North Energy Island Borrow Pit. Beach fill and creation of SWH fill, two of the primary beneficial reuses practiced in the region, have accounted for approximately 1 percent and 3 percent of the total disposal volume in the Region, respectively. Approximately 5 percent of the total historical volume generated in the Region has been kept for stock piling at the Ports' storage facilities. The remaining 16 percent of the total volume is unquantifiable based on the available records, which state that it was either disposed as harbor infill or used for SWH creation from two capital improvement projects at the POLA.

Historical dredged records did not provide sufficient information on the volumetric breakdown between statutorily contaminated and uncontaminated (clean) dredged material on a project-by-project basis. Based on the disposal method, since only clean material would be allowed for ocean disposal or for beach fill, 10.2 million m^3 (13 percent) of the dredged material was clean sediment. However, the remaining 68.2 million m^3 (87 percent) were not necessary all contaminated. Sediment that was deemed unsuitable for ocean disposal or for beach placement actually consists of a mix of clean and contaminated material. For example, the POLA Pier 400 project incorporated a large volume of dredge material, the majority of which was clean. However, there were no attempts in past projects to separately record the ratio of the clean sediments to the contaminated sediments for individual projects.

1.4 Regional Projection of Contaminated Sediments from Dredging Operations

Future dredging of contaminated sediments in the Region will be largely driven by the needs of the USACE and the Ports to maintain safe navigation and economic development. Similar needs also exist with local governments such as the City of Long Beach to maintain recreational marinas. The future dredging and disposal need has been estimated based on discussions with USACE, the POLA, the POLB, and the City of Long Beach for maintenance and capital improvements over the next five to six years. The projections do not account for the potential of sediment source reductions attributed to source control measures being implemented in the various watersheds. A summary of the projected contaminated sediment quantities is shown in Table 1-4.

Table 1-4
Summary of Projected Contaminated Sediment Quantities

Location	Average Annual Maintenance Dredging Rate		Capital Improvement Dredging	
	Total	Contaminated	Total	Contaminated
Marina del Rey	50,000 – 100,000 m^3	1/4 – 1/3	0	0
Port of Los Angeles	44,000 m^3	44,000 m^3	2,576,000 m^3 over 6 years	1,375,000 m^3 over 6 years
Port of Long Beach	31,000 m^3	31,000 m^3	6,038,000 m^3 over 5 years	4,416,000 m^3 over 5 years
Los Angeles River Estuary	86,000 m^3	86,000 m^3	0	0
Alamitos Bay	14,000 m^3	0	153,000 m^3 over 3 years*	39,000 m^3 over 3 years*

* One-time event.

For Marina del Rey, USACE will continue regular maintenance dredging programs at a rate of approximately 50,000 to 100,000 m^3 per year with about one-fourth to one-third of the dredged quantity expected as contaminated sediment. No capital improvement projects are expected for Marina del Rey.

The POLA is expecting to generate 261,200 m^3 of contaminated sediment from maintenance dredging over the next six years, which is approximately 44,000 m^3 per year. A total of 2.58 million m^3 of sediment is anticipated from capital improvement projects, out of which 1.38 million m^3 (53 percent) are considered contaminated.

The POLB has estimated a total of 153,000 m^3 of contaminated sediment will be generated between 2004 and 2008 (from maintenance dredging). Capital improvements are expected to generate about 6.04 million m^3 with 73 percent (4.4 million m^3) being contaminated over the same period.

USACE and the City of Long Beach estimate that the LARE maintenance dredging will generate 86,000 m^3 per year. It is estimated that 25 percent of the total sediment volume will be contaminated. Currently, due to the heterogeneity of sediment quality at small spatial scales, there are no cost effective methods to separate the contaminated fraction from the total dredge volume, thus requiring the entire volume to be treated as contaminated.
For Alamitos Bay, the City of Long Beach expects to continue the annual maintenance dredging of the entrance channel. Historical maintenance dredging records for Alamitos Bay indicate an average annual dredging rate of approximately 14,000 m^3 per year. The City of Long Beach is also planning a one-time capital improvement project of the Alamitos Bay Marina that is expected to generate 153,000 m^3 of sediment over three years with one-fourth of the total volume (39,000 m^3) estimated to be contaminated.

1.5 History and Overview of the CSTF

In response to the growing problem associated with dredging and disposal of contaminated sediments in the Region, Governor Wilson signed into law Senate Bill SB 673 on October 12, 1997, authored by Senator Betty Karnette of Long Beach. SB 673 subsequently became Chapter 897 of the Statutes of 1997 and Section 13396.9 was added to the state Water Code to incorporate the conditions of the Bill.

This new legislation required the CCC and the LARWQCB to establish a multi-agency CSTF to address issues related to contaminated sediments. It also required the Commission and the Water Board to actively participate in the Task Force and assist in the preparation of a Long-Term Management Strategy (this document) for dredging and disposal of contaminated sediments in the Los Angeles area. The strategy should consider aquatic and upland disposal alternatives, treatment, beneficial reuse, and other management techniques. Additionally, the strategy should include a component focused on the reduction of contaminants at their source.

The added section to the Water Code from the Karnette Bill (SB 673) required the LARWQCB and the CCC, on or before January 1, 2003[1], to:

- Develop a long-term management plan for the dredging and disposal of contaminated sediments found in coastal waters adjacent to Los Angeles County.
- Establish and participate in a multi-agency Los Angeles Basin CSTF;
- Seek to enter into an agreement with the EPA and the USACE to participate in the Plan's development,
- Report to the Legislature on or before January 1, 1999, regarding the status of that agreement; and
- Conduct annual public workshops to review the status of plan development and to promote public participation.

1.5.1 Structure and Function of the CSTF

As presented in Table 1-1, the CSTF includes representatives from the USACE, EPA, CCC, LARWQCB, California Department of Fish and Game (CDFG), Southern California Coastal Water Research Project (SCCWRP), POLB, POLA, City of Long Beach, Los Angeles County Department of Beaches and Harbors, National Oceanic Atmospheric Administration Fisheries (NOAA Fisheries), Heal the Bay, and other interested parties. In 1999, a cooperative agreement was established through an MOU between many of the agencies involved in the CSTF. When SB 673 was signed into law, a Task Force already in existence to deal with Marina del Rey dredging issues was dissolved and reconvened as a part of the CSTF. The original MOU was amended in 1999 to add additional members, and agencies proceeded to sign both the original agreement and the amendment incorporating the provisions of Senate Bill 673.

[1] A two year extension was subsequently provided, extending the due date for completion of the Strategy to January 1, 2005.

Organizationally, the CSTF consists of an Executive Committee, a Management Committee, five Strategy Development Subcommittees, a Technical Advisory Subcommittee, and an Interim Disposal Advisory Subcommittee.

The Executive Committee includes the head of the four regulatory agencies responsible for managing dredging activities in the region (USACE, EPA, LARWQCB, and the CCC) and is the final level of approval for the resulting strategy document. The Executive Committee meets on a semi-annual basis to assess the progress of the CSTF Technical and Management Committees.

The Management Committee is the main evaluation and decision making body for the CSTF and conducts meetings every month, which are open to the public. Under the direction of the Management Committee are five subcommittees charged with identifying and resolving technical issues related to the development of the CSTF Management Strategy.

The five subcommittees include the Upland Disposal and Beneficial Reuse Subcommittee; Aquatic Disposal and Dredge Operations Subcommittee; Watershed Management and Source Reduction Subcommittee; Implementation Subcommittee; and Sediment Screening Threshold Subcommittee. These groups are charged with preparing specific technical components of the strategy. An Interim Advisory Committee (which changed its name simply to Advisory Committee in 2001) meets as needed when specific dredging and disposal projects are proposed prior to completion of the strategy.

1.5.2 Goals and Objectives of the CSTF

The overall goal of the CSTF is to develop a Long-Term Management Strategy for dredging and disposal of contaminated sediments from coastal waters adjacent to Los Angeles County. Specific objectives of the CSTF include:

- Develop unified multi-agency policies related to the management of sediments not suitable for unconfined aquatic disposal;
- Promote multi-user disposal facilities;
- Promote beneficial reuse, and
- Support efforts for watershed management to control contaminants at their source.

In an effort to reach these objectives, the CSTF formed technical subcommittees, as described below, to work on particular elements of the Long-Term Management Strategy. The Watershed Management and Source Reduction Subcommittee focused on the major ongoing sources of contaminated sediments to dredged waterways, and particulates associated with polluted runoff from inland watersheds. The Upland Disposal and Beneficial Reuse Subcommittee evaluated the full range of disposal and reuse alternatives, assessed the suitability of the alternatives for the Los Angeles Region and conducted special studies where needed to be better understand likely alternatives. The Aquatic Disposal and Dredging Operations Subcommittee was charged with identifying suitable aquatic disposal alternatives for contaminated sediments, as well as developing dredge operation procedures to minimize water quality impacts associated with dredging activities. The Sediment Thresholds Subcommittee was tasked with evaluating the feasibility of developing regional Sediment Quality Guidelines (SQGs) that could be used to rapidly assess the suitability of contaminated sediments for various disposal options. Lastly, the Implementation Subcommittee was charged with implementing recommendations made by the other subcommittees, when possible, prior to completion of the strategy.

1.5.3 Development of a Long-Term Management Strategy

The development of a Long-Term Management Strategy for contaminated sediments is the primary goal of the CSTF. Development activities included identifying strategy report objectives; reviewing the results from previous studies conducted in the region and elsewhere; and identifying data needs to fulfill the objectives. Data gap studies were then initiated to fill the data needs. Study results were interpreted at the technical subcommittee level and then brought before the Management Committee for incorporation into the strategy report. This section briefly describes some of the key aspects of the development process.

1.5.3.1 Goals of the Long-Term Management Strategy

The specific goals of the Long-Term Management Strategy report include the following:

- Identification of pollution sources within and outside the ports and marinas within the study area;

- Identification of the location, approximate quantity, and nature of sources of contaminated dredge material;
- Identification and description of beneficial reuse alternatives;
- Identification and description of feasible treatment technologies;
- Identification of the location and nature of alternative disposal sites including, but not limited to, upland sites and aquatic sites;
- Criteria for monitoring dredging operations;
- Plans for operation, management, and monitoring of any regional confined aquatic disposal sites, regional upland sites, or regional upland re-handling sites;
- Description of funding mechanisms for long-term operation, management, and monitoring of regional upland and confined aquatic disposal sites;
- Development of an implementation plan for contaminated sediment management that shall include, at least, the following elements:
  - Consolidated application for permits or federal consistency review;
  - Recommendations for streamlining multi-agency permit process;
  - Guidance on incorporating the identified disposal and management alternatives into an evaluation procedure and selecting the alternative appropriate to each project;
  - Criteria for use of each disposal alternative;
  - Description and status of existing watershed management and source reduction programs that are applicable to sediments within the study area;
  - Recommendations for additional watershed and source reduction management, if necessary;
  - Recommendations on the need for and benefit of establishing a permanent Dredge Material Management Committee to implement the strategy;
  - Identification of best management practices (BMPs) for dredging and disposal of contaminated sediment; and
  - Establishment of regional contaminated sediment screening thresholds.

1.5.3.2 Previous Studies

The USACE, Los Angeles County Department of Beaches and Harbors, the POLA and the POLB have conducted numerous studies in the Region that are relevant to the objectives of this document. These studies include useful information regarding the physical, chemical and biological environments for the Region. Since there are numerous studies available for the Region, only the most recent, relevant and comprehensive studies are described here.

Most of the USACE studies were performed to meet their dredging and disposal needs in the Los Angeles area. Marina del Rey and Ballona Creek have been extensively studied by the USACE to evaluate various alternatives that could stop or minimize the migration of sediments from Ballona Creek to the Marina del Rey harbor entrance. These studies provide information on the Ballona Creek Watershed, sediment and pollutant loads of Ballona Creek, characteristics of the sediment deposits near the harbor entrance channel, as well as the coastal and geotechnical conditions of Marina del Rey.

The USACE also studies the coastline of Southern California regularly. These studies involve systematic beach profile surveys, coastal engineering evaluations, and geotechnical studies. Information collected for these studies were reported in the State of the Coast of California reports.

Recently, the EPA completed a study for the designation of the ocean dredged material disposal site "LA-3" for the Los Angeles Basin. In addition to providing general coastal and geotechnical conditions for the coastal environments, the study includes an extensive summary of historical dredged and disposal activities in the Region. The results form the basis for the CSTF Management Strategy by providing estimates of future dredging and disposal needs for the Los Angeles Basin.

The POLA and the POLB have undergone major expansions in the last three decades. Major port expansion projects include deepening of the navigation channels, construction of landfills at Pier 300 and Pier 400 and a transportation corridor between Pier 400 in the Los Angeles Harbor and downtown Los Angeles rail yards, the Pier J expansion, development of the POLB West Basin, and the construction of Pier T at Long Beach Harbor. Because of the development needs, the two Ports have conducted numerous engineering and environmental studies for the LA/LB Harbor Basins. Many of these studies were conducted with the help of the former USACE Waterways Experiment Station (WES)[2] to address tidal circulation, water quality and wave conditions within the harbors.

Since the 1950s, the two Ports have been studying the marine biological environment of the LA/LB Harbors. The first comprehensive surveys of biological and chemical conditions of the harbors were conducted in 1971. Since then, the two Ports have continued to conduct biological surveys in the LA/LB Harbors about once every ten years. The most recent comprehensive biological baseline condition survey for the LA/LB Harbors was completed in 2002 by MEC Analytical Systems. Some of the findings of the study were used to define the affected environment described in Section 2.

For decades, the Los Angeles County Department of Public Works (LACDPW) has collected hydrologic information, storm water discharge, and water quality data for the Los Angeles River Watershed, Dominguez Channel Watershed and the Ballona Creek Watershed. The collected data were compiled and published regularly in their hydrology and storm water quality reports. Information collected for these three watersheds by LACDPW were used to define pollutant loadings to the harbors by watershed.

There are numerous other studies for the Los Angeles area that were conducted by State Regulatory Agencies, City of Long Beach, City of Los Angeles, and local research universities. Some of these study results were used in the development of this CSTF Management Strategy report.

1.5.3.3 Identification of Data Needs

As described previously, the five CSTF Subcommittees were charged with identifying and resolving technical issues related to the development of the CSTF

[2] WES is now referred to as the Engineering Research Development Center (ERDC).

Management Strategy. After reviewing existing available data, the Subcommittees identified several data needs, and initiated the following studies to fill the data gaps. The results of the studies listed below were used in the development of the CSTF Management Strategy:

- A bench and field scale pilot study was conducted by the USACE with the main objective to provide technical data for the evaluation of four disposal management alternatives – aquatic capping, cement stabilization, sediment washing and sediment blending.
- A study to evaluate water quality issues related to marine dredging in the Los Angeles area.
- The development of a comprehensive Sediment Quality Database (SQD) for the Los Angeles Basin.
- The development of a storm water discharge and water quality database documenting historical storm water and pollutant discharges of the Los Angeles River Watershed, Dominguez Channel Watershed and the Ballona Creek Watershed.
- A marketing survey study on the constraints and opportunities of beneficial reuse of contaminated sediments in the Los Angeles area.
- A study to develop regional sediment screening thresholds.

1.5.4 Public Participation

Public participation in the development of the CSTF Contaminated Sediment Strategy was encouraged at several levels by creating a website to update the public on Task Force activities and upcoming meeting schedules, opening the monthly meetings to all individuals, holding annual workshops to review the status of the development process, and releasing a draft of the Management Strategy for public review. The following sections briefly detail each of these steps.

1.5.4.1 Monthly Meetings and Annual Workshops

The CSTF Management Committee and most of the technical subcommittees met as needed to review the status of the development process, review study results prepared by outside contractors hired to perform research for the group, and discuss technical issues related to data interpretation. Once each year, a workshop was held at a central location to provide an opportunity for the public to become acquainted with and provide comments on the development process.

1.5.4.2 Public Review

Public review of the CSTF Management Strategy was possible on an informal basis by distributing sections of the document to the CSTF Management Committee attendees for comment as they were developed, and making draft versions of the document available for download on the CSTF website. After approval of the complete document by the CSTF Management Committee, a draft was submitted to the CSTF Executive Committee for approval and public review.

1.5.4.3 Response to Public Comments

All comments received through the public review process were considered by the CSTF Management Committee and, when agreed to by all, incorporated into the final document. In instances where disagreement occurred between participants of the Management Committee regarding the validity of a proposed modification to the document, a final decision was made by the representatives from the CCC and LARWQCB.

1.6 Overview of the Los Angeles Regional Dredged Materials Management Plan

Under the authorization of the Water Resources Development Act (1986), the USACE is developing a Dredged Material Management Plan (DMMP) for the County to provide guidance and methods for dredging and disposal of clean and contaminated sediments. Local sponsors for the Los Angeles Regional DMMP are the POLA, the City of Long Beach, and the County.

1.6.1 Objectives and Timeline of the Dredged Materials Management Plan

The current timeline for completion of the Los Angeles DMMP is mid-year of 2006 and specific objectives include the following:

- Establish preliminary dredged material disposal sediment threshold levels, through defining trigger points and hierarchal approaches for the disposal of dredged sediments.

- Establish local best management practices for the dredging and disposal of contaminated and non-contaminated marine sediments.
- Identify regional disposal alternatives for contaminated and non-contaminated dredged sediments.
- Implement both bench scale and pilot scale projects to assess the viability of various treatment alternatives for contaminated dredged sediments through the USACE Operations and Maintenance program.
- Identify environmental restoration and/or enhancement opportunities that are directly related to the dredging and disposal of contaminated marine sediments.
- Prepare detailed cost estimates for identified disposal alternatives.
- Recommend a regional disposal management strategy, to include: (1) the recommended regional disposal sites and/or treatment alternatives; (2) BMPs for the dredging and disposal operations; (3) a consolidated and consistent plan for regulatory review; (4) chemical trigger levels for sediment testing and disposal site selection; and (5) a tiered approach for site selection to dispose dredged sediments.
- Prepare a programmatic Environmental Impact Statement/Environmental Impact Report (EIS/EIR) to implement regional disposal management alternatives.
- Recommend a regional dredged materials management plan that is consistent with the Los Angeles Region CSTF Long-Term Management Strategy.

1.6.2 Coordination with the CSTF Strategy Report

The last specific objective for the Los Angeles DMMP is to "recommend a regional dredged material management plan that is consistent with the Los Angeles Region CSTF Long-Term Management Strategy." To fulfill this objective, the USACE actively participated in the development of the CSTF report by sponsoring and managing several pilot field and laboratory studies to evaluate sediment management options identified as data needs during the strategy report development process. USACE staff was also actively involved in the data interpretation process occurring at the monthly CSTF meetings and led the Subcommittee on Aquatic Disposal and Dredge Operations. It is anticipated that the CSTF Management Strategy and the DMMP will contain shared data and offer similar recommendations related to the management of contaminated sediments.

2 AFFECTED ENVIRONMENT

Contaminated sediments are typically located in bays and harbors due to their proximity to anthropogenic contaminant sources and their hydrological characteristics that contribute to particulate settlement and retention. The Bight 1998 survey (Noblet et al. 2003) characterized Southern California Bight bays and harbors as containing 22 percent of total Bight-wide sediment contamination, even though they constitute only 6 percent of the area surveyed. The other notable factor listed in the Bight 1998 survey as contributing to a greater than proportional degree of contamination was proximity of sampling locations to large publicly owned treatment works (POTW) outfalls. Within bays and harbors, areas of greater sediment contamination are typically located in areas with low water exchange rates, such as blind slips, and/or in areas of high sedimentation, such as river or creek mouths. These areas typically contain elevated total organic carbon (TOC) concentrations (defined as greater than 1.8 percent, Noblet et al. 2003), and may also be associated with periods of reduced dissolved oxygen (less than 5.0 milligrams per liter [mg/L]) or reduced salinity (in the case of freshwater discharge sources). These additional factors are not in and of themselves causes or results of sediment contamination but are variables that typically co-vary with contamination due to similar habitat characteristics.

Urban, industrial and recreational uses of marine waters and associated upstream watersheds all contribute to contaminants found in sediments offshore of Los Angeles County (County). Effects of these contaminants subsequently degrade the associated beneficial uses of the waters overlying the sediments, including the biological, commercial, industrial, and recreational values. This section presents a general description of the resources within the area of interest to the Contaminated Sediments Task Force (CSTF) in terms of biological habitats and species, threatened and endangered species, and land and water resources. Table 2-1 presents a matrix summarizing the resources associated with locations in Santa Monica and San Pedro Bays likely to face contaminated sediment issues in the future. Resources that should be considered when addressing contaminated sediment issues are described in greater detail below.

2.1 Biological Habitats

Contaminated sediments within Santa Monica and San Pedro Bay are primarily associated with areas of intense anthropogenic sources of contaminants. The type and source of impairments related to sediment contamination issues are described below for the major Los Angeles CSTF area water bodies.

Table 2-1
Affected Resources in the CSTF Study Area

Affected Resources	Santa Monica Bay			San Pedro Bay			
	Marina del Rey	Lower Ballona Creek	Nearshore Habitats and Wetlands	LA/LB Harbor	LARE	Alamitos Bay	Nearshore Habitats and Wetlands
Biological Resources							
Avian	x	x	x	x	x	x	x
Benthic Invertebrate	x	x	x	x	x	x	x
Fish	x	x	x	x	x	x	x
Marine Mammals	x			x			
Threatened and Endangered Species	x	x	x	x	x	x	x
Land and Water Resources							
Air Quality	x	x	x	x	x	x	x
Commercial	x		x	x			x
Historical/Archaeological	x	x	x	x	x	x	x
Navigation/Shipping	x	x	x	x	x	x	x
Recreational	x	x	x	x	x	x	x
Upland Infrastructure	x	x	x	x	x	x	x

2.1.1 Santa Monica Bay

2.1.1.1 Marina del Rey

Marina del Rey primarily functions as a recreational marina, and addressing contaminated sediments in its vicinity would potentially impact the water body's biological resources as well as the associated land and water resources. The interior basins of the marina and the hydrologically linked Venice canals are likely to exhibit elevated chemical concentrations. A surrogate measure for water circulation (and therefore likelihood of elevated contaminants) is dissolved oxygen. In Santa Monica Bay, dissolved oxygen levels typically range from 7.5 to 8.6 mg/L, which is common. In general, the dissolved oxygen levels in Marina del Rey decline with distance from the entrance of the harbor. This pattern reflects the reduced mixing with off-shore water and/or increased organic load and bacterial activity within the interior basins (USACE 1998a).

The marina is primarily soft bottom and supports benthic invertebrate and fish communities as well as serving as a foraging area for sea- and shorebirds. Studies of

Marina del Rey infaunal communities conducted between 1976 and 1995 found the harbor bottom to be dominated by species of nematodes and polychaete worms that prefer fine-grained sediments and can tolerate elevated levels of chemicals (USACE 1998b). Molluscs, crustaceans, echinoderms, and taxa that tend to be sensitive to chemicals, were relatively rare. In general, the number of invertebrate taxa decline from the entrance channel to the back portions of the Marina.

Marine mammals, while not a common occurrence, occasionally utilize the protected waters and structures. The margins of the marina include hard-substrates such as pier pilings, armored shorelines, and rock jetties that also support biological communities.

2.1.1.2 Lower Ballona Creek

Lower Ballona Creek, the Ballona wetlands, and Del Rey Lagoon are located to the south of Marina del Rey which is the discharge point for a flood control channel that drains a large portion of the City of Los Angeles, and has historically accumulated a wide variety of contaminants. The Lower Ballona Creek ecosystem supports a variety of habitat types, including wetlands, soft-bottom biological assemblages, and hard substrate communities associated with the jetties at the interface between the creek and Santa Monica Bay. The area serves as one of the major migratory bird foraging areas in Los Angeles County due to its associated upstream wetlands. Marine mammals do not utilize the area on a regular basis.

2.1.1.3 Santa Monica Bay Nearshore and Wetland Habitats

Southern California wetlands are often associated with marinas and storm water discharge points as well as industrial, electricity generation, and/or petroleum extraction activities that were historically sited on filled wetlands or at their margins.

Storm water discharge areas and marinas are among the major sources contributing sediments with elevated contaminants. The margin of Santa Monica Bay includes a variety of habitats that may be directly or indirectly impacted by contaminated sediment issues. In addition to Marina del Rey, the other major marina located on the margin of Santa Monica Bay is King Harbor in Redondo Beach. Major storm water discharges in the northern Santa Monica Bay are associated with the creeks of the Santa Monica Mountains (e.g. Topanga Creek, Malibu Creek).

The Ballona wetlands and Del Rey Lagoon are located south of the Ballona Channel in Marina del Rey and include approximately 185 acres of degraded wetlands habitat. Habitats include pickelweed salt marsh, mudflats and channels. Although degraded, the marsh still supports a viable wetland ecosystem. The Ballona Lagoon, located south of Marina del Rey is an artificially confined tidal slough channel approximately 1,219 meters (4,000 feet) long and 45 to 61 meters (150 to 200 feet) wide. The lagoon contains some remnant salt marsh vegetation including pickelweed (*Salicornia* sp.) and *Jaumea* sp. Shorebirds forage on the mudflats of the lagoon and grebes, herons, gulls, terns and waterfowl use the open water. These areas represent remnants of a much larger tidal wetlands system that once extended through the communities of Venice to the north, inland almost to the San Diego Freeway, and south to the Westchester Bluffs (Soule et al. 1992).

2.1.2 San Pedro Bay

2.1.2.1 Ports of Los Angeles and Long Beach

The Ports of Los Angeles (POLA) and Long Beach (POLB) are located along the northern coastline of San Pedro Bay and are among the most industrialized sites in Southern California. Areas associated with contaminated sediments are often those areas with low water circulation and/or high sedimentation rates. A dye-tracer study in the POLA and POLB using the Waterways Experiment Station (WES) hydrodynamic numerical model indicated that the inner harbor areas (inshore of the Vincent Thomas and Gerald Desmond Bridges) exhibited static circulation patterns (Vermulakonda et al. 1991 as cited in the Los Angeles/Long Beach (LA/LB) Harbors Navigation Improvement Environmental Impact Statement/Environmental Impact Report [EIS/EIR]). Recent dissolved oxygen concentration measurements have consistently been above 5.0 mg/L in the outer harbors (MEC 2002). Mean concentrations in other areas of the harbor were consistently greater than 5.0 mg/L; limited depressed values within the harbor complex were observed primarily in spring mid- and bottom-depth samples and were mainly above 4.0 mg/L, indicating a long-term trend of improvement (MEC 2002).

The POLA and POLB serve as valuable habitat for benthic invertebrates, fish, avian fauna, and marine mammals. Within their jurisdictions, both ports contain deep water soft bottom, shallow water soft bottom, and hard substrate (in the form of armored shorelines, pier structures, and rocky substrate breakwater jetties). In addition, the POLA also contains vegetated shallows in the Cabrillo Beach area, which support eelgrass (*Zostera marina*). Specific resources are discussed below in Section 2.2.

2.1.2.2 Los Angeles River Estuary

The Los Angeles River Estuary (LARE) was designed as a flood control discharge into San Pedro Bay, and habitat characteristics are more similar to industrialized harbor environs than to an idealized Southern California estuary due to the seasonal influence of storm water-born contaminants. Sediments in the area consist of surficial sands overlying finer material and contain elevated levels of metal and organic contaminants (USACE 2001). Soft bottom and armored shoreline are the primary habitats typical of the estuary. Marina facilities have been constructed in the outer LARE and provide some hard-substrate habitat. The estuary serves as an important foraging and resting area for a variety of migrating and resident bird species; marine mammals do not use the area on a regular basis.

2.1.2.3 San Pedro Bay Nearshore and Wetland Habitats

Wetland habitats along the shoreline of San Pedro Bay are extremely limited within the study area due to a long history of development in the area. Wetland areas within the Study Area include [the Cabrillo marsh within the POLA], the Golden Shore Marine Reserve in the vicinity of the LARE, and the Los Cerritos wetland complex located between the Long Beach Marina and the San Gabriel River Estuary. Sporadic areas of pickleweed (*Salicornia virginica*) and saltgrass (*Distichlis spicata*) patches have been documented along minimally developed harbor shorelines (e.g., MBC 1999).

2.1.3 Alamitos Bay

Alamitos Bay is located in close proximity to San Pedro Bay and contains many of the same habitat features and biological organisms found in the inner harbor areas near the

LARE and City of Long Beach downtown marina. Current dredging activities in Alamitos Bay are limited to the mouth of the harbor where the presence of contaminated sediments rarely occurs. Habitats in this portion of the bay include hard substrate along the rock jetties, soft bottom sediments along the inner portions of the harbor and sand bottom along the main entrance channel. Just inside Alamitos Bay are numerous dock structures which also support a range of biological assemblages. Marine mammals do not utilize the bay on a regular basis.

2.2 Biological Assemblages

This section provides a generalization of biological assemblages inhabiting areas likely to exhibit elevated sediment contaminant levels in Santa Monica, San Pedro and Alamitos bays (due to their nearshore, low circulation, and/or high sedimentation characteristics). Because of the document's overview nature, the goal of this section is not intended to discuss the diversity of biological organisms in the study area. Instead the goal is to provide a brief summary of resources potentially at risk from contaminated sediments in the Los Angeles Region (Region).

2.2.1 Submerged Aquatic Vegetation

The primary submerged aquatic vegetation type, which overlaps with areas typically affected with elevated sediment contaminants, is the angiosperm *Zostera marina*, often referred to as eelgrass. It inhabits shallow soft-bottom substrates in bays and estuaries from Alaska to Baja California, and is generally tolerant of the wide range in physical habitat characteristics such as temperature and salinity. With respect to sediments, eelgrass beds often accrete sediments and function ecologically as substrate for epifauna and nursery habitat for juvenile fish such as the California halibut (*Paralichthys californica*). With respect to in-water projects (such as dredging), National Oceanic and Atmospheric Administration (NOAA) fisheries requires that any impacts to eelgrass beds be mitigated at a ratio of 1.2 acres for every acre impacted (NOAA Fisheries 1991).

An invasive alga, *Caulerpa taxifolia*, was discovered in San Diego County's Agua Hedionda Lagoon on June 12, 2000, and subsequently in Huntington Harbor. As a result, surveys of Southern California in-water construction projects are required by NOAA's fisheries section. To date no sightings of *Caulerpa* have occurred in the Study Area (RWQCB 2003).

2.2.1.1 Santa Monica Bay

Submerged aquatic vegetation is relatively sparse in areas of Santa Monica Bay expected to exhibit elevated sediment contaminants. At Marina del Rey, submerged aquatic vegetation is limited to eelgrass on soft bottoms and giant kelp growing on rip rap areas of the outer harbor; eelgrass beds are relatively sparse. Along the middle portion of the bay, macroalgae is most commonly associated with rock breakwater and jetty structures. In the extreme north and south of Santa Monica Bay, macroalgae communities inhabit naturally occurring rocky reefs.

2.2.1.2 San Pedro Bay

The protected nearshore areas of San Pedro Bay have been documented to be dominated by sparse coverage of stress tolerant algal species such as *Ulva* spp. and *Enteromorpha* spp. More exposed areas are typically dominated by red and brown algal species, including *Sargassum* spp., *Taonia* spp., *Gigartina* spp., and *Corallina* spp. (USACE and LAHD 1984). A strip of giant kelp (*Macrocystis* sp.) currently lines the inner side of the breakwater and along submerged rock dikes in the outer San Pedro Bay.

Eelgrass has become established in shallow waters off Cabrillo Beach extending northward to the Cabrillo Marina as well as in the Pier 300 shallow water habitat (SWH) and Seaplane Lagoon in the POLA. In a recent 2000 survey for the POLA, a dramatic seasonal increase in eelgrass bed area from 21.66 acres in March to 42.27 acres by August was recorded. The coverage in August was considered to be healthy based upon the observed density and growth as well as the presence of flowering turions (MEC 2002).

2.2.1.3 Alamitos Bay

The kelp and macroalgae species found in Alamitos Bay are expected to be similar to that found in areas of San Pedro Bay. Nearshore areas are dominated by sparse coverage of stress tolerant algal species such as *Ulva* spp. and *Enteromorpha* spp.; more exposed areas are typically dominated by red and brown algal species, including *Sargassum* spp., *Taonia* spp., *Gigartina* spp., and *Corallina* spp. (USACE and

LAHD 1984). Eelgrass beds have been documented in the Entrance Channel and Marine Stadium areas of the bay.

2.2.2 Benthic Invertebrates

The benthic environment may be defined as that associated with the interface between the water column and the underlying geology. In the case of contaminated sediments, this interface typically consists of sediments of varying grain sizes, but is usually dominated by fine-fraction silts and clays due to the adhesion of contaminants onto particulates and their subsequent settlement and accumulation over time.

Benthic invertebrates are typically defined as those associated with the sea floor interface, although for the purposes of discussion here, the group will be limited to those either inhabiting or living in close proximity to sediments. Benthic infauna is considered to be a key indicator of whether a submerged site is contaminated due to the strong correlation between pollution tolerant species, which generally do not occur in clean sediments at high abundances, and contaminants or conditions indicating a disturbed biological community. The benthic communities within the CSTF Study Area for the most part are made up of similar assemblages of species. Although variation in benthic communities between habitat types is significant, geographical distance within the study area is not among the factors affecting the benthic community composition.

Classic pollution tolerant species of the San Pedro Bay area include the bivalves in the Genus *Solemya*, *Dorvilleid* polychaetes, and the polychaete species *Capitella capitata*, *Schistomerigos longicornis*, and *Notomastus* sp. (MEC 2002). The species typically associated with sediments substantially free of contaminants or disturbance includes the brittlestars of the Genus *Amphiodia*, polychaetes such as *Maldane sarsi* and *Pectinaria californiensis*, and worms of the Genus *Phoronis*. Presence/absence data relating to benthic species can be a strong indicator of the relative condition of the sediments or the site in terms of pollution load or stability of ambient conditions (e.g., dissolved oxygen concentration).

An additional factor that should be considered with respect to benthic infauna is their potential effect on food-web dynamics with respect to bioaccumulation and biomagnification. Species associated with sediments serve as an important food source for a variety of demersal or epibenthic fish species (e.g., the bat ray *Myliobatis californica*). Due to their close association with sediments, there is potential for uptake of bioaccumulative substances (e.g., metals and organics listed in the Region IX guidance for Green Book bioaccumulation testing [USACE and EPA 1991]). Once incorporated into benthic invertebrate tissue (via absorption, adsorption, and/or sequestration), these contaminants may then be biomagnified within the food web and affect higher-order predator species.

2.2.3 Hard Substrate Biological Assemblage

Biological assemblages inhabiting hard substrates are generally similar throughout the CSTF Study Area. Organisms on hard substrates typical of areas with contaminated sediments commonly include barnacles, bivalves, polychaete worms, snails, anemones, echinoderms, and algae. The hard substrate communities often include the bay mussel (*Mytilus galloprovincialis*) and the Pacific oyster (*Crassostrea gigas*). These long-lived bivalve species typically filter large volumes of water throughout their lifetimes. Incidental ingestion of resuspended particulates provides the potential to ingest and bioaccumulate associated contaminants. Other smaller filter feeding organisms on hard substrates face the same challenge with respect to particle-adsorbed contaminants. Contaminants ingested by hard substrate fauna may subsequently enter the food web via predation by fish species associated with hard substrate habitat such as surf perches (*Embiotocidae*) (see Section 2.2.4.3).

2.2.4 Fish

Fish species present within the study area utilize pelagic, epibenthic, and demersal habitats, and are therefore exposed to a variety of contaminant exposure pathways. Demersal species, such as bat rays or California halibut, are exposed to sediment-associated risk pathways on many levels. Pelagic species are perhaps the most removed from impacts due to contaminated sediments, although resuspension of contaminated sediments, exposure to sediment flux products (i.e., desorbed dissolved contaminants in the water column), and ingestion of prey species with elevated tissue contaminant burdens present some level of risk. The degree of exposure risk of epibenthic species to sediment-associated contaminants is most likely between that of demersal and pelagic species. Exposure pathways for demersal and epibenthic species, in addition to those listed above for pelagic species, include direct skin contact, contact of gill tissues with suspended particulates, and incidental ingestion of contaminated sediments. The following sections discuss fish species present within each management area.

2.2.4.1 Santa Monica Bay

Similar to the cases of the POLB and POLA, existing fish community data available for Marina del Rey provides a generalized picture of the fishes associated with the areas along the margins of Santa Monica Bay. Fish communities in Marina del Rey include those associated with the sandy bottom, the shallow soft bottom, the water column, and the rocky substrate of the entrance jetties and breakwater. The fish observed in Marina del Rey studies include diamond turbot, bat rays, California halibut, spotted turbot, white croaker *(Genyonemus lineatus)*, yellowfin croaker, California killifish, arrow gobies (*Clevelandia ios*), shadow gobies, stripped mullet, northern anchovy (*Engraulis mordax*), Pacific sardines (*Sardinops sagax*), queenfish (*Seriphus politus*), blacksmith, opaleye, pile surfperch, black surfperch, rock wrasse, giant kelpfish, garibaldi, seniorita fish, kelp bass, barred sand bass, and dwarf surfperch (USACE 1998b). Three special interest species found in Marina del Rey are California halibut, grunion, and white seabass.

2.2.4.2 San Pedro Bay

Though it did not extend into other areas of San Pedro Bay, the 2000 Biological Baseline Survey (MEC 2002) conducted by the POLA and POLB serves as a valuable record of the diverse nature of fish species present in San Pedro Bay. The survey included a variety of habitat types (e.g., shallow subtidal, deepwater) and is a good general indication of fish fauna found not just in the Ports, but throughout the nearshore areas of San Pedro Bay.

Of the 554 species described in Miller and Lea's Guide to the Coastal Marine Fishes of California, 74 species were observed in the 2000 Biological Baseline Survey of the POLB and POLA (MEC 2002). The most abundant species observed included the species northern anchovy, white croaker, queenfish, topsmelt *(Atherinops affinis)*, and Pacific sardine, which together accounted for 90 percent of the total abundance.

These species plus bat ray and barracuda (*Sphyraena argentea*) accounted for 77 percent of the total biomass observed. These species may then be considered to be a generalized list of species of primary concern in the harbor complex (although the species listed in the Pacific Fishery Management Plans for Coastal Pelagics and Groundfish are clearly additional species which must be accounted for when considering contaminated sediment issues in relation to fish habitat). Of these species, consumption advisories have been issued for white croaker and queenfish caught within the LA/LB Harbors (California Office of Environmental Health Hazard Assessment, 2003 California Ocean Fishing Regulations Book) due to unacceptable levels of contaminants in tissues most likely the result of exposure to sediment contaminants.

2.2.4.3 Alamitos Bay

Alamitos Bay is in close proximity to San Pedro Bay and the LARE and supports similar aquatic habitats. As such, similar fish species are expected to be found within the bay. These species included northern anchovy, white croaker, queenfish, topsmelt, Pacific sardine, bay goby (*Lepidogobius lepidus*), California tonguefish, white surfperch, shiner surfperch, Pacific butterfish (*Peprilus simillimus*), and arrow goby (MEC 2002 and USACE and LAHD 1984).

2.2.5 Avian Fauna

As discussed above for fish, exposure of avian fauna to chemicals associated with contaminated sediments may occur though a variety of pathways. The most likely chronic exposure is that via the food web for piscivorous birds such as terns or pelicans. Acute exposure pathways may occur as contaminated sediments are being dredged, handled, and disposed of through dermal contact with suspended particulates of a turbidity plume while loafing or by incidental ingestion of turbid waters while feeding.

2.2.5.1 Santa Monica Bay

Marina del Rey provides a protected habitat for marine-associated species. The highest abundance of water birds is in the winter when large numbers of waterfowl, gulls, and shorebirds migrate south from breeding grounds in the north. Loons, grebes, and ducks loaf and feed in the open waters of the marina. The breakwall provides a protected roosting area for the California brown pelican (*Pelicanus occidentalis californicus*) double-crested, pelagic and Brandt's cormorants. The breakwall and channel jetties provide foraging for shorebirds such as black oystercatchers, black and ruddy turnstones, surfbirds, and wandering tattlers that prefer rocky shores (Holt 1990 and Childs 1993). As in the LA/LB Harbors, gulls utilize most of the habitats in the harbor including the open water, armored shoreline, docks, and the sandy shore of Mother's Beach in Basin D. The limited amount of sandy shore in the harbor provides foraging space for shorebirds such as marbled godwits, whimbrels, and willets. Terns, which dive for fish from the air, also forage in the protected open water of the marina. Caspian terns and Forester's terns (*Sterna caspia* and *Sterna fosteri*, respectively) are found in the harbor year round. In the summer, the California least tern nests on Dockweiler State Beach and forages in the marina.

Because Marina del Rey is heavily developed, little natural habitat exists for terrestrial birds. Terrestrial birds associated with the harbor are primarily species such as rock dove and European starling.

2.2.5.2 San Pedro Bay

Over 100 bird species have been reported to occur within the LA/LB Harbor, and 99 species were observed in the 2000 to 2001 surveys (MEC 2002). Of these, 70 percent could be considered water-associated, and 44 percent of all birds observed in the harbors over the year were gulls (MEC 2002). Other abundant taxa were terns, grebes, California brown pelican (an endangered species), and cormorants. Pier 400 is occupied by primarily gulls (*Larus* spp.), american crows (*Crovus brachyrhynchos*), common ravens (*Crovus corax*), black skimmers (*Rhychops niger*), Caspian tern, elegant terns (*Sterna elegans*), royal terns (*Sterna manxima*), and California least terns (*Sterna antillarum browni*) (Keane Biological Consulting 1999). Some bird species are year-round residents while others are winter or migrant visitors. They use habitats within the harbors primarily for resting and foraging, although some species breed there. Additional information regarding avian species in LA/LB Harbors can be found below (Section 2.4 Threatened and Endangered Species in the Los Angeles Coastal Region).

2.2.5.3 Alamitos Bay

Alamitos Bay supports habitats similar to San Pedro Bay and the LARE for over 100 bird species which have been reported to occur in the area. The dominant species are water-associated and include gulls, grebes, cormorants, black skimmers, Caspian terns, elegant tern, royal terns, and California least terns (Keane Biological Consulting 1999). Some bird species are year-round residents while others are winter or migrant visitors. They use habitats within the harbors primarily for resting and foraging, although some species breed there as well.

In a survey conducted by the California Department of Fish and Game (CDFG) from October 1979 to March 1980, 53 species were identified in the Los Cerritos Wetland. Forty-eight of the species were water-associated, including five special status species (CDFG 1981).

2.2.6 Marine Mammals

California sea lions (*Zalophus californianus*) and harbor seals (*Phoca vitulina*) are relatively common within marina and harbor environments throughout the Study Area. They are most abundant on structures that they utilize to haul out on (i.e., channel buoys and breakwater jetties) and also commonly forage in the outer portions of harbors and marinas.

Gray whales (*Eschrichtius robustus*), common dolphins (*Delphinus delphis*), Pacific bottlenose dolphins (*Tursiops truncates*), and Pacific white-sided dolphins (*Lagenorhynchus obliquidens*) are the cetacean species (whales and dolphins) that would be the most commonly expected in nearshore waters of both Santa Monica and San Pedro Bays. No cetaceans have been documented to regularly inhabit the Los Angeles harbor (LAHD 1999 and POLB 2000), but cetaceans observed in the outer harbor include gray whales, Pacific bottlenose dolphins, common dolphins, Pacific white-sided dolphins, Risso's dolphins (*Grampus grieus*), and Pacific pilot whales (*Globicephala macrorhynchus*) (USACE and LAHD 1992). Sightings of these species within areas associated with sedimentation and low water circulation are rare. However, in 1990, one or two gray whales were present in the Pier 300 SWH in the Outer Los Angeles Harbor.

2.3 Biological Community Effects of Contaminated Sediments

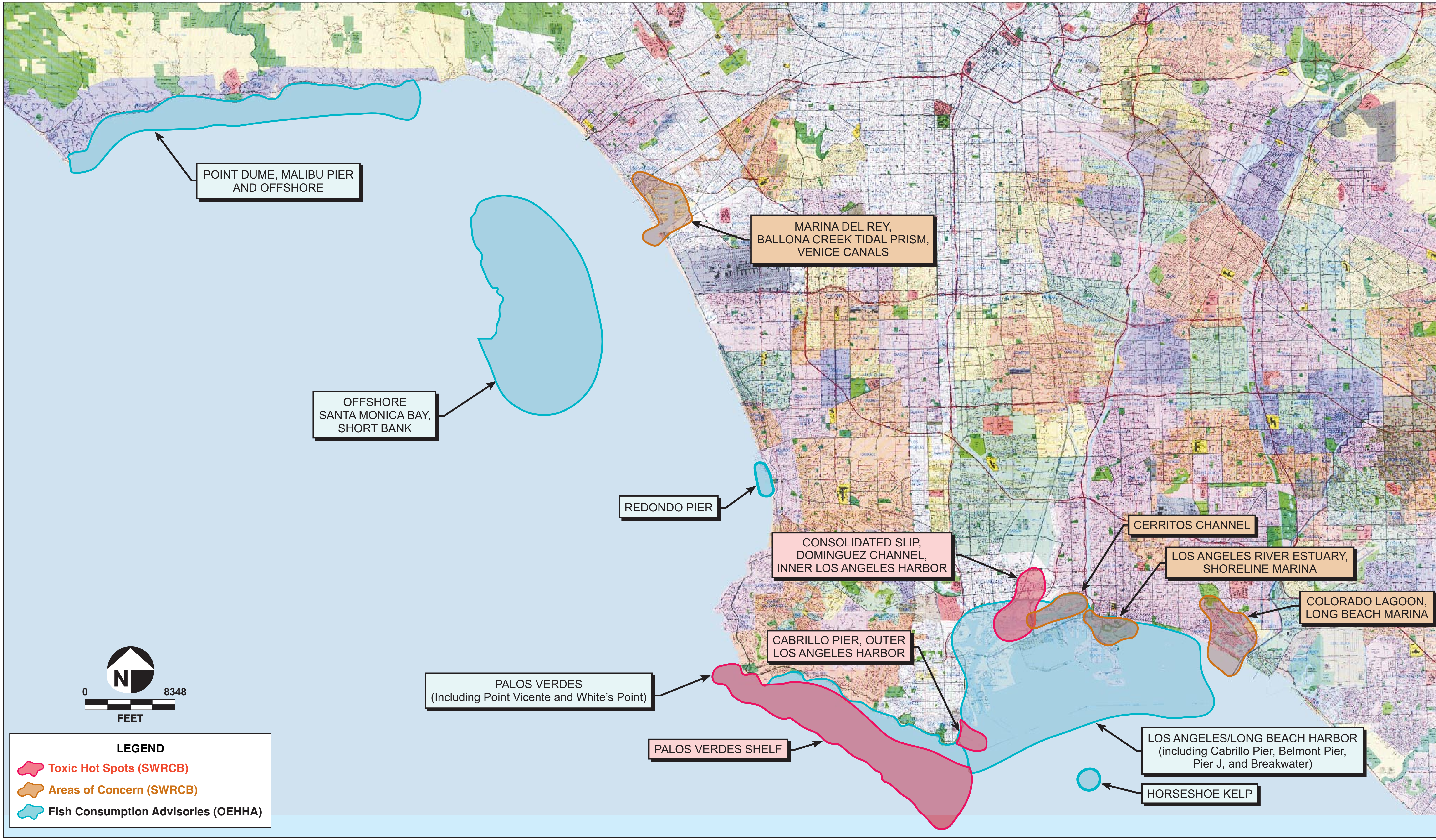
Contaminated sediments impact biological communities on many levels. Direct toxicity as a result of ingestion, dermal contact, exposure to pore water, etc., is one of the most severe consequences of sediment contamination, but is not well documented *in situ*. The effects of toxicity and other impacts from sediment contamination are indicated by benthic community studies, which have documented low infauna abundance and diversity in naturally occurring communities from areas with relatively elevated sediment contaminant levels (e.g. MEC 2002).

Bioaccumulation of contaminants within tissues and subsequent potential biomagnification within the food chain are also significant concerns when considering impacts of elevated contaminant levels in sediments. Exposure of marine and estuarine organisms to contaminants also has the potential to lead to human exposure, due to elevated fish tissue contaminant levels. The California Office of Human Health Hazard Assessment has issued consumption advisories for the following species in portions of the CSTF Study Area: white croaker, queenfish, surfperches, corbina, black croaker, sculpin, rockfishes, and kelp bass (CFG 2003). Areas for which fish consumption advisories have been issued are presented in Figure 2-1.

2.4 Threatened and Endangered Species of the Los Angeles Coastal Region

The California least tern, the California brown pelican and the western snowy plover (*Charadrius alexandrinus nivosus*) are the primary species that could be potentially impacted by contaminated sediments under the Endangered Species Act (ESA) of 1973. These birds are in a similar situation to the fish or invertebrates that they consume, insofar as there are multiple potential routes of exposure by which they can be impacted by contaminated sediments.

The California least tern and the California brown pelican forage in Southern California waters and are thereby exposed to the risks of contact with waters impacted by the resuspension of contaminated sediments and incidental ingestion of waters with elevated levels of contaminants as they forage. They may also be susceptible to ingestion of prey species which may contain elevated levels of contaminants due to bioaccumulation.



Graphics/Aquatic Sciences/Contaminated Sediments Maps/LA Harbor Map/Degraded Coastal Areas.FH8

Figure 2-1

Degraded Coastal Areas Identified by the State of California within the CSTF Study Area

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Dredging operations may impact these species by creating turbidity plumes and producing noise which may impact their ability to forage, roost, or nest, and/or provide alternative roosting areas. As such, in-water construction activities (including dredging operations) in the study area are regulated by the U.S. Fish and Wildlife Service (USFWS) during the least tern nesting season (April 15 through September 30).

The California least terns forage in many Southern California bay and estuary waters. The least tern is present in the LA/LB harbor area only during its April to September breeding season, primarily in the vicinity of Pier 400. California least terns nest on Pier 400, and presumably forage in the nearby waters (LAHD 1997). A large, important California least tern colony is located on Dockweiler State Beach approximately 122 meters (400 feet) up-coast from the northern entrance jetty to Marina del Rey.

The California brown pelican is present in Southern California throughout the year and commonly forage in semi-exposed waters.   Brown pelicans use the harbor year-round for foraging and rest, but are not known to breed there (LAHD 1997). Breakwaters such as the Marina del Rey breakwater, which are relatively free from human disturbances, are especially important roosting sites for brown pelicans.

The Western snowy plover (*Charadrius alexandrinus nivosus*) is federally listed as threatened and is a state species of special concern. This species inhabits sandy beaches where it forages and nests. A few migratory snowy plovers have been reported in the Long Beach harbor, but no nesting is known (USACE and LAHD 1992). Several plovers were observed on Pier 400 in 1998 (Keane Biological Consulting 1999). Wintering Western snowy plovers occur in the vicinity of Marina del Rey. Page et al. (1986) counted wintering snowy plovers between 1979 and 1985 on nine occasions and observed between one and eight plovers per year in the vicinity of Marina del Rey.

2.5 Commercial and Recreational Resources

Contaminated sediments have the potential to impact commercial and recreational uses, especially in the context of the State Water Quality Control Board’s (SWQCB’s) 303(d) listing process. Many areas impacted by contaminated sediments are best described as second-tier options for commercial and recreational uses such as contact or non-contact recreation.

Contaminants associated with sediments clearly have at least the potential to impact recreational activities such as fishing and water-contact sports such as water skiing or kayaking.

Marina del Rey has a total recreational value estimated at $17 million, with half attributed to wet-berthed boats and one quarter attributed to other boating and use of Mother's Beach (USACE 2004). The Marina del Rey harbor consists of 136 hectares (406 acres) of water and is the largest small-craft harbor in the world. The harbor provides over 6,000 wet berthed slips, 3,000 dry boat storages, 240 boat launch facilities, 640-meter (2,100-foot) transient/guest docks, charter and rental boats, harbor tours, sailing instructions, and repair yards. Approximately 12 commercial boats (fishing and party/cruise) and 12 emergency vessels dock in the harbor, excluding boats from the launch facilities or visiting from other harbors. Commercial and recreational activities include charter boat fishing, sport fishing, dining cruises, wind surfing, jet skiing, sailboarding, and ferry service to Catalina Island. The harbor jetties are also regularly used for sightseeing, bicycling, fishing, and walking. In addition, Marina del Rey has multiple hotels and restaurants located throughout the harbor area. Fisherman's Village offers sightseeing, shopping, eating, and equipment rentals. Special spectator events include the annual Christmas Boat Parade, California Cup Race, regattas, crew races, and park concerts. The marina area hosts a number of parks including Burton W. Chace, Admiralty, Harold Edgington, and A.E. Austin Parks that offer outdoor leisure activities. Mother's Beach, known for its shallow, calm water, provides a sandy beach and boating lagoon for beach activities and windsurfing and has an average annual attendance of 368,000. Other facilities around the harbor serving recreational purposes include the UCLA Boathouse, Pardee Sea Scout Base, and Los Angeles County South Bay Bicycle Trail.

San Pedro Bay within the Los Angeles Harbor is home to commercial and sport fishing fleets and supports recreational activities including sport fishing, harbor cruising, whale watching diving, jet skiing, sailing, swimming, and windsurfing. Areas around the harbor area offer shoreline restaurants and waterfront walks. Major attractions include Ports O'Call Village, West Channel/Cabrillo Beach Recreational Complex, and several museums. Ports O'Call Village is a New England-style seaside village comprised of shops, restaurants, and attractions. The West Channel/Cabrillo Beach Recreational Complex is comprised of the Cabrillo Marina with 1,100 pleasure boat slips, the Cabrillo Marine Aquarium, Cabrillo Beach, and the Cabrillo Beach Pier. Museums include the Banning Residence Museum, the Drum Barracks Civil War Museum, the Los Angeles Maritime Museum, and the S.S. Lane Victory. The World Cruise Center at the POLA, which serves as the homeport for three cruise lines and hosts eight other cruise lines, hosts more than one million passengers per year making it the largest cruise passenger complex on the West Coast and 4th busiest in the U.S.

The LARE hosts several major charter boat operators that provide passenger and charter service to Santa Catalina Island from boat basins within the estuary, including Queensway Marina and Pacific Terrace Harbor. The passenger and charter services support recreational activities such as sport fishing, scuba diving, whale watching, and harbor sightseeing. The Queen Mary, permanently docked on the southern shoreline of the estuary, attracts over a million visitors a year, and contains hotel accommodation and restaurants. The Long Beach Shoreline Marina and Rainbow Harbor/Marina located in downtown Long Beach serves primarily recreational boating in the area. Opened in 1982, Shoreline (Downtown) Marina has 1,844 recreational boat slips located adjacent to Shoreline Village with retail shops and restaurants. Rainbow Harbor/Marina is located next to the Long Beach Aquarium and is composed of 103 commercial and recreational boat slips and 61-meter (200-foot) day mooring dock. There are twelve 46-meter (150-foot) docks for commercial vessels. Downtown Long Beach contains the Long Beach Aquarium and offers recreational vehicle parking, retail, and entertainment venues. Sailboat regattas, day sailing events, power-boat cruising, offshore power-boat racing, and other water-based recreational events take place throughout the year. Further downcoast, Belmont Pier serves as the main locale for sport fishing. Bluff Park and Beach, south of Ocean Boulevard; offer activities such as strolling, beach sports, and picnicking.

Alamitos Bay Marina has 1,991 slips and can accommodate vessels between 5 to 38 meters (18 to 124 feet). Facilities in the area include the Peter Archer Rowing Center, Shoreline Pedestrian Bike Path, Alamitos Beach, Bayshore Beach, Marina Beach (Mother's Beach), Colorado Lagoon, Mossy Kent Park, and Marine Stadium, an official state historic site. Marine Stadium hosts California Outdoor Motor Racing Association (COBRA) races, International Jet Ski Association demonstrations, Long Beach Rowing Association regattas, Golden West Water Ski Tours slaloms, and water-ski club activities. Alamitos Bay Marina is host to the Congressional Cup, the Trans Pac race to Hawaii, and North Sails Week. Other recreational activities include sailing, canoeing, kayaking, board sailing, wind surfing, water skiing, and rowing.

2.6 Historical and Archeological Resources

Within the Study Area, while no known submerged prehistoric archeological sites have been reported in LA/LB Harbors, there are several sites in the general area of Ballona Lagoon that indicate inhabitance dating from 7,000 to 200 Before Present (B.P.) (Chamber 2003). Prehistoric adaptations have been divided into the Early Period (7,000 to 3,000 B.P.), the Middle Period (3,000 to 1,000 B.P.) and the Late Period (1,000 to 200 B.P.). Population growth follows the changes in the area. The Baldwin Hills area was inhabited in the Early Period, followed by settlement and resource procurement in the Centinela Creek and Westchester Bluffs areas in the Middle Period, before settlement shifted toward Ballona Lagoon and Centinela Creek (Chambers 2003).

Available records indicate that there are no known prehistoric or historic culture resources present within Marina del Rey. The construction and periodic dredging of the harbor would have destroyed any such resources if present (USACE 1998c). The construction and periodic dredging of the POLB and POLA would similarly destroy any such resources (USACE 1998c).

2.7 Navigation and Shipping

While the largest marina facility is Marina del Rey, the primary industrialized harbor in the County is the LA/LB Harbor Complex. The Marina del Rey harbor consists of two entrance jetties and an offshore breakwater that form the entrance and main navigation channels of the harbor. The harbor provides wet berthed slips for commercial fishing boats, private pleasure boats, and emergency vessels, dry storage, launch ramps for trailer boats, and additional boat launching facilities. Patterns of harbor use depend on boat types. Fishing boats generally leave early in the morning and return in the early afternoon as winds pick up, when sailboats typically go out for sail. Approximately 25 to 30 percent of the wet-berthed sailboats and 15 to 25 percent of the wet-berthed power boats were observed to operate on summer Sundays. The period of lowest usage is typically weekdays during winter (USACE 1998c). The U.S. Coast Guard estimates about 10 percent of the wet-berthed boats departing from the slips stay within the harbor. Other traffic within the harbor are rowing crew practice, scheduled dinghy races, rental boat use, and dinner cruise excursions (USACE 2004).

LA/LB Harbors host a wide variety of vessels. The harbors are predominantly used by container and bulk cargo ships. Additional types of vessels that use the harbors include cruise ships, commercial fishing boats, power and sail boats, and small personal recreational watercrafts. Combined, the two Ports are the third-busiest port complex in the world based on container volume (the largest container port in the U.S.) and handle more than 25 percent of the cargo coming into the U.S. West Coast. Individually, the POLA and POLB were respectively ranked the 8th and 12th busiest ports in the world in 2002.

The POLA houses 29 major cargo terminals, including facilities to handle automobiles, containers, dry and liquid bulk products, and breakbulk products. In 2002, the POLA handled 51.4 million tons of cargo, with 87 percent from foreign trade (of which two-thirds were foreign imports). Top trading partners include Japan, China, Taiwan, South Korea, and Ecuador (USACE 2004). In 2002, the top five containerized imports were furniture, apparel, electronic products, toys, and computer equipment and the top five containerized exports were wastepaper, synthetic resins, fabric (including raw cotton), animal feed, and scrap metal.

POLB facilities include terminals for containerized cargo, dry and liquid bulk cargo, and breakbulk cargo. In 2002, the POLB handled nearly 65 million tons of cargo equivalent to $89 billion. East Asian trade accounts for more than 90 percent of the shipments. The top trading partners in 2002 were China/Hong Kong, Japan, South Korea, and Malaysia. The top imports by tonnage are petroleum, salt, electric machinery, furniture, vehicles, chemicals, steel products, and toys. The top exports by tonnage are machinery, electric machinery, vehicles, toys, clothing, furniture, shoes, plastics, and medical equipment (USACE 2004).

Traffic at the two harbors increased through the 1980s but decreased slightly during the 1990s. Vessel arrivals at the two harbors were approximately 7,033 in 1990 and 5,480 in

1996. Ship movements within the Federal breakwaters are expected to increase in the future, though not significantly, if planned harbor improvements are implemented. Navigation lanes and precaution areas were established by the U.S. Coast Guard to promote safe traffic in and out of LA/LB Harbors in San Pedro Bay. These lanes and areas, together with separation zones that buffer north- and southbound traffic were designated to aid in collision prevention in the heavily trafficked marine waters of Los Angeles and Orange Counties. In addition, there are a number of traffic routes for ferries between the mainland (LA/LB Harbors, Newport Harbor, and Dana Point Harbor) and Santa Catalina Island (Isthmus Cove and Avalon Point) (USACE 2003b).

Primary vessel types using the navigable waters in the LARE include passenger and charter ships, recreational boats, and dinner and harbor cruise ships. The LARE hosts several major charter boat operators (e.g. Catalina Express and Catalina Explorer) that provide passenger and charter service to Santa Catalina Island from bases within the estuary including Queensway Marina and Pacific Terrace Harbor. Marinas in Long Beach Harbor/Queensway Bay contain over 8,000 boat slips. Recreational use is predominant in Outer Long Beach Harbor. Boat traffic peaks on summer weekends and is the least during winter weekdays (USACE 1998c). The Downtown Long Beach/ Shoreline Marina is the dominant location for recreational boating in the area.

The City of Avalon on Catalina Island is dependent on various ports to bring supplies and passengers for tourism. Transportation to Avalon via water accounts for 90 to 85 percent of goods shipped. Goods (e.g., groceries, construction supplies, etc.) are brought to Avalon via barge from Wilmington in the POLA. Passenger services bringing visitors to Avalon are primarily from Catalina Landing in the LARE and San Pedro via Carnival Cruises at the POLB. Airfreight service accounts for the remaining 10 to 15 percent of goods brought to Avalon.

2.8 Circulation and Sediment Transport

Circulation patterns within the study area govern the observed deposition and transport of the contaminated sediments. Understanding of the existing circulation patterns and sediment transport characteristics are important for the evaluation of some of the management options described in Section 6 such as the selection of SWH areas, confined disposal areas, as well as capping sites.

The oceanic circulation system of the Southern California Bight, in which the CSTF Study Area is located, is typically driven by the California Current in the spring and the California Undercurrent in the fall and winter (CLAEMD 1992). Within Santa Monica Bay, water has been found to move both up-coast and down-coast, indicating the presence of a gyre (vortex) in the bay (CLAEMD 1992). Within the northern portion of San Pedro Bay, the effects of the Federal breakwater dominate circulation patterns.

Contaminated sediments in the CSTF Study Area are primarily located in unexposed portions of bays and estuaries. The effects of oceanic currents and waves on exposed beaches are not included in this discussion. This section will focus on areas within the study area likely to be impacted by contaminated sediments and is therefore limited to the vicinity of Marina del Rey/Ballona Creek Mouth and areas inside the Federal breakwater in the northern portion of San Pedro Bay.

2.8.1 Marina del Rey/Ballona Creek Mouth

Marina del Rey Harbor is located in Santa Monica Bay along the Southern California coastline. The harbor entrance and the Ballona Creek outlet are comprised of four major structures. The North and Middle Jetties define the main harbor channel. Ballona Creek discharges into Santa Monica Bay through the channel between the Middle and South Jetties. A detached breakwater just offshore reduces wave exposure of the Marina del Rey Harbor, providing safe navigation conditions within the harbor entrance channels and interior portions of the marina.

Nearshore currents at the Marina del Rey entrance are the combination of tidal and sub-tidal currents, as well as the wind/wave-induced longshore currents. Typical mean monthly sub-tidal currents in Santa Monica Bay are small, in the order of 5 centimeters per second (cm/s) (USACE 1995). Wind effect is appreciable on the short-time circulation fluctuations of water velocity in the bay, producing a mean five-to-ten day sub-tidal current of about 20 cm/s (USACE 1995).

During flood tide, the flood current enters Marina del Rey Harbor through the north and south harbor entrances, as well as into Ballona Creek. The flood flow is slightly stronger on the north side and relatively weaker on the south side. During ebb tide, the flow from Ballona Creek hits the breakwater and splits into two parts. The main part flows into the ocean through the south entrance, while the other part flows along the detached breakwater to the northwest and leaves the north harbor entrance. In general, tidal currents at the Marina del Rey Harbor entrance are small. Field data collected by U.S. Army Corps of Engineers, Los Angeles District (USACE) during their dredging operation in 1994 indicated that nearshore currents near the south harbor entrance and the Ballona Creek mouth were in the range of 2 to 16 cm/s. A recent numerical model study conducted by USACE (2003b) also indicated that tidal currents in the vicinity of the south harbor entrance and the Ballona Creek mouth are in general less than 5 cm/s.

Tidal and sub-tidal currents near the south entrance and Ballona Creek mouth are generally too small to re-suspend the sediments being discharged from Ballona Creek and deposited behind the breakwater. Sediments near the Ballona Creek mouth will be resuspended and transported only during wave and rainstorm events. A recent study by USACE (2003b) indicated that sediments deposited near the mouth of Ballona Creek will start to migrate southward under a five-year storm wave event, or northward under an eight-year storm wave event. In addition, the study also concluded that the sediments will be resuspended and transported southward into the bay under a one-year or larger flood event.

2.8.2 Ports of Los Angeles and Long Beach, and the Los Angeles River

The POLA and POLB occupy the entire western half of San Pedro Bay and form the nation's largest harbor complex. The Ports are protected from incoming waves by the Federal breakwater, which consists of three individual rock jetty structures. In addition to protecting the ports from waves, the Federal breakwater reduces the exchange of the water between the harbor and the rest of San Pedro Bay, hence creating unique tidal circulation patterns.

In the last three decades, the Ports have undertaken a long-range effort, known as the 2020 Plan, to increase the capacity of the ports. For the POLA, the 2020 Plan included the construction of the Pier 400 and related channel deepening projects. The Pier 400 causeway essentially divided the outer harbors into two halves, with the POLB to the east and the POLA to the west. Water exchange between the east and west sides of the causeway is maintained through a 90-meter (300-foot) opening adjacent to the Navy Mole. The opening is known as the Transportation Corridor Gap or the "causeway gap" in the literature.

Maximum flood and ebb current patterns in the POLA and POLB under typical tidal conditions are shown in Figures 2-2 and 2-3, respectively. The tidal currents shown in the figures were predicted by a depth-averaged two-dimensional hydrodynamic model RMA2 developed by the U.S. Army Corps of Engineers (USACE). The model has been calibrated against field data collected by NOAA at the POLB, as well as against more sophisticated three-dimensional model. Details about the model capability, setup and calibration can be found in Everest (2001).

As shown in Figure 2-2, flood currents entering the Los Angeles Harbor through Angel's Gate are blocked by Pier 400 and forced to go around the structure and conform to the shape of the Pier 400 Landfill. On the Long Beach side, flood currents enter the harbor through the Queen's Gate as well as the opening near the eastern tip of the Federal breakwater. Flood currents passing through Queen's Gate flow to either side of Pier J.

During the ebb tide, as shown in Figure 2-3, the flow in the harbor is drawn from all directions as a potential flow toward the exits. Ebb currents leaving the Los Angeles Harbor flow mainly through the Angles Gate. On the Long Beach side, ebb currents exit either through the Queen's Gate or the eastern opening passing the tip of the Federal breakwater. An important observation about the tidal flow patterns is that ebb flows from the LARE will exit the breakwater either through the eastern opening or the Queen's Gate without entering the LA/LB Harbor, indicating that contaminants discharging from the LARE during dry weather flow are unlikely to be transported into the LA/LB Harbor.

Tidal currents within the POLA and POLB are generally very small. As shown in Figures 2-2 and 2-3, typical maximum tidal currents within the harbor are in general less than 0.5 feet per second (ft/s).

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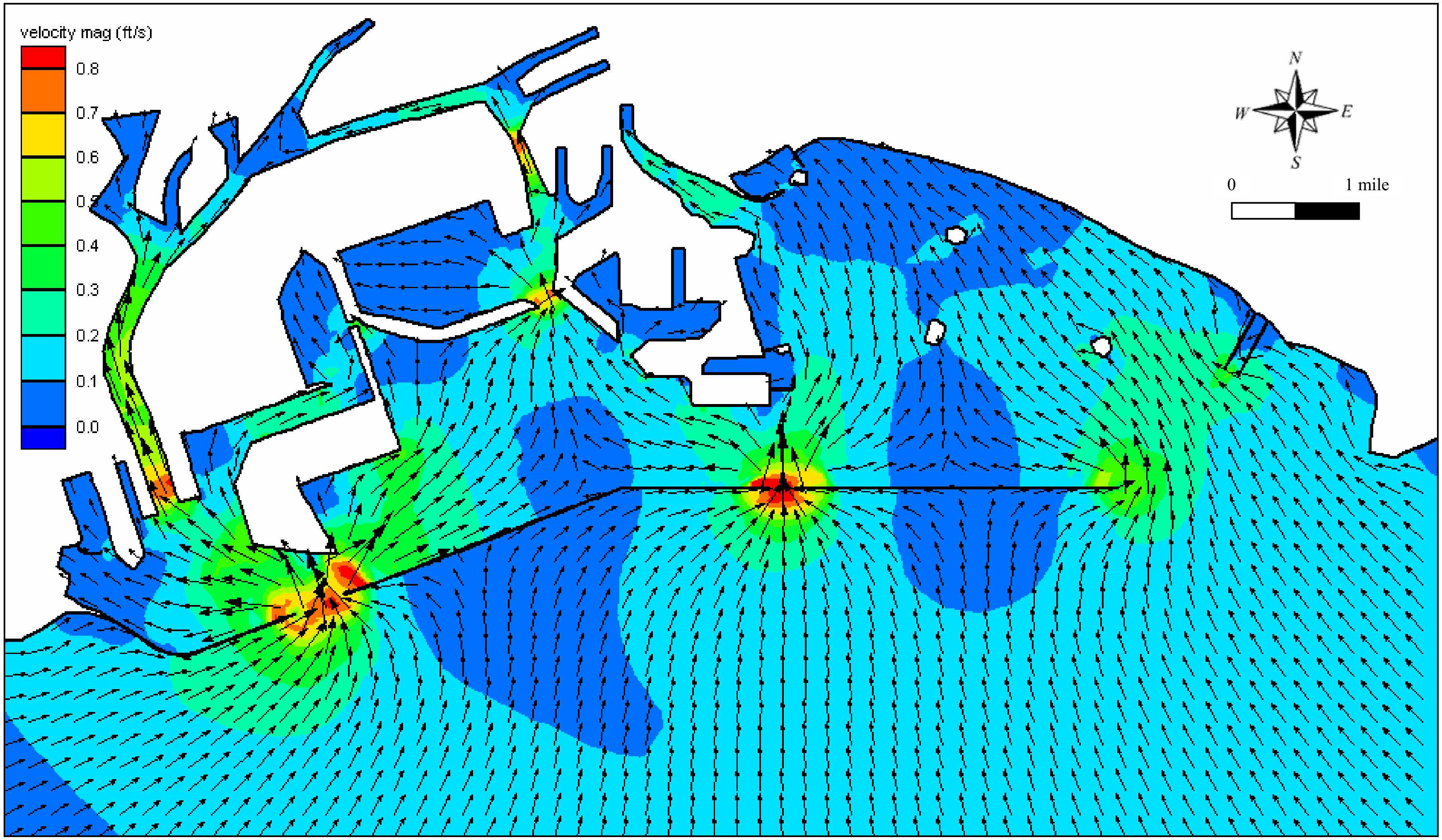

Figure 2-2

Maximum Flood Current during Typical Tide Condition

Source: Model Output based on work of Everest 2001

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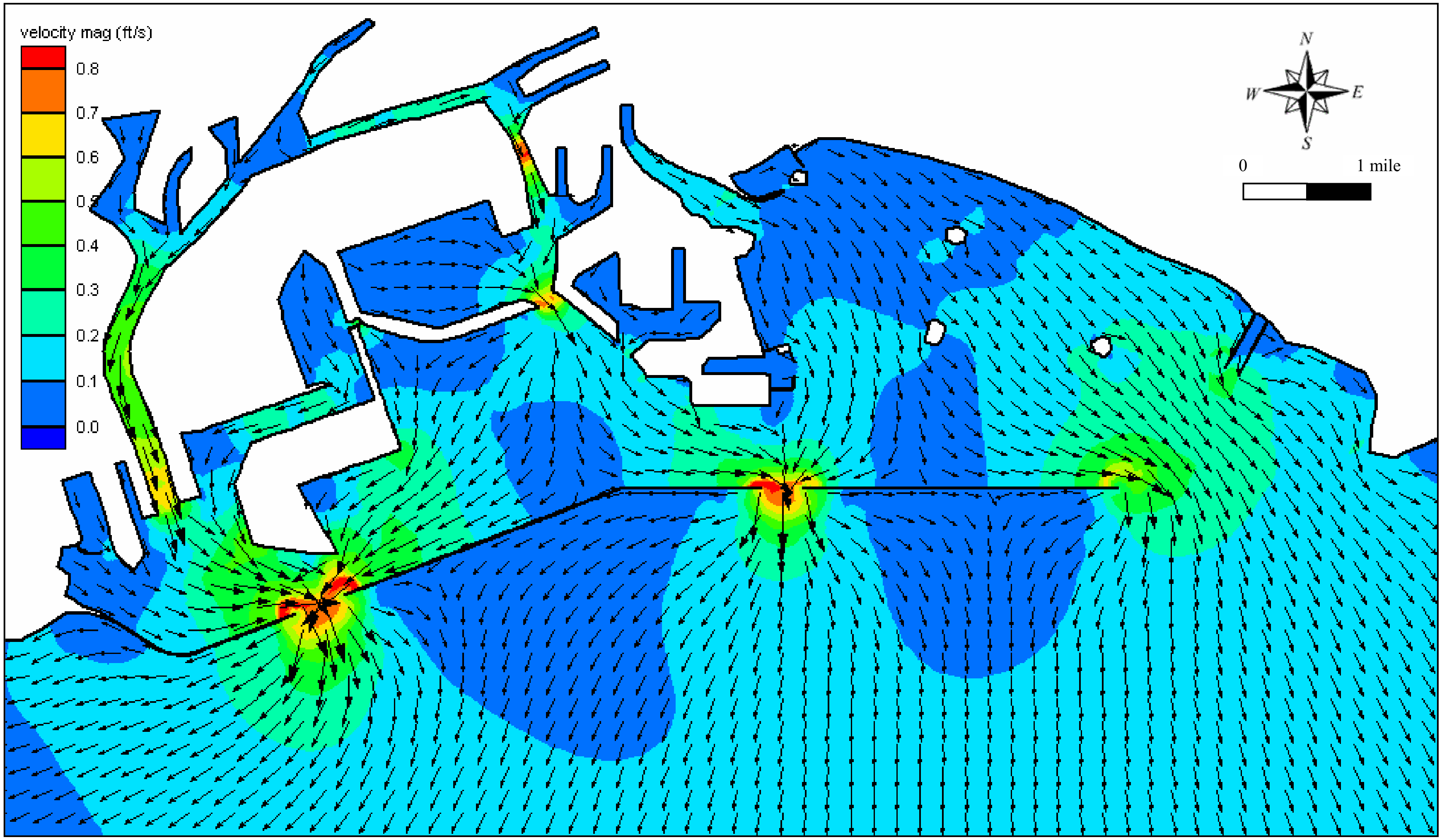

Figure 2-3

Maximum Ebb Current during Typical Tide Condition

Source: Model Output based on work of Everest 2001

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Tidal currents entering and exiting Angel's Gate and Queen's Gate are higher, but are still in general less than 0.8 ft/s. These small tidal currents generally will not cause sediment resuspension and sediment transport within the harbor. Resuspension and transport of sediments will occur during major rain or wave storm events. As an example, Figure 2-4 shows the flow patterns in the POLA and POLB with a 133-year flood discharging from the LARE into the harbor. Under such a flood event, currents near the LARE can be as high as 15 to 20 ft/s, causing resuspension and transport of deposited sediments near the river entrance into the POLA and POLB.

Field measurement or model predicted storm discharge from Dominguez Channel is unavailable; though the POLA is currently funding a hydrodynamic model. Nevertheless, it is expected that storm discharge from Dominguez Channel will produce currents high enough that can cause resuspension and transport of deposited sediments in the POLA and POLB.

2.9 Upland Infrastructure and Natural Resources

2.9.1 Transportation

The project areas are served by a network of ground transportation facilities, including highways and local roads, providing connections to all parts of the County, as well as the neighboring Counties of Orange, Ventura, Riverside, and San Bernardino. These facilities also provide access to other inland regions in California and regions out-of-state.

The highway system in the County consists of 37 major freeways and highways. The interstate highways include I-5, I-10, I-110, I-210, I-405, I-605, and I-710. With the exception of I-10 and I-210, the interstate freeways are mostly run in the north-south direction. These interstate freeways, together with the state highways, such as SR 91, SR 103, SR 42 and SR 1, form a transportation network serving the Los Angeles metropolitan area. Truck routes are available on all major freeways. The busiest highways are Routes 5, 10, 60, 101, 110, and 405, with peak hour traffic of about 20,000 vehicles and annual average daily traffic of about 300,000 vehicles (Caltrans 2002).

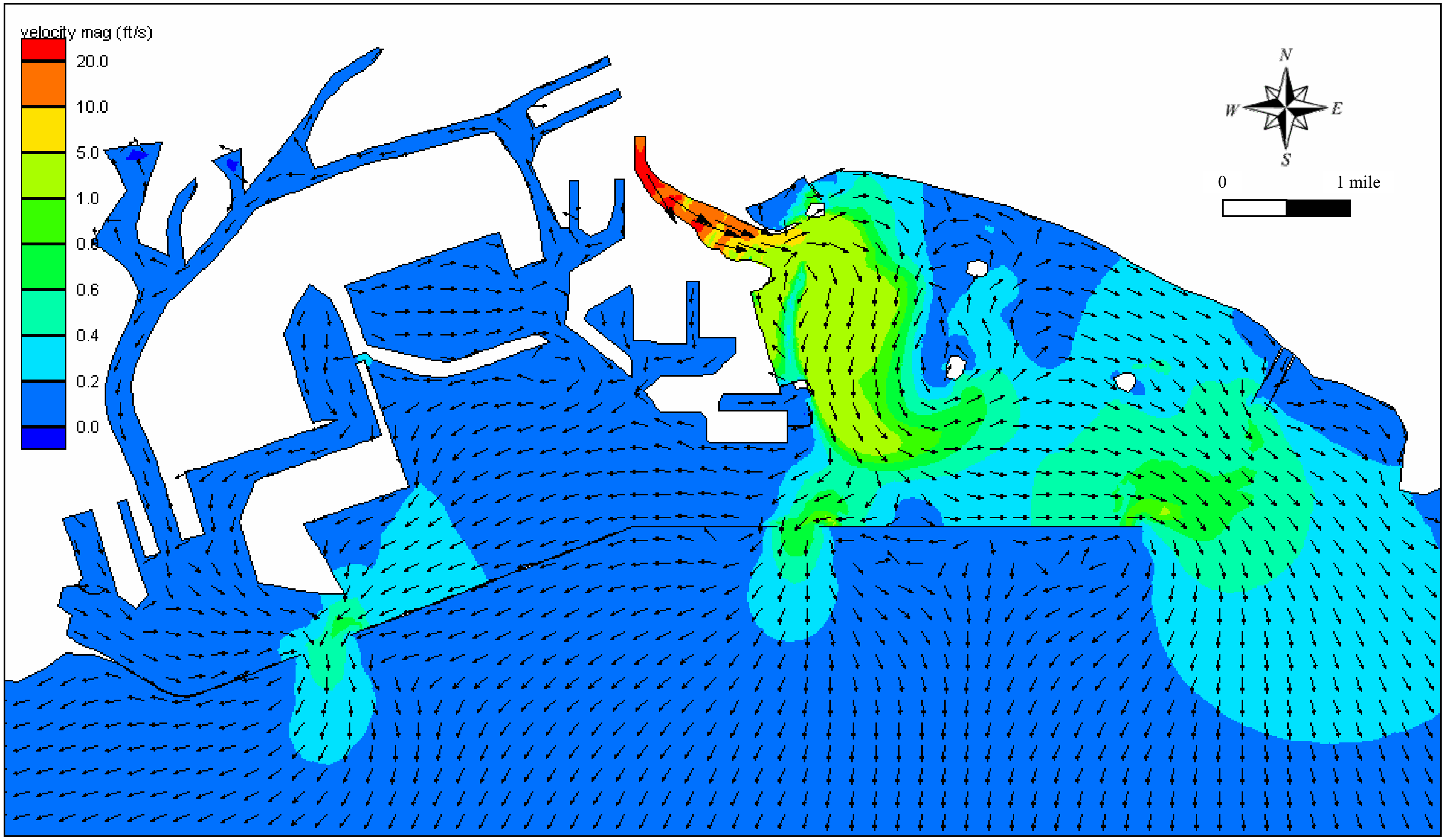

Figure 2-4

Maximum Current during a 133-year Storm Discharge from Los Angeles River

Source: Model Output based on work of Everest 2001

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The two interstate freeways that provide immediate access to the LA/LB harbor areas are I-710 and I-110, which connect to I-405 and other roads. Other state highways serving the port area are SR 103 and SR 213. The major highways serving the Marina Del Rey area are SR1, SR90, I-405 and I-10.

There are several major bridges that link the LA/LB Harbors to the rest of the County. The Vincent Thomas Bridge, together with Gerald Desmond Bridge and Commodore Schuyler F. Heim Bridge, provide the linkage among freeways in the vicinity of LA/LB Harbors. Daily truck movements to and from LA/LB Harbors totaled 25,000 in 2000 (Thornton 2003).

Train is another mode of transportation in the County. The LA/LB Harbors are equipped with train facilities and railroad tracks to transport goods effectively from the ports to other areas in the country. Currently, the Marina del Rey area is not directly served by rail.

Daily freight train movements to and from LA/LB Harbors totaled 50 in 2000 (Thornton 2003). Railroad tracks connect many of the container terminals in the Ports to other parts of the country. The railroad operations in the County include Burlington Northern and the Santa Fe Railway (freight), Los Angeles Junction Railway (freight), Union Pacific Railroad Company (freight), Amtrak (passenger) and Metrolink (passenger).

Faced with increased freight traffic volumes in and out of LA/LB Harbors, design and construction of the Alameda Corridor was initiated in 1997 with the aim of diverting surface freight traffic loads from local freeways and railroads. The 20-mile railroad express line runs approximately parallel to Alameda Street and connects LA/LB Harbors with the transcontinental rail network east of downtown Los Angeles.

2.9.2 Land Use

Land use in the County is in general substantially urbanized as a result of population growth through recent history. Table 2-2 shows the distributions of land use in the four primary watersheds upstream of tidal influence within the County (LACDPW 2000). As shown in the table, urban development has been especially significant in the Ballona

Creek watershed where vacant/open lands constitute only 11 percent of the watershed area. The Los Angeles River Watershed is the largest watershed in the County covering an area of approximately 2,135 square kilometers (824 square miles). The watershed is comprised of a diverse mixture of land uses. The vacant land use (40 percent of the watershed) is almost entirely located in the headwaters in Angeles National Forest that covers approximately 840 square kilometers (324 square miles). The remaining watershed is highly urbanized with residential, commercial, and industrial land uses. The Dominguez Channel Watershed with an area approximately 110 square miles is also highly urbanized with about 94 percent of the area developed. The San Gabriel River Watershed has a large portion of vacant land (54 percent) primarily located at the headwaters in the San Gabriel Mountains and includes undisturbed riparian and woodland habitats and wilderness areas. The lower portion of the watershed is more heavily developed.

Table 2-2
Land Use by Watershed

Land Use	Ballona Creek[1]	Los Angeles River[2]	Dominguez Channel[3]	San Gabriel River[4]
	Land Use Percent (%)			
High Density Single Family Residential	40	28.8	34.2	21.0
Multi-Family Residential	12.3	3.5	5.8	2.6
Mixed Residential	6.7	1.8	4.3	0.1
Commercial	9.9	3.6	6.2	2.5
Light Industrial	3.5	5.1	13.2	3.8
Transportation	1.5	2.4	4.7	1.2
Education	2.7	1.9	3.7	2.3
Vacant	11.1	40.4	2.5	53.6
Other	12.3	12.5	25.4	12.9

1. Above Sawtelle Boulevard.
2. Above Willow Street.
3. Dominguez Channel and Inner LA/LB Harbor Watershed.
4. Watershed areas includes San Gabriel River above San Gabriel Parkway in Pico Rivera and Coyote Creek above Spring Street.

2.9.3 Air Quality

Air quality within the County is strongly affected by winds, temperature patterns, and topography surrounding the Los Angeles Basin. The climate conditions in conjunction with the topographic characteristics of the Los Angeles Basin severely restrict the ability of the local airshed to disperse air pollutants generated within the Basin. While onshore sea breeze brings in clean air that dilutes and disperses the polluted air during the night, recirculation of polluted air and incomplete ventilation of the Basin can cause significant air quality problems even in coastal areas. In addition, temperature inversions created in response to wind circulation and heating patterns tend to trap emissions within shallow layers above ground and limit vertical dilution. Trapping inversion, which frequently occurs during summer afternoons, tends to trap emissions within the shallow marine layer and limit vertical mixing. Reactive organic gases and nitrogen oxides combine under abundant sunlight to form photochemical smog, which increases in level from coastal areas inland until being broken down near the mountains surrounding the basin. Radiation inversion, which occurs most frequently during cloudless nights in winter, tends to trap emissions within localized air pockets and limit their dispersion (USACE 1998c and Chambers 2003).

Existing conditions of air quality and historical trends have been measured and documented by the South Coast Air Quality Management District (SCAQMD). Long-term monitoring data in the 1990s showed recurring violations of hourly ozone and particulate matter standards. However, no first stage alerts (0.20 mg/L ozone for an hourly exposure) occurred. Levels of primary automobile pollutants including CO did not exceed their standards. The air quality conditions in general have shown improvement throughout the 1990s (USACE 1998c and Chambers 2003).

2.9.4 Groundwater Resources

Groundwater basins in the County underlie five major geographic areas. These include San Gabriel Valley, Coastal Plain, San Fernando Valley, and Antelope Valley. With each geographic area, the groundwater basin is composed of a number of sub-basins. The basins are separated by geologic features that confine or impede groundwater movement or by political boundaries. Basins underlying the Coastal Plain include the Central, West Coast, Santa Monica, and Hollywood Basins. Among these, the West Coast and Santa Monica Basins are situated along the coast. The West Coast Basin underlies Long Beach, San Pedro, Redondo Beach, Hermosa Beach, Manhattan Beach, and El Segundo as well as Torrance, Gardena and Inglewood, and is separated by the

Newport-Inglewood Fault. The groundwater elevations in the West Coast Basin are typically below sea level except in the area of recharge injection. The Santa Monica Basin underlies Marina del Rey and Santa Monica.

Groundwater within the County is extensively recharged through natural and constructed means. Stretches of streams with soft-bottom channels promote groundwater recharge year-round. In addition, the Los Angeles County Department of Public Works (LACDPW) maintains 2,436 acres of spreading grounds and soft-bottom channel spreading areas which are used to collect storm runoff, imported water, and recycled water as a means of replenishing local groundwater aquifers. Together with similar facilities operated by other agencies, the gross acreage of spreading grounds totals 3,361 acres in the County (LACDPW 2002).

3 CONTAMINATED SEDIMENTS IN THE LOS ANGELES REGION

This section discusses the nature and extent of the contaminated sediment problem within the Contaminated Sediments Task Force (CSTF) Study Area, focusing on the characteristics, locations, quantities, and sources of contaminated sediments within the Los Angeles Region (Region). Specific areas of concern are identified and estimated quantities of contaminated sediment that may need treatment and/or removal are provided. In addition, watershed management plans in the Los Angeles County (County) that may have an impact to contaminant and sediment sources to the Study Area are also discussed.

3.1 Characteristics of Contaminated Sediments

Specific criteria used to characterize contaminated sediments in the Region does not exist. While agreement generally exists that severely contaminated sediments are not suitable for unconfined aquatic disposal, consensus is not always available for more moderately contaminated sediments. Multiple national and regional sediment guidelines currently exist with respect to defining sediments as contaminated, and these guidelines in turn are mostly defined by concentrations of specific chemical contaminants.

Within the CSTF Study Area, contaminated sediments have generally been defined as those sediments which do not meet criteria for ocean or unconfined aquatic disposal and therefore are defined by multiple characteristics including sediment chemistry, toxicity, and bioaccumulative potential as outlined in regulatory guidance documents (The Green Book [EPA and USACE 1991] and the Inland Testing Manual [ITM] [EPA and USACE 1998]). Ecological and/or human health risk assessment and other assessment tools (e.g., equilibrium partitioning, sediment guideline quotient methodologies, apparent effects threshold); have been applied to specific sites in the Region. Generally they have not been used to determine whether sediments are considered "contaminated", but instead have been used to address more specific questions regarding sediment characteristics.

Sediments with elevated levels of contaminants are often found near sources of anthropogenic inputs, which can generally be categorized as either point or non-point sources. Point sources include discharges generated by a single process (e.g., manufacturing facility) and may be limited to a relatively small number of contaminants or a broad spectrum of contaminants (e.g., publicly owned treatment works [POTW]). Non-point sources (NPS) commonly integrate a variety of sources through a single pathway such as via flood control systems (e.g., the mouth of the Los Angeles River). Regardless of the source, contaminated sediments share some general characteristics due mostly to the physiochemical reactions that occur once contaminants enter an aqueous environment. This section describes contaminated sediments in the study area and summarizes the main environmental properties that impact the behavior of contaminants and/or contaminated sediments in the region.

3.1.1 Physical Characteristics

Contaminants are often associated with areas of low water circulation, high sedimentation rates, and silt- and clay-dominated sediments. Two reversible processes dominate the behavior of contaminants in marine and estuarine systems: formation of metal colloids, and binding of hydrophobic organic compounds onto fine sediment particles suspended in the water column. Due to the relatively large surface areas of fine-grained particles and environmental characteristics of areas where fine-grained particles settle out of the water column, contaminants are generally associated with silts and clays. A number of other factors impact the rate and direction of these physiochemical reactions, including redox potential and interaction with sulfides, pH and formation of metal hydroxides, amount and type of organic carbon, concentrations of iron (in the case of other metals), and the presence/activity of microbial organisms.

3.1.1.1 Grain Size

Due to the physiochemical processes described above, contaminants in sediments are usually associated with the fine-grained fraction and/or the interstitial pore water. While sequestration of contaminants can occur in high-clay sediments due to the lattice structure formed during clay mineralization, contaminants associated with silts are generally more susceptible to mobilization. Despite the affinity of contaminant binding to fine-grained sediments, grain size cannot always be used as an indication of contamination. For example, elevated metal concentrations due to boatyard sandblasting operations may be associated with relatively large paint chips. Locally, there are sites that are predominantly sand that frequently exhibit contamination (e.g. the Los Angeles River Estuary [LARE] which typically has more than 75 percent sand [USACE 2002a] and Ballona Creek Estuary which also typically has more than 75 percent sand [USACE 2003b]). In both instances, contamination is most likely associated with the finer sediment fraction even though it represents only a small portion of the total volume.

3.1.1.2 Water Content

The water content of contaminated sediments varies considerably depending on the grain size and compaction of the material. Recently settled surficial fines may be up to 70 percent water (as a percentage of the total mass). While, 'native' consolidated sediments may be as little as 20 percent water. In its review of available sediment data, the U.S. Army Corps of Engineers, Los Angeles District (USACE) found that percent water (moisture) of Los Angeles Basin sediments found unsuitable for open water disposal ranged from 21 to 41 percent and averaged 30 percent (USACE 2002a).

3.1.1.3 Geotechnical Properties

Geotechnical characteristics of sediments are critical in the determination of whether they are suitable for reuse at construction and/or fill sites. Final site design and land use typically defines the minimum geotechnical qualities of the fill material. Within the study area, fine-grained sediments have been used as construction fill by either placing it selectively within a fill area (e.g., Pier T fill at the Port of Long Beach), diverting it to an alternative project component with less stringent design criteria (e.g., creation of Port of Los Angeles' [POLA's] Shallow Water Habitat (SWH) with fine-grained sediments dredged for the Pier 400 project), or by placing it in alternating lifts between layers of coarser-grained material to meet project specifications (USACE 2002a).

3.1.1.4 Variability by Location

Within the CSTF Study Area, the variety of (environmental) contaminants and physical characteristics are the result of a variety of input parameters. Physical characteristics in the context of regional sediment contamination issues are a reflection of current, recent, and historical discharges. The degree of sediment contamination is often highly correlated with proximity to anthropogenic sources at various spatial scales, as are the physiochemical characteristics of sediments such as grain size distribution, organic carbon content, and iron content. A limited amount of data has been compiled for the study area and is presented in Table 3-1 to illustrate the variability in some commonly measured physical characteristics.

Physical characteristics interact with chemical constituents to produce highly variable systems in terms of the degree of contaminant sequestration, availability of contaminants to biological systems, and mobility of contaminants between bound and aqueous forms.

3.1.2 Chemical Characteristics

As stated above, the varied land use history of the Los Angeles Basin has resulted in sediments within the CSTF Study Area exhibiting a variety of contamination types. Generalizations within the study area are twofold and include: (1) the propensity of sediments at the mouths of flood control structures to contain elevated levels of metals (especially lead and zinc), pesticides (e.g., dichlorodiphenyltrichloroethane [DDT]), polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and total recoverable petroleum hydrocarbons (TRPHs) and (2) for sediments in the northern portion of San Pedro Bay to exhibit elevated levels of the pesticide DDT due to releases into the sanitary sewer system (and subsequently the Palos Verdes Shelf) and into the Dominguez Watershed (and subsequently the POLA and Port of Long Beach[POLB]) from the Montrose Chemical Corporation facility in Torrance.

3.2 Locations of Contaminated Sediments

As part of the Bay Protection Toxic Cleanup Program (BPTCP), the Los Angeles Regional Water Quality Control Board (LARWQCB) prioritized contaminated sites to protect water and sediments from discharges of waste, in-place sediment pollution and contamination, and any other factors that impacted beneficial uses of water resources. After considering available data, sites that demonstrated considerable impairment were designated as either high priority hot spots or sites of concern if they met specified criteria (LARWQCB 1997). State Water Resources Control Board (SWRCB) designated toxic hot spots and the sites of concern are presented in Figure 2-1.

Table 3-1
Comparison of Total Organic Carbon, Percent Solids, and Percent Sand in Various Locations within the Study Area

Location	Study/Data Source/Sampling Methodology	Percent TOC	Percent Solids	Percent Sand and Gravel
Marina del Rey	Marina Del Rey (BPTCP, surface grab)	1.1	31.4	7
Marina del Rey	Marina Del Rey (CSTF Cement Stabilization Pilot Study)	NA	NA	93
Ballona Creek	Ballona Creek (USACE Feasibility Study, composite)	NA	NA	77
Ballona Creek	Ballona Creek (BPTCP, surface grab)	3	51.5	35
Coastal Shelf	Palos Verdes Shelf (BPTCP, surface grab)	1.5	56.3	41
Port of Long Beach Inner Harbor	Pier S Realignment (average of top composites, N=2)	0.2	68.7	52
Port of Long Beach Inner Harbor	Pier S Realignment (average of bottom composites, N=2)	0.1	73.7	48
Port of Long Beach Inner Harbor	Channel Two (average of Area F top composites, N=8)	1.4	62.7	29
Port of Long Beach Inner Harbor	Channel Two (average of Area F bottom composites, N=8)	0.5	74	46
Port of Long Beach Middle Harbor	Main Channel (average of top composites, N=3)	0.2	71.2	55
Port of Long Beach Middle Harbor	Main Channel (average of bottom composites, N=3)	0.1	78.6	54
Port of Long Beach Outer Harbor	Long Beach Outer Harbor (BPTCP, surface grab)	0.9	52.1	30
Port of Long Beach Outer Harbor	Long Beach Channel (BPTCP, surface grab)	1.2	52	19
Port of Los Angeles Inner Harbor	Berths 121-124 (average of top composites, N=2)	0.1	76.9	63
Port of Los Angeles Inner Harbor	Berths 121-124 (average of bottom composites, N=2)	0	80.6	73
Port of Los Angeles Inner Harbor	Consolidated Slip (range, multiple sampling techniques)	0.1 - 10.4	33 - 81	5 - 98
Port of Los Angeles Inner Harbor	Southeast Basin (BPTCP, surface grab)	2.2	52.8	17
Port of Los Angeles Inner Harbor	Consolidated Slip (BPTCP, surface grab)	4.4	36.5	13
Port of Los Angeles Inner Harbor	Southwest Slip (BPTCP, surface grab)	1.7	53.3	26
Port of Los Angeles Outer Harbor	Off Cabrillo Beach (BPTCP, surface grab)	2.2	50.2	14
Los Angeles River Estuary	CSTF Pilot Studies	0.4	56.4	78

NA – data not available.
Sources: AMEC 2001a, AMEC 2001b, AMEC 2002, Anderson et al. 1998, MEC Analytical Systems 1999, Ogden 2000, USACE/County of Los Angeles 1998, and USACE 2002a.

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3.2.1 Hot Spots

The LARWQCB prioritized a number of sites within their jurisdiction for remediation or prevention of toxic hot spots. Within the CSTF Study Area, three sites were designated high priority toxic hot spots: Santa Monica Bay/Palos Verdes Shelf, Los Angeles Outer Harbor/Cabrillo Pier, and Los Angeles Inner Harbor/Dominguez Channel/Consolidated Slip.

The Palos Verdes Shelf has been identified as an impaired water body due to sediment contamination (DDT, PCBs, cadmium, copper, lead, mercury, nickel, zinc, PAHs, and chlordane), sediment toxicity, tissue bioaccumulation of pollutants (DDT, PCBs, silver, chromium, and lead), and the issuance by the California Office of Environmental Health Hazard Assessment (OEHHA) of a health advisory warning against consumption of white croaker (*Genyonemus lineatus*). Elevated DDT and PCB levels have been the focus of much attention by a variety of regulatory authorities, among them the U.S. Environmental Protection Agency (EPA), which is developing a plan for remediation of the area. Although heavy metals contamination is recognized as an additional source of impairment, remediation of the DDT impairment may fully or partially address the issue.

The area in the vicinity of the Cabrillo Pier in the Outer Los Angles Harbor is considered impaired due to sediment contamination (PAHs, DDT, zinc, copper, and chromium), sediment toxicity, and tissue bioaccumulation of DDT. High bacteria levels are also a concern. As part of the Main Channel Deepening Project, the USACE and POLA are currently in the process of expanding the Cabrillo Shallow Water Habitat (CSWH) area to cover much of the area with available uncontaminated sediments, effectively capping a portion of the area. Additional efforts are being undertaken by the POLA to address sources of impairment other than the existing sediments.

In the Inner Los Angeles Harbor, Consolidated Slip and the Dominguez Channel Watershed are recognized to be impaired: sediment contamination (PAHs, zinc, chromium, lead, DDT, chlordane, and PCBs), sediment toxicity, benthic community effects, and tissue bioaccumulation (DDT, chlordane, PCBs, organotins, and zinc) have been documented. Fish consumption advisories have also been posted for these areas.

The Consolidated Slip Restoration Program Working Group is currently considering remediation alternatives under the leadership of the LARWQCB. The group has recently compiled data showing the extent of contamination to be at least 6 meters (20 feet) below the harbor bottom in some areas. Restoration alternatives for sediments in the consolidated slip as well as the Dominguez Channel Watershed are in development, which is recognized to be a potential source of recontamination.

3.2.2 Areas of Concern

The BPTCP process also included listing a number of sites as areas of concern. These sites were candidates for listing as toxic hot spots due to substantial impairments, but ultimately were not among those sites prioritized for more immediate attention. Sites listed within the CSTF Study Area and the respective reasons for listing include Marina del Rey (sediment chemistry, mussel bioaccumulation), Cerritos Channel in the POLB (mussel bioaccumulation), LARE (sediment chemistry, mussel and fish bioaccumulation), Ballona Creek Tidal Prism (sediment chemistry and storm water impacts), Offshore Santa Monica Bay (sediment chemistry and fish bioaccumulation), Venice Canals in the City of Los Angeles (mussel bioaccumulation), Colorado Lagoon in the City of Long Beach (sediment chemistry, mussel and fish bioaccumulation), Long Beach Marina (sediment chemistry), and Shoreline Marina in the City of Long Beach (sediment chemistry).

3.3 Contaminated Sediments from Dredging Operations

3.3.1 Historical Dredging and Disposal Operations

Historical dredging operations of the major sediment generating locations in the County were compiled from various databases, permit archives, and prior studies. The major sediment generating locations in Los Angeles County discussed in this section are Marina del Rey, POLA, POLB, LARE, and Alamitos Bay. Dredging and disposal events were identified from original data sources, reconciled among multiple references, and tabulated chronologically by dredging sites in the following sections. In the tables below that summarize dredging and disposal events for each site, dredging events are listed by the year (or the starting year for dredging events lasting for more than a year). The tables also include information on the project proponent, the dredge and disposal quantities location and dredge method, as well as the source of data. For dredging quantities obtained from permit archives, it was assumed that the figures provided a good estimate of the quantities actually dredged, although discrepancies generally exist between the permitted and pay volumes. In cases where only disposal records exist, it was assumed that the corresponding dredging volumes are identical. For entries where descriptions in the records are incomplete or limited, best knowledge based on professional experience in the region was used to complete the information. In cases where significant differences in dredging quantities occur among records, selection was weighted toward records with relatively complete documentation. In such a case, if the adopted quantity is not the greatest among the records, the difference is also listed as a separate entry to account for potentially unidentified events. The total maintenance, capital improvement dredge volumes and corresponding average annual rate for completed projects in the study area are also shown.

3.3.1.1 Marina del Rey

Marina del Rey Harbor, the largest man-made small craft harbor in the world, was created from the original Ballona wetlands area in the early 1960s (1960 to 1963). The capital project excavated approximately 9.2 million cubic meters (m^3) of material out of the site, and placed approximately 2.3 million m^3 of the dredged sediment on Dockweiler Beach downcoast to prevent the anticipated erosion after the creation of the harbor (USACE 1986). Since then, the harbor entrance channels have been periodically dredged by the USACE to maintain the designated safe navigation channel dimensions.

The primary source of shoaling in the southern portion of the entrance channel is sediment discharge from the neighboring Ballona Creek during storm runoff events. Littoral drift of sediment from up- and downcoast beaches also contributes to the shoaling of the entrance channels. The sediment in the entrance channel shoals is, in general, relatively sandy but typically contains an appreciable portion of contaminated material unacceptable for unrestricted ocean disposal. Specifically, sediment in the north entrance channel, which is largely derived from littoral transport, is typically uncontaminated and suitable for beach replenishment or open water disposal at offshore disposal sites such as LA-2. Sediment from the south entrance channel, which primarily originates from Ballona Creek discharges tends to be contaminated and requires special handling and disposal.

Based on a sediment budget analyses conducted for Marina del Rey harbor entrance (USACE 2003b), littoral transport contributes about 65 percent of the shoaled sediments in the harbor entrance, while watershed discharge from Ballona Creek contributes about 35 percent.

The USACE conducts maintenance dredging of the federally designated navigation channels in the harbor. Table 3-2 presents a chronology of historical dredging and disposal events in Marina del Rey Harbor since the completion of the offshore breakwater in 1965. A total of approximately 1.5 million m^3 (1.92 million cubic yards [cy]) has been dredged from the Marina del Rey Harbor entrance channel and vicinity between 1969 and 1999. The average annual maintenance dredging rate has been approximately 49,000 m^3 (64,000 cy) per year over that period, with a frequency of once every two to five years.

3.3.1.2 Port of Los Angeles

The POLA, founded in 1907, underwent major development during the period of 1910 through 1930s that culminated in the completion of the federal San Pedro breakwater in 1937. Since then, the ever increasing demand of shipping needs, especially with the advent of containerized shipping and growing vessel sizes, has necessitated continued capital improvements of the harbor including channel deepening, terminal expansion, and wharf replacement. The current channel deepening project for the Main Channel, East Basin and West Basin will increase the channel depth to -16.1 meters (-53 feet), mean lower low water (MLLW) to accommodate larger, deeper-draft vessels, which is expected to generate a total of 6.1 million m^3 (8 million cy) of dredged sediment. Dredging for this project began in September 2002 and is schedule for completion in 2005.

Table 3-2
Dredging and Disposal History for Marina del Rey

Year [a]	Project Proponent	Project	Dredging: Location	Dredging: Quantity (m^3)	Dredging: Method	Disposal: Site	Disposal: Quantity (m^3)	Source [c]
1969	USACE	Channel Maintenance	Ballona Creek mouth	298,024	-- [d]	Del Rey Beach	298,024	5
1973	USACE	Channel Maintenance	South side of north jetty	12,308	-- [d]	Upcoast of north jetty	12,308	5
1981	USACE	Channel Maintenance	Entrance channel; Ballona Creek mouth	166,241	-- [d]	South of Dockweiler Beach	166,241	1, 5
1987	USACE	Channel Maintenance	Jetty tips; Ballona Creek mouth	27,000	-- [d]	Dockweiler Beach	27,000	1, 5
1992	USACE	Channel Maintenance	Ballona Creek mouth	16,438	-- [d]	Local Knockdown	16,438	3, 5
1994	USACE	Channel Maintenance	Entrance channel	43,580	Clamshell	Port of Los Angeles shallow water habitat	43,580	2, 3, 5
1996	USACE	Emergency Maintenance	Entrance channel	181,964	Clamshell/hydraulic	Beach	181,964	1, 2, 3
1998	USACE	Emergency Maintenance	Entrance channel	96,200	Hydraulic	LA-2	39,759	1, 2, 3, 4
						Harbor Infill	56,441	
1999	USACE	Channel Maintenance	Entrance channel	627,003 [b]	Clamshell	Beach	245,422	1
						Harbor Infill	381,581	

Total Maintenance Dredging Volume = 1,468,758 m^3 (1,921,063 cy).
Overall Maintenance Dredging Rate = 48,959 m^3/yr (64,036 cy/yr).
(a) Year indicates start of project.
(b) Volume difference exists with data from other Sources 2 and 3.
(c) Source:

1. USACE 2003c. Zone of Siting Feasibility Study Draft Report.
2. Navigation Data Center. USACE record. http://www.iwr.usace.army.mil/ndc.
3. USACE 2003a. Dredging Analysis Appendix Marina del Rey and Ballona Creek Feasibility Study.
4. Ocean Disposal Database. U.S. Army Corps of Engineers (Corps), Research and Development Center, Waterways Experiment Station, Environmental Laboratory. http://www.wes.army.mil/el/odd/odd.html.
5. USACE 1995. Marina del Rey and Ballona Creek, CA, Final Reconnaissance Report.

(d) No record

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The sediment accumulated in the harbor is typically silty with varying quality levels ranging from being highly contaminated at certain inner harbor locations such as the Consolidated Slip, to being relatively clean in the approach channel. USACE conducts maintenance and capital improvement dredging of the federally designated navigation channels in the harbor. Maintenance dredging of berthing locations, on the other hand, generally comes under the POLA. Table 3-3 presents a chronology of historical maintenance and capital improvement dredging and disposal events in the POLA since 1978.

The data indicate that a total of approximately 2 million m^3 (2.65 million cy) has been dredged from POLA for harbor maintenance between 1978 and 2002 at an average annual rate of approximately 85,000 m^3 (111,000 cy) per year. In addition, a total of approximately 57.6 million m^3 (75.3 million cy) of material has been generated from POLA capital improvement projects between 1980 and 1997 at an average annual rate of approximately 3.4 million m^3 (4.4 million cy) per year. This total accounts for the completed capital improvement projects and does not include the volume of the current POLA Channel Deepening Project.

3.3.1.3 Port of Long Beach

The POLB was founded in 1911. Built out of some 800 acres of mudflats at the mouth of the Los Angeles River, the early development and improvement of the harbor roughly parallel those of the neighboring POLA and was marked by the completion of the Long Beach breakwater in 1949. Similar to the Los Angeles Harbor, the ever increasing demand of shipping needs, especially with the advent of containerized shipping and growing vessel sizes, has necessitated continued capital improvements of the harbor including channel deepening, terminal expansion, and wharf replacement. Recent capital improvements in the harbor include the deepening of the approach channel to -23 meters (-76 feet), MLLW to accommodate deep-draft crude oil tankers.

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Table 3-3 Dredging and Disposal History for Port of Los Angeles

Year [a]	Project Proponent	Project	Dredging			Disposal Site		Source [f]
			Location	Quantity (m^3)	Method	Site	Quantity (m^3)	
1978	Port of Los Angeles	Cerritos Channel Maintenance	Cerritos Channel	-- [g]	Hydraulic	LA-2	71,872	3
1978	-- [g]	Harbor Maintenance	Los Angeles Harbor	-- [g]	-- [g]	Ocean disposal	76,455 [e]	1
1979	Port of Los Angeles	Harbor Maintenance	Los Angeles Harbor	-- [g]	Clamshell	LA-2	9,481	1, 3
1980	Port of Los Angeles	Port of Los Angeles Main Channel and Super Tanker Channel Deepening [b]	Los Angeles Harbor	10,801,630 [d]	-- [g]	Pier 300 and Shallow Water Habitat	10,801,630 [d]	5
1982	Port of Los Angeles	Harbor Maintenance	Los Angeles Harbor	-- [g]	Clamshell	LA-2	53,522	1, 3
1982	Port of Los Angeles	Harbor Maintenance	Los Angeles Harbor	-- [g]	Hydraulic	LA-2	84,106	1, 3
1982	Port of Los Angeles	Harbor Maintenance	Los Angeles Harbor	-- [g]	Hydraulic	LA-2	49,699	1, 3
1982	Port of Los Angeles	Harbor Maintenance	Los Angeles Harbor	-- [g]	Clamshell	LA-2	57,345	1, 3
1982	National Steel and Shipbuilding	Harbor Maintenance	Los Angeles Harbor	-- [g]	-- [g]	LA-5	153,685	3
1983	Port of Los Angeles	Harbor Maintenance	Los Angeles Harbor	-- [g]	Clamshell	LA-2	612	3
1983	-- [g]	Harbor Maintenance	Los Angeles Harbor	-- [g]	-- [g]	Ocean disposal	48,549 [e]	1
1984	Port of Los Angeles	Harbor Maintenance	Los Angeles Harbor	-- [g]	Clamshell	LA-2	4,282	3
1984	Port of Los Angeles	Harbor Maintenance	Los Angeles Harbor	-- [g]	Clamshell	LA-2	93,281	3
1985	Port of Los Angeles	Harbor Maintenance	Los Angeles Harbor	-- [g]	Clamshell	LA-2	6,270	3

Table 3-3 Dredging and Disposal History for Port of Los Angeles

			Dredging			Disposal Site		
Year [a]	Project Proponent	Project	Location	Quantity (m^3)	Method	Year [a]	Project Proponent	Project
1985	-- [g]	Harbor Maintenance	Los Angeles Harbor	-- [g]	-- [g]	Ocean disposal	106,070 [e]	1
1986	Port of Los Angeles	Harbor Maintenance	Los Angeles Harbor	-- [g]	Clamshell	LA-2	38,230	3
1986	Port of Los Angeles	Harbor Maintenance	Los Angeles Harbor	-- [g]	Clamshell	LA-2	6,270	3
1986	Port of Los Angeles	Harbor Maintenance	Los Angeles Harbor	-- [g]	Clamshell	LA-2	53,522	3
1986	Port of Los Angeles	Harbor Maintenance	Los Angeles Harbor	-- [g]	Clamshell	LA-2	32,113	3
1987	Port of Los Angeles	Harbor Maintenance	Los Angeles Harbor	-- [g]	Clamshell	LA-2	11,469	3
1987	Port of Los Angeles	Harbor Maintenance	Los Angeles Harbor	-- [g]	Clamshell	LA-2	76,919	3
1987	-- [g]	Harbor Maintenance	Los Angeles Harbor	-- [g]	-- [g]	Ocean disposal	89,448 [e]	1
1988	Port of Los Angeles	Harbor Maintenance	Los Angeles Harbor	-- [g]	Clamshell	LA-2	76,460	3
1988	-- [g]	Harbor Maintenance	Los Angeles Harbor	-- [g]	-- [g]	Ocean disposal	60,625 [e]	1
1989	Port of Los Angeles	Harbor Maintenance	Los Angeles Harbor	-- [g]	Clamshell	LA-2	76,460	1, 3
1990	Port of Los Angeles	Harbor Maintenance	Los Angeles Harbor	-- [g]	Clamshell	LA-2	76,460	1, 3
1991	Port of Los Angeles	Harbor Maintenance	Los Angeles Harbor	-- [g]	Clamshell	LA-2	22,938	1, 3
1993	Port of Los Angeles	Harbor Maintenance	Los Angeles Harbor	-- [g]	-- [g]	LA-3	5,352	1, 3
1993	Port of Los Angeles	Berth 226-231 Maintenance	Los Angeles Harbor	-- [g]	-- [g]	-- [g]	-- [g]	4
1995	USACE	Maintenance	Los Angeles Harbor	35,951	Hopper and Clamshell	Open water and upland	-- [g]	1, 2

Table 3-3 Dredging and Disposal History for Port of Los Angeles

			Dredging			Disposal Site		
Year [a]	Project Proponent	Project	Location	Quantity (m^3)	Method	Year [a]	Project Proponent	Project
1995	USACE, Port of Los Angeles	Pier 400 Stage I [b]	Los Angeles Harbor	22,768,140	Clamshell, hydraulic, and hopper	Pier 400 Landfill	22,768,140 [h]	8
1996	USACE, Port of Los Angeles	Port of Los Angeles East Basin Maintenance	Los Angeles Harbor	-- [g]	Hydraulic	LA-2	22,020	1, 3
1997	Port of Los Angeles	Berths 238-239 Wharf Repair and Fender Upgrade Project	Los Angeles Harbor	5,352 [d]	-- [g]	-- [g]	-- [g]	4
1997	Port of Los Angeles	Berths 51-55 Maintenance	Los Angeles Harbor	11,468 [d]	-- [g]	-- [g]	-- [g]	4
1997	USACE, Port of Los Angeles	Pier 400 Stage 2 Deep Draft Navigation Project [b]	Los Angeles Harbor	23,993,246	Clamshell and hydraulic dredge [i]	LA-2 Stage 2 CSWH Stage 2/CSWH	1,422,981 18,364,447 2,572,466 1,633,352 [j]	6
1998	USACE, Port of Los Angeles	Port of Los Angeles O&M	Los Angeles Harbor	-- [g]	Hopper	LA-2	118,360	1, 3
1998	Port of Los Angeles	Berths 49-50 Maintenance	Los Angeles Harbor	-- [g]	-- [g]	-- [g]	-- [g]	4
1998	Port of Los Angeles	Berth 144 Wharf Rep.	Los Angeles Harbor	108,567 [d]	-- [g]	LA-2 ARSSS [c]	99,392 9,175	4
1999	Port of Los Angeles	Berth 71 Maintenance	Los Angeles Harbor	--	-- [g]	-- [g]	-- [g]	4
1999	Port of Los Angeles	Berths 51-55 Maintenance	Los Angeles Harbor	114,683 [d]	-- [g]	ARSSS	114,683 [d]	4
1999	Port of Los Angeles	Berths 121-126 Maintenance	Los Angeles Harbor	22,937 [d]	-- [g]	LA-2	22,937 [d]	4
1999	Port of Los Angeles	Berths 163-164 Maintenance	Los Angeles Harbor	30,582 [d]	-- [g]	LA-2 ARSSS	22,937 7,645	4
1999	Port of Los Angeles	Berth 191 Maintenance	Los Angeles Harbor	5,352 [d]	-- [g]	LA-2 ARSSS	3,823 1,529	4
1999	Port of Los Angeles	Berths 216-221 Maintenance	Los Angeles Harbor	30,582 [d]	-- [g]	ARSSS	30,582 [d]	4

Table 3-3 Dredging and Disposal History for Port of Los Angeles

Year [a]	Project Proponent	Project	Dredging			Disposal Site		Project
			Location	Quantity (m^3)	Method	Year [a]	Project Proponent	
1999	Port of Los Angeles	Berths 118-120 Maintenance	Los Angeles Inner Harbor	6,116 [d]	-- [g]	ARSSS	6,116 [d]	4
1999	Port of Los Angeles	West Basin Entrance Berths 97-102	Los Angeles Harbor	-- [g]	-- [g]	-- [g]	-- [g]	4
2001	Port of Los Angeles	LA Inner Harbor Basin Berths 212-215 Maintenance	Los Angeles Harbor	16,820 [d]	Clamshell	ARSSS	16,820 [d]	4
2001	Port of Los Angeles	Berths 167-169 Maintenance	Los Angeles Harbor East Basin Channel	4,587 [d]	Clamshell	ARSSS	4,587 [d]	4
2001	Port of Los Angeles	Berths 148-151 Maintenance	Los Angeles Harbor Main Channel and Turning Basin	7,646 [d]	Clamshell	ARSSS	7,646 [d]	4
2001	Port of Los Angeles	Berths 261-265 Maintenance	Los Angeles Harbor Fish Harbor	19,114 [d]	Clamshell	ARSSS	19,114 [d]	4
2002	Port of Los Angeles	Berth 100 Wharf Construction	Los Angeles Harbor	26,759 [d]	Clamshell	ARSSS	26,759 [d]	4
2002 [k]	USACE	Port of Los Angeles Channel Deepening Project [b]	Los Angeles Harbor	6,116,439 [d]	Hydraulic and clamshell	Southwest Slip West	1,146,832 [d]	7
						Southwest Slip East	688,099 [d]	
						Eelgrass Shallow Water Habitat	76,456 [d]	
						Pier 300	1,223,288 [d]	
						Pier 400	2,217,209 [d]	
						Cabrillo Shallow Water Habitat	764,555 [d]	

Table 3-3 Dredging and Disposal History for Port of Los Angeles

Total Maintenance Dredging Volume = 2,028,391 m^3 (2,653,035 cy).

Overall Maintenance Dredging Rate = 84,516 m^3/yr (110,543 cy/yr).

Total Capital Improvement Dredging Volume = 57,563,016 m^3 (75,289,580 cy) [k].

Overall Capital Improvement Dredging Rate = 3,386,060 m^3/yr (4,428,799 cy/yr) [k].

(a) Year Indicates start of project.

(b) Capital improvement project.

(c) Anchorage Road Soil Storage Site.

(d) Estimated or maximum permitted amount.

(e) Difference between quantities provided by Source 1 and by other records. Reflects potential quantities unaccounted for by sources available to present study.

(f) Source:

1. USACE 2003c Zone of Siting Feasibility Study Draft Report.
2. Navigation Data Center. USACE record. http://www.iwr.usace.army.mil/ndc.
3. Ocean Disposal Database. Corps Waterways Experiment Station. http://www.wes.army.mil/el/odd/odd.html.
4. Los Angeles Regional Water Quality Control Board (LARWQCB) 401 Permit Information.
5. USACE and LAD. 1980. Plans and Specifications for Dredging and Outfall Sewer at Los Angeles Harbor, Los Angeles, California DACW09-80-B-0030.
6. USACE 2000a. Monthly Summary Report No.036, Report Period September 2000, Port of Los Angeles Pier 400 Stage 2 Construction Project. Prepared by Gahagan & Bryant Associates, Inc.
7. USACE 2002f. Final Supplemental Environmental Assessment for the POLA Channel Deepening Project, San Pedro Bay, California.

   Prepared by USACE South Pacific Division.
8. Gahagan & Bryant Associates, Inc. Project Files for Pier 400 Stage I.

(g) No record.

(h) Source 1 1997 quantities are close to Pier 400 Stage I and II.

(I) 550,536 m^3 done by Clamshell, remaining done by hydraulic dredge.

(j) Record indicated 1,633,352 m^3 was disposed at both Stage 2 and CSWH.

(k) The POLA Channel Deepening Project began in 2002 and is expected to be completed in 2005. The volume is not included in the total capital improvement dredging volume and rate since it is an on-going project.

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The sediment accumulated in the harbor is typically silty with varying quality levels ranging from being appreciably contaminated at certain inner harbor locations such as Channel Two, to being relatively clean in the approach channel. USACE conducts maintenance and capital improvement dredging of the federally designated navigation channels in the harbor, while the POLB is responsible for maintenance dredging along berthing areas. Table 3-4 presents a chronology of historical maintenance and capital improvement dredging and disposal events in the POLB since 1976.

The data indicate that a total of approximately 1.9 million m^3 (2.4 million cy) has been dredged from Long Beach Harbor for harbor maintenance from 1976 to 2003, at an average annual rate of approximately 71,000 m^3 (93,000 cy) per year. In addition, a total of approximately 13.0 million m^3 (17.0 million cy) of dredged material has been generated from harbor capital improvement projects in Long Beach Harbor over the same period at an average annual rate of approximately 592,000 m^3 (774,500 cy) per year.

3.3.1.4 Los Angeles River Estuary

The LARE connects the Los Angeles River with San Pedro Bay in the Long Beach Harbor. As the outlet of the Los Angeles River flood control channel, constructed during the period of 1919 to 1923, it drains the highly urbanized Los Angeles River Watershed. Sediment discharged from the Los Angeles River has historically shoaled in the waterways of the estuary, creating navigation hazards for recreational and commercial vessels using facilities along the shores of the estuary such as Queensway Marina, Golden Shore Boat Ramp, Rainbow Harbor/Marina and Long Beach Shoreline Marina.

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Table 3-4 Dredging and Disposal History for Port of Long Beach

Year [a]	Project Proponent	Project	Dredging			Disposal Site		Source [g]
			Location	Quantity (m^3)	Method	Site	Quantity (m^3)	
1976	Port of Long Beach	Harbor Maintenance	Long Beach Harbor	--[h]	Clamshell	LA-2	37,083	1,3
1977	Port of Long Beach	Harbor Maintenance	Long Beach Harbor	--[h]	Clamshell	LA-2	14,374	1,3
1980	Port of Long Beach	Harbor Maintenance	Long Beach Harbor	--[h]	Clamshell	LA-2	45,876	1,3
1981	Port of Long Beach	Harbor Maintenance	Long Beach Harbor	--[h]	Clamshell/ hydraulic	LA-2	439,645	3
1981	--[h]	Capital Improvement [b]	Long Beach Harbor	--[h]	--[h]	Ocean Disposal	768,378	1
1982	Port of Long Beach	Harbor Maintenance	Long Beach Harbor	--[h]	Clamshell	LA-2	30,584	3
1982	Port of Long Beach	Harbor Maintenance	Long Beach Harbor	--[h]	Clamshell	LA-2	38,230	3
1982	--[h]	Harbor Maintenance	Long Beach Harbor	--[h]	--[h]	Ocean Disposal	114,679 [f]	1
1982	--[h]	Capital Improvement [b]	Long Beach Harbor	--[h]	--[h]	Ocean Disposal	259,949	1
1983	--[h]	Harbor Maintenance	Long Beach Harbor	--[h]	--[h]	Ocean Disposal	11,468	1
1984	Port of Long Beach	Harbor Maintenance	Long Beach Harbor	--[h]	Clamshell	LA-2	15,292	1,3
1985	Port of Long Beach	Harbor Maintenance	Long Beach Harbor	--[h]	Clamshell	LA-2	91,752	1,3
1985	Port of Long Beach	Harbor Maintenance	Long Beach Harbor	--[h]	Clamshell	LA-2	15,292	1,3
1985	Port of Long Beach	Harbor Maintenance	Long Beach Harbor	--[h]	Clamshell	LA-2	61,168	1,3
1986	Port of Long Beach	Harbor Maintenance	Long Beach Harbor	--[h]	Clamshell	LA-2	30,584	3
1986	--[h]	Harbor Maintenance	Long Beach Harbor	--[h]	--[h]	Ocean Disposal	110,859 [f]	1
1987	U.S. Navy	--[h]	Long Beach, CA	--[h]	--[h]	LA-2	35,554	1,3
1992	Port of Long Beach	Harbor Maintenance	Long Beach Harbor	--[h]	Hopper/ Clamshell	LA-2	87,929	3
1992	Port of Long Beach	Port of Long Beach 5-Year Maintenance	Berths F206 - F207	1,888	Clamshell	Former Ford Site Berths 95-97	13,908	1, 4
			Berths E25 - E26	5,942				
			Berths F208 - F209	2,194				
			Berths F204 - F205	3,884				

Table 3-4 Dredging and Disposal History for Port of Long Beach

Year [a]	Project Proponent	Project	Dredging			Disposal Site		Source [g]
			Location	Quantity (m^3)	Method	Site	Quantity (m^3)	
1992	--[h]	Capital Improvement [b]	Long Beach Harbor	--[h]	--[h]	Ocean Disposal	550,021	1
1993	Port of Long Beach	Harbor Maintenance	Long Beach Harbor	--[h]	Hopper/ clamshell	LA-2	462,124	3
1996	--[h]	Capital Improvement [b]	Long Beach Harbor	--[h]	--	Ocean Disposal	535,188	1
1997	Port of Long Beach	Port of Long Beach 5-Year Maintenance	Berths E24 - E26	14,909	Clamshell	Former Ford Site Berths 95-97	15,826	4
			Berths B76 - B79	917	Clamshell			
1998	Port of Long Beach	Port of Long Beach 5-Year Maintenance	Long Beach Harbor	19,144	Clamshell	Pier A	19,144	4
1998	Port of Long Beach	Pier A Marine Terminal - Inner Harbor Maintenance	Long Beach Harbor	--[h]	--[h]	--[h]	--[h]	4
1998	USACE	Main Channel Deepening [b]	Long Beach Harbor	3,828,000	Undefined	Palo Verdes Shelf	93,000	2
						S. Energy Island Borrow Pit	811,000	
						Western Anchorage	2,924,000	
1999	Port of Long Beach	Harbor Maintenance	Long Beach Harbor	--	Hopper	LA-2	92,975	1,3
1999	Port of Long Beach	Port of Long Beach 5-Year Maintenance	Long Beach Harbor	15,215	Clamshell	Pier E	15,215	4
1999	Port of Long Beach	Capital Improvement [b]	Long Beach Harbor	--[h]	Hydraulic	LA-2	1,812,102	3
1999	Port of Long Beach	Pier T Marine Terminal West Basin Dredging [b]	Long Beach Harbor	1,524,968 [d]	--[h]	Harbor Infill [c]	1,524,968 [d]	4
1999	--[h]	Capital Improvement [b]	Long Beach Harbor	491,075 [f]	--[h]	Stock Piling	--[h]	1
						Capping and Upland	--[h]	
2000	Port of Long Beach	Port of Long Beach 5-Year Maintenance	Long Beach Harbor	15,368	Clamshell	Pier T	15,368	4
2000	Port of Long Beach	Berths J245-J247 Deepening [b]	Port of Long Beach Pier J	10,821	Hopper	Western Anchorage	10,821	4

Table 3-4 Dredging and Disposal History for Port of Long Beach

Year [a]	Project Proponent	Project	Dredging: Location	Dredging: Quantity (m^3)	Dredging: Method	Disposal Site: Site	Disposal Site: Quantity (m^3)	Source [g]
2000	Port of Long Beach	Terminal Island Container Facilities Expansion [b]	Port of Long Beach Pier T	305,822 [d]	Hopper/ clamshell	Dry Docks #2 and #3	305,822 [d]	4
			Western Anchorage	764,555 [d]		Navy Mole Site	764,555 [d]	
2000	--[h]	Capital Improvement [b]	Long Beach Harbor	--[h]	--[h]	Harbor Infill	1,666,612 [f]	1
2002	Carnival Corporation	Passenger Terminal Facility Long Beach Maintenance	Long Beach Harbor	11,468 [d]	Clamshell	Pier G [e]	11,468 [d]	4
2002	Port of Long Beach	Port of Long Beach 5-Year Maintenance	Long Beach Harbor	24,428	Clamshell	Pier G	11,583	4
			Long Beach Harbor		Clamshell	Western Anchorage	12,845	
2002	Port of Long Beach	Piers G/J Southeast Basin Deepening [b]	Port of Long Beach Southeast Basin and Outer Harbor Borrow Site	275,010	Hydraulic	Pier G Landfill	275,010	4
2003	Port of Long Beach	Piers G/J Southeast Basin Deepening [b]	Long Beach Harbor	235,483	--[h]	Western Anchorage	235,483	4

Total Maintenance Dredging Volume =1,850,825 m^3 (2,420,788 cy). Total Capital Improvement Dredging Volume = 13,027,984m^3 (17,039,960 cy).

Overall Maintenance Dredging Rate = 71,186 m^3/yr (93,107 cy/yr). Overall Capital Improvement Dredging Rate = 598,181 m^3/yr (1,774,544 cy/yr).

(a) Year Indicates start of project.

(b) Capital Improvement Project.

(c) Harbor Infill site includes Pier E Slip 2, nearshore upcoast from Alamitos Bay west jetty (Peninsula Beach), Navy Mole in West Basin and Main Channel fill site.

(d) Estimated or maximum permitted amount.

(e) Pier G Berth 236 Wharf Rehabilitation Project.

(f) Difference between quantities provided by Source 1 and by other records. Reflects potential quantities unaccounted for by sources available for present study.

(g) Source:

1. USACE 2003c. Zone of Siting Feasibility Study Draft Report. U.S. Army Corps of Engineers, Los Angeles District.
2. Navigation Data Center. U.S. Army Corps of Engineers, Los Angeles District record. http://www.iwr.usace.army.mil/ndc.
3. Ocean Disposal Database. U.S. Army Corps of Engineers, Waterways Experiment Station. http://www.wes.army.mil/el/odd/odd.html.
4. Los Angeles Regional Water Quality Control Board LARWQCB 401 Permit Information.

(h) No record

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The sediment in the shoals affecting the navigation channel consists typically of a relatively high percentage of silt and clay, and is often contaminated and unsuitable for unrestricted ocean, nearshore, or upland disposal. USACE conducts maintenance of the navigation channel between Queensway Marina and San Pedro Bay, for which federally designated channel dimensions were established relatively recently, at a dredging cycle of approximately two years. The City of Long Beach has also historically performed maintenance dredging of the estuary on an as-needed basis to support access to various facilities in the estuary. Table 3-5 presents a chronology of historical maintenance dredging and disposal events in the LARE since 1979.

The data indicate that a total of approximately 1.2 million m^3 (1.9 million cy) has been dredged from the LARE and vicinity for access and navigation channel maintenance between 1979 and 2001. The average annual maintenance dredging rate has been approximately 55,000 m^3 (72,000 cy) per year over that period.

3.3.1.5 Alamitos Bay

Alamitos Bay is a recreational harbor that receives watershed runoff directly from Los Cerritos Channel and indirectly from San Gabriel River located adjacent to the bay entrance. The bay has been historically dredged by the City of Long Beach every winter season to maintain channel and basin depths to support boating activities. Table 3-6 presents a chronology of historical maintenance dredging and disposal events in the bay during the past decade.

The data indicate that a total of approximately 111,000 m^3 (145,000 cy) has been dredged from Alamitos Bay for entrance channel and basin maintenance from 1994 to 2002. The average annual maintenance dredging rate has been approximately 14,000 m^3 (18,000 cy) per year over the same period. All dredged sediment is disposed at nearby beaches indicating a lack of contamination.

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Table 3-5 Dredging and Disposal History for Los Angeles River Estuary

Year [a]	Project Proponent	Project	Dredging			Disposal		Source [c]
			Location	Quantity (m^3)	Method	Site	Quantity (m^3)	
1979	--[d]	Maintenance	Los Angeles River Estuary	--[d]	--[d]	Ocean Disposal	271,417 [e]	1
1980	City of Long Beach [f]	Downtown Shoreline Marine Mole	Los Angeles River Estuary	841,000	--[d]	--[d]	--[d]	7
1988	City of Long Beach	West Beach Area Maintenance	Long Beach	--[d]	--[d]	--[d]	--[d]	5
1990	USACE	Los Angeles River Estuary Maintenance	Los Angeles River Estuary	112,533	Hydraulic/ clamshell	Confined	--[d]	2
1990	USACE	Golden Shore Boat Ramp Area Maintenance	Los Angeles River Estuary	19,114 [b]	--[d]	--[d]	--[d]	4
1991	USACE	Queensway Marina Navigation Channel Maintenance	Los Angeles River Estuary	93,276 [b]	--[d]	POLB Infill - Pier J	93,458	1, 4
1992	City of Long Beach	Los Angeles River Estuary Maintenance	Los Angeles River Estuary	8,000-15,000 [b]	--[d]	--[d]	--[d]	4
1994	City of Long Beach	Los Angeles River Estuary Maintenance	Los Angeles River Estuary	69,000-77,000 [b]	--[d]	--[d]	--[d]	4
1995	USACE	Queensway Marina Navigation Channel Emergency Maintenance	Los Angeles River Estuary	229,366	Hydraulic	Long Beach Outer Harbor borrow pit	230,100	1, 2, 4, 6
1997	USACE	Maintenance	Los Angeles River Estuary	62,428	Hydraulic/ clamshell	Overboard and open water	--[d]	1, 2
1999	USACE	LA River Estuary Maintenance	Los Angeles River Estuary	126,330	Hydraulic	LA-2	25,232	1, 2, 3
						POLB Infill - Pier E	101,098	
2000	City of Long Beach	Catalina Cruises Terminal Basin Dredging	Los Angeles River Estuary	--[d]	Hydraulic	Harbor Infill	15,000	1, 5
2001	USACE	LA River Estuary Pilot Study	Los Angeles River Estuary	103,346	--[d]	North Energy Island Borrow Pit	103,346	1

Table 3-5 Dredging and Disposal History for Los Angeles River Estuary

Total Maintenance Dredging Volume = 1,213,156 m^3 (1,586,748 cy).
Overall Maintenance Dredging Rate = 85,613 m^3/yr (111,978 cy/yr). Rate is based on records from 1990 to 2001.
(a) Year indicates start of project.
(b) Estimated or maximum permitted amount.
(c) Source:

1. USACE 2003c. Zone of Siting Feasibility Study Draft Report.
2. Navigation Data Center. USACE record. http://www.iwr.usace.army.mil/ndc.
3. Ocean Disposal Database. USACE, Waterways Experiment Station. http://www.wes.army.mil/el/odd/odd.html.
4. USACE1996. LARE Navigation Channel Alternatives. Prepared for USACE.
5. LARWQCB 401 Permit Information.
6. Contaminated Sediments Task Force Metadata.
7. City of Long Beach, personal communication.

(d) No record.
(e) Record not included in total rate due to gap in record.
(f) One-time initial construction project.

Table 3-6 Dredging and Disposal History for Alamitos Bay

Year [a]	Project Proponent	Project	Dredging			Disposal		Source [c]
			Location	Quantity (m^3)	Method	Site	Quantity (m^3)	
1988	City of Long Beach	East Beach Area Maintenance	East Beach	-- [d]	-- [d]	-- [d]	-- [d]	1
1994	City of Long Beach	Harbor Maintenance	Entrance Channel	10,226	Hydraulic	East Beach [b]	10,226	1
1995	City of Long Beach	Alamitos Bay Basin One Maintenance	Basin One	13,284	Hydraulic	East Beach [b]	13,284	1
1996	City of Long Beach	Harbor Maintenance	Entrance Channel	34,405	Hydraulic	East Beach [b]	34,405	1
1997	City of Long Beach	Harbor Maintenance	Entrance Channel	5,373	Hydraulic	East Beach [b]	5,373	1
1998	City of Long Beach	Harbor Maintenance	Entrance Channel	11,010	Hydraulic	East Beach [b]	11,010	1
1999	City of Long Beach	Harbor Maintenance	Entrance Channel	2,515	Hydraulic	East Beach [b]	2,515	1, 2
2001	City of Long Beach	Harbor Maintenance	Entrance Channel	14,144	Hydraulic	East Beach [b]	14,144	1, 2
2002	City of Long Beach	Harbor Maintenance	Entrance Channel	19,680	Hydraulic	East Beach [b]	19,680	1, 2

Total Maintenance Dredging Volume = 110,637 m^3 (144,708 cy).
Overall Maintenance Dredging Rate = 13,830 m^3/yr (18,088 cy/yr).
(a) Year indicates start of project.
(b) Beach nourishment 30.3 meters offshore at east end of East Beach adjacent to Alamitos Jetty.
(c) Source:
1. LARWQCB 401 Permit information.
2. Dredging volume obtained from post-dredging seasonal report from the City of Long Beach to USACE.
(d) Permit exists, but no quantity information.

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3.3.1.6 Historical Dredging and Disposal Summary

In the last three decades, the Region has generated substantial amounts of dredged material from maintenance and capital improvement projects in its major harbors, marinas, and navigation channels. Table 3-7 summarizes the historical dredging volumes from major dredging sites in the Region.

Table 3-7
Los Angeles Regional Dredging Quantities

Location	Period of Available Record	Maintenance Dredging (m^3)	Maintenance Dredging (m^3/year)	Capital Improvement Dredging (m^3)	Capital Improvement Dredging (m^3/year)
Marina del Rey	1969-1999	1,469,000	49,000	-	-
Port of Los Angeles	1978-2002	2,028,000	85,000	57,563,000	3,386,000
Port of Long Beach	1976-2003	1,851,000	71,000	13,028,000	592,000
Los Angeles River Estuary	1979-2001	1,213,000	86,000*	-	-
Alamitos Bay	1994-2002	111,000	14,000	-	-
	Regional Total	**6,672,000**	**274,000**	**70,591,000**	**3,978,000**

* Rate based on record between 1990 and 2001.

The dredging history in the Region based on available records indicates that a total of approximately 6.7 million m^3 (8.7 million cy) of dredged material has been generated from harbor and channel maintenance projects over the past few decades at an annual rate of approximately 274,000 m^3 (359,000 cy) per year. Among the total dredged volume, approximately 70.6 million m^3 (92.3 million cy) of the dredged material has been generated from capital improvement projects in the Ports over the same period at an annual rate of about 4 million m^3 (5.3 million cy) per year. The data indicate that capital improvement projects for the two Ports historically generated more than 10 times the contaminated sediments than those resulting from maintenance projects.

Disposal practices in the region include harbor infill, open ocean disposal, nearshore open water disposal, beach fill, SWH fill, and stockpiling. Table 3-8 presents the quantities by disposal methods for materials from the major dredging sites in the region. Harbor infill includes records for Port fill activities and confined disposals. Open ocean disposal refers to sites such as LA-2 or LA-3. Nearshore open water refers to disposal records for nearshore, overboard, and borrow pit (e.g., North Energy Island Borrow Pit [NEIBP]). Beach fill include beach placement and nourishment. SWH indicates disposal at locations designated for SWH. Stock piling refers to the disposal of dredge material at the Anchorage Road Soil Storage Site (ARSSS) for the POLA and Western Anchorage for the POLB. The mixed disposal method refers to the combination of harbor infill and SWH disposal records in which the volume breakdown for each method was not available. Volumes from disposal events with methods that are indeterminate from available records are grouped under "unspecified".

Table 3-8
Los Angeles Regional Disposal Method Volumes (m^3)

Disposal Method	Marina del Rey	Port of Los Angeles	Port of Long Beach	Los Angeles River Estuary	Alamitos Bay	Regional Total	Percent of Total
Harbor Infill	438,000	41,133,000	4,639,000	410,000	-	46,631,000	60%
Open Ocean	40,000	3,154,000	5,661,000	297,000	-	9,152,000	12%
Nearshore Open Water	16,000	36,000	904,000	395,000	-	1,351,529	2%
Beach Fill	931,000	-	-	-	111,000	1,042,000	1%
Shallow Water Habitat	44,000	2,572,000	-	-	-	2,616,000	3%
Stock Piling	-	245,000	3,674,000	-	-	3,919,000	5%
Mixed*	-	12,435,000	-	-	-	12,435,000	16%
Unspecified	-	17,000	-	111,000	-	128,000	< 1%

* Disposed as harbor infill or SWH.

The disposal data indicate that approximately 60 percent (46.6 million m^3) of the total historical volume of dredged material from the region has been used as infill for harbor infrastructure development and expansion projects at the POLA and POLB. This is followed by 12 percent disposed of offshore at designated ocean disposal sites including LA-2 and LA-3 and 2 percent at nearshore disposal sites such as the NEIBP and South Energy Island Borrow Pit. Beach fill and SWH fill, two of the primary beneficial reuses practiced in the Region, have accounted for approximately 1 percent and 3 percent of the total disposal volume in the Region, respectively. In addition, 5 percent of the total historical volume generated in the region has been kept for stock piling at the Ports' storage facilities. A significant 16 percent of the total volume was disposed as mixed that included both harbor infill and SWH. This volume was from two of the capital improvement projects at the POLA. The unspecified disposal volumes were minimal relative to the total dredge volume.

The volumetric breakdown between contaminated and uncontaminated (clean) dredged material could not been determined on a project-by-project basis. The disposal method does not always indicate if the dredge material is contaminated or uncontaminated, although open ocean disposal is only allowed for clean material.

3.3.2 Projected Future Contaminated Sediment Quantities

In this section, the projected quantities of contaminated sediment for the Study Area are discussed. The projected quantities are based on future dredging and disposal needs estimated from historical dredging rates and discussions with agencies responsible for conducting dredging operations (e.g., USACE, POLA, POLB, and City of Long Beach).

Anticipated capital improvement projects are expected for the POLA, POLB, and Alamitos Bay. Both Ports have very accurate projections for the capital improvement and maintenance needs over the next five to six years. For the other locations, agency maintenance projections are based on historical records. These future projections can be fairly accurate until the effects of source control measures to reduce sediment (especially contaminated sediment) loads to the coast come into effect.

3.3.2.1 Marina del Rey

USACE anticipates continuing its regular maintenance dredging programs at the Marina del Rey entrance channels. Historically, Marina del Rey requires dredging every three to five years. The projected maintenance dredging need is anticipated at a rate of 50,000 to 100,000 m^3 per year, which is consistent with the historical dredging rate. It is estimated that about one-fourth to one-third of the dredge volume will be contaminated. The next dredge event is planned for 2005 with an expected volume of 300,000 to 350,000 m^3. No capital improvement projects are expected for Marina del Rey in the near future. However, the USACE is planning a feasibility study to restore a wetland at the Lower Ballona Creek which may require dredging and disposal of dredged materials.

The projected rate is expected to continue until a sediment control alternative is implemented. USACE is currently conducting a feasibility study to evaluate several sediment control alternatives at Marina del Rey and along Ballona Creek to reduce sediment depositions at the harbor entrance and hence reduce the need for future maintenance dredging. In addition, source control best management practices (BMPs) have been and will continue to be installed in portions of the Ballona Creek watershed.

3.3.2.2 Port of Los Angeles

Currently the POLA Channel Deepening Project is underway, as discussed previously. The project is expected to generate 6.1 million m^3 of sediment by the projected completion in 2005. Disposal will be limited within the POLA for harbor infill and shallow water habitat. The Channel Deepening Project is not considered in the evaluation of future dredging and disposal needs since disposal needs have already been met. The POLA is currently planning other dredging projects scheduled between 2004 and 2009. These anticipated maintenance and capital improvement activities for the POLA are listed in Table 3-9. Several capital improvement projects shown in the table will involve substantial landside cutting (these cut volumes are shown in parentheses in the table). Strictly speaking, these are a combination of excavation and dredging activities (delimited at +4.8 feet MLLW), but the cut volumes are included because they add to the need of identifying suitable disposal sites for the Region.

Table 3-9
Projected Future Dredging of Sediment Quantities in the Port of Los Angeles

Year [1]	Total Volume (m^3)	Contaminated Volume (m^3)	Dredging Location	Comment
2004	69,470	570	Berth 36	Maintenance
		4,000	Berths 90-92	Maintenance
		3,800	Berths 93A-93B	Maintenance
		5,000	Berths 122-124	Maintenance
		5,100	Berths 127-131	Maintenance
		10,200	Berths 153-155	Maintenance
		2,200	Berths 165-166	Maintenance
		8,000	Berths 177-179	Maintenance
		6,300	Berths 180-181	Maintenance
		19,300	Berths 226-231	Maintenance
		5,000	Berth 240B	Maintenance
2005	69,470	8,400	Berths 57-58	Maintenance
		7,600	Berths 59-60	Maintenance
		770	Berth 94	Maintenance
		15,300	Berths 136-139	Maintenance
		7,600	Berths 195-199	Maintenance
		3,800	Berth 200A	Maintenance
		6,100	Berths 206-209	Maintenance
		2,300	Berths 210-211	Maintenance
		6,100	Berths 225-225	Maintenance
		11,500	Berths 232-236	Maintenance
	168,200 (145,300) [2]	168,200	Berths 145-147	Capital Improvement
	57,300 (35,100) [2]	29,100	Berths 173 & 176	Capital Improvement
	260,000 (206,500) [2]	130,000	Berths 206-209	Capital Improvement
	520,000 (405,200) [2]	260,000	Berths 226-236	Capital Improvement
2007	81,160	760	Berth 36	Maintenance
		11,500	Berths 45-47	Maintenance
		7,650	Berths 49-50	Maintenance
		3,100	Berths 87-90	Maintenance
		7,650	Berths 174-176	Maintenance
		7,650	Berths 182-186	Maintenance
		15,300	Berths 187-190	Maintenance
		15,300	Berth 240Z	Maintenance
		4,600	Berth 240A	Maintenance
		7,650	Berths 258-260	Maintenance
	994,000 (909,900) [2]	497,000	Berths 122-129	Capital Improvement
2008	313,500 (183,500) [2]	160,600	Berths 214-218	Capital Improvement
2009	41,100	3,800	Berths 51-55	Maintenance
		1,500	Berths 70-71	Maintenance
		3,800	Berths 118-120	Maintenance
		3,800	Berths 148-151	Maintenance

Table 3-9
Projected Future Dredging of Sediment Quantities in the Port of Los Angeles

Year [1]	Total Volume (m^3)	Contaminated Volume (m^3)	Dredging Location	Comment
		6,100	Berths 167-169	Maintenance
		1,500	Berths 191-194	Maintenance
		7,650	Berths 212-215	Maintenance
		7,650	Berths 216-221	Maintenance
		1,500	Berths 238-239	Maintenance
		3,800	Berths 261-269	Maintenance
	252,300 (211,000) [2]	130,000	Berth 136	Capital Improvement

Note: Estimated dredge volumes at the time of report preparation. This information is provided for reference purposes only.
1. Year indicates first year of estimate schedule for Capital Improvements.
2. Volume for landside cutting.

Over the next six years, the POLA is expecting to generate a total of 261,200 m^3 due to maintenance dredging (a rate of 44,000 m^3 per year). It is expected that all maintenance dredging sediment will be contaminated. Several capital improvement projects have been proposed for the POLA. Capital improvement projects are estimated to generate 2.58 million m^3 of sediment over the next six years (429,000 m^3 per year) with 1.38 million m^3 (1.8 million cy), or 53 percent being contaminated. The combined maintenance and capital improvement projects for POLA will generate a total of 2.84 million m^3 sediments (473,000 m^3 per year) over the next six years, and a total of 1.636 million m^3 (2.14 million cy) of contaminated sediment.

Other capital improvement projects in the preliminary planning phase include the Cabrillo Marina Phase II and Waterfront Development projects. In addition, remedial action is also being contemplated for Consolidated Slip at the POLA. While sediment characterization in the Consolidated Slip is still underway, preliminary estimates indicate that about 400,000 to 800,000 m^3 are contaminated, not including the upstream Dominguez Channel sediments.

The projected maintenance dredging rate of 44,000 m^3 per year and capital improvement dredging rate of 1.38 million m^3 are lower than historical rates. Between 1978 and 2002, the average maintenance dredging rate was 85,000 m^3 per year. The capital improvement dredging rate was estimated to be 3.4 million m^3 per year from 1980 to 1997.

3.3.2.3 Port of Long Beach

Similar to the POLA, the POLB has a fairly accurate projection of their dredging and disposal needs due to maintenance dredging and capital improvement projects over the next four to five years (2004 to 2008). A summary of these anticipated maintenance dredging and capital improvement projects over the next five years is listed in Table 3-10. The total volumes presented in the table include portions generated from landside cutting or shoreline excavation (shown in parentheses under the contaminated volume). Strictly speaking, these are not dredging activities, but the cut volumes are included because they add to the need of identifying disposal sites for the Region.

Table 3-10
Projected Future Dredging of Sediment Quantities in the Port of Long Beach

Year [1]	Total Volume (m^3)	Contaminated Volume (m^3)	Dredging Location	Comment
2004	841,000	650,000	Pier T Wharf Extension, Phase 2	Capital Improvement (2005) [3]
	321,000	268,000	Back Channel Navigation Safety Improvements	Capital Improvement
	153,000	153,000	On-Going Maintenance Dredge (5-yr permit June 30, 2003-2008)	Maintenance (2008) [3]
2005	1,223,000	(1,050,000) [2]	Pier S Dike Realignment & Berth	Capital Improvement
	765,000	0	Main Channel Deepening Phase II & Turning Basin Widening	Capital Improvement
2006	77,000	77,000	Pier T Berth T126 LNG Terminal to –50 ft, MLLW	Capital Improvement (2007) [3]
	593,000	153,000	Pier T Berth T124 Liquid Bulk Terminal to –80 ft, MLLW	Capital Improvement (2007) [3]
	765,000	(765,000) [2]	Pier E Slip 3 Widening	Capital Improvement (2007) [3]
Undefined[4]	306,000	306,000	DTSC/Navy Mandated Cleanup of AOEC-A	Capital Improvement
	1,147,000	(1,147,000) [2]	Pier F South Tip Removal	Capital Improvement

Note: Estimated dredge volumes at the time of report preparation. This information is provided for reference purposes only.
1. Year indicates first year of estimate schedule for Capital Improvements.
2. Shoreline Excavation.
3. Expected Completion Date.
4. Undefined but expected to be within five years.

The POLB estimates a total maintenance dredge volume of 153,000 m^3 (200,000 cy) between 2004 and 2008 resulting in a maintenance dredging rate of 31,000 m^3 per year. For planning purposes, all sediments from maintenance dredging are considered contaminated. The total projected sediment volume from capital improvement projects (dredging and shoreline excavation) is estimated to be 6 million m^3 (8 million cy) for a rate of 1.2 million m^3 per year. The contaminated portion from capital improvement projects is estimated at 4.4 million m^3 (5.8 million cy) for a rate of 873,000 m^3 per year. The total five-year projected dredge volume for both maintenance and capital improvements is 6.2 million m^3 (8.1 million cy) with a rate of 1.24 million m^3 per year. Of the total volume, 74 percent is contaminated for a volume of 4.6 million m^3 (6 million cy).

Compared to the POLA, the POLB had an average annual maintenance dredging rate of approximately 71,000 m^3 per year and an average dredging rate for capital improvement projects of approximately 644,000 m^3 per year from 1976 to 2003.

Additional dredging projects that may occur after Year 2008 include Pier S Berth 100 Wharf, Pier F South Lumber Terminal, and Mandated IR Site (West Basin) cleanup that may generate 638,400 m^3 (835,000 cy) of contaminated sediment.

3.3.2.4 Los Angeles River Estuary

USACE and the City of Long Beach estimate that the need for maintenance dredging at the LARE at about 53,000 m^3 (69,187 cy) per year. It is estimated that 25 percent of the total will be contaminated. Currently, there are no methods to separate the contaminated fraction from the total dredged volume. Thus, the entire quantity would be required to be treated as contaminated. The City of Long Beach is currently considering an expansion project at the downtown shoreline marina which may require the use of fill material. If this project were to move forward it may provide a disposal location for some of the projected dredge material from the LARE.

The estimated dredging need is expected to continue until sediment control BMPs are implemented within the Los Angeles River watershed to achieve the total maximum daily loads (TMDLs) that will be established in the future. BMPs to reduce sediment and contaminants have been installed and will continue to be implemented in portions of the watershed. It is difficult to determine when these BMPs will be fully in-place and what impact it will have on the sediment load to the LARE.

3.3.2.5 Alamitos Bay

For the future dredging and disposal needs for Alamitos Bay, the City of Long Beach expects to continue the annual maintenance dredging of the entrance channel. Historical maintenance dredging records for Alamitos Bay indicate an average annual dredging rate of approximately 14,000 m^3 (18,276 cy) per year. The City of Long Beach is also planning a capital improvement project of the Alamitos Bay Marina. This project is expected to generate 153,000 m^3 (200,000 cy) of sediment over three years and it is expected that one-fourth of the total volume (39,000 m^3 or 50,911 cy) will be contaminated.

3.3.2.6 Projected Future Contaminated Sediment Summary

Future quantity of contaminated sediments for the CSTF Study Area has been estimated based on projected dredging and disposal needs and historical dredging records. Projections obtained from USACE, POLA, POLB, and the City of Long Beach for maintenance and capital improvement needs reflect relatively accurate quantities of contaminated sediment expected to be generated. A summary of the projected contaminated sediment quantities are shown in Table 3-11. These estimates do not account for potential sediment source reductions attributed to source control measures being implemented in the various watersheds.

Table 3-11
Summary of Projected Contaminated Sediment Quantities

	Average Annual Maintenance Dredging Rate		Capital Improvement Dredging	
Location	**Total**	**Contaminated**	**Total**	**Contaminated**
Marina del Rey	50,000 – 100,000 m^3	1/4 – 1/3	0	0
Port of Los Angeles	44,000 m^3	44,000 m^3	2,576,000 m^3 over 6 years	1,375,000 m^3 over 6 years
Port of Long Beach	31,000 m^3	31,000 m^3	6,038,000 m^3 over 5 years	4,416,000 m^3 over 5 years
Los Angeles River Estuary	53,000 m^3	53,000 m^3	0	0
Alamitos Bay	14,000 m^3	0	153,000 m^3 over 3 years*	39,000 m^3 over 3 years*

Note: Estimated dredge volumes at the time of report preparation. This information is provided for reference purposes only.
* One-time event.

3.4 Sources of Contaminants

Primary sources of contaminated sediments to the coastal waters of the Region include historical contamination, marine vessel activities, port operations, and, most-significantly, storm water runoff. This section discusses historical and current sources of contaminants to the Study Area. Historical sources are defined in this document as those sediments initially deposited historically, but that remain in the environment. In some cases (e.g., the Consolidated Slip), a historical source can become a new source if the historical sediments are available for remobilization and/or transport to other areas.

3.4.1 Historical Sources

Primary historical sources of contaminants to the Study Area include ports, marinas, and storm water runoff. Storm water runoff includes both point source discharges into storm drains leading to the Study Area and non-point discharge from surface street runoff into collector drains. Wastewater treatment plant discharges can also be included in this category.

3.4.1.1 Ports and Marinas

Ports and marinas share some aspects that contribute to elevated concentrations of contaminants in sediments while others aspects are specific to each. The POLA and POLB have a history of a variety of land uses relating to the transfer of fishery resources, bulk liquid and solid cargo, and passengers between land and vessels. The Ports have been designed to facilitate these transfers, and commensurate development of shoreline infrastructure to support fueling, cargo and passenger transfer from vessel to overland transport, and shipbuilding/ship repair has been developed over the past century. Release of contaminants over the past century due to a combination of accidental release, ignorant pollution (especially prior to approximately 1960), and intentional discharges, combined with the scale of the Ports' operations, has resulted in the accumulation of contaminants in harbor sediments. Large areas within the ports historically impacted by these releases have been dredged over the past 20 years due to channel and berth development projects and shoreline construction activities.

Marinas in the CSTF Study Area have had a more limited use compared to the two main Ports. Historically, sediment contamination in marinas can be attributed to releases from commercial and private vessels, their proximity to points of storm water discharge, and low circulation environments. Operationally, the marinas contribute to sediment contamination through the actions of a minority of boaters whose poor "housekeeping practices" result in the release of contaminants such as fuel, lubricating oils, bilge water, and debris. Boat anti-fouling paints also contribute contaminants (especially organotins and heavy metals) to the environment via leaching (Schiff et al. 2003) and from the release of sanding dust. Specific sites within marinas, such as boatyards or fuel docks, may contribute pollutants at a disproportionate rate and may function as point sources of specific contaminants.

Historical releases of contaminants into the environment in some cases result in ongoing impacts well beyond the time of discharge due to the persistence of organic chemicals such as organochlorine pesticides and PCBs. Likewise, heavy metals generally are stable when incorporated in sediments, and remain a potential ongoing source in the event of sediment mobilization.

3.4.1.2 Watersheds

Storm water runoff from the watersheds in the region is known to be the predominant historical source of contaminated sediments to the coastal waters of the Region. Runoff flow during major storms carry sediments eroded or mobilized from the watersheds to the coast through major streams. The sediments tend to settle and form shoals at the river mouths where major navigation channels are often located. While portions of the sediment bypass the navigation channels and join the natural littoral processes along the coast, the sediments that deposit into the navigation channels eventually create navigation hazards and require management through maintenance dredging. Historically, significant volumes of sediment that typically shoal up navigation channels in Marina del Rey Harbor and the LARE contained chemical concentrations deemed unacceptable for unrestricted open water disposal.

The primary historical contaminant point source important on a regional basis is the discharge of treated municipal wastewater offshore onto the Palos Verdes Shelf and into Santa Monica Bay. Discharge from the Los Angeles County Sanitation Districts' ocean outfalls has resulted in a 6-hectare (17-acre) area of sediments contaminated with 100 metric tons of DDTs and 10 metric tons of PCBs. The discharge of wastewater and sludge (now terminated) from the City of Los Angeles has resulted in areas of sediment contamination and biological impacts within Santa Monica Bay.

In addition to periodic maintenance dredging, dredging of contaminated sediments for remediation purposes as a result of storm water runoff is expected to occasionally occur in the region. This will produce additional quantities and add to the regional loading rate of contaminated sediments requiring management. One example is the proposed remediation of the Dominguez Channel/Consolidated Slip in the Los Angeles Harbor, which could generate well over 76, 000 m^3 (100,000 cy) of contaminated sediment.

3.4.2 Current Sources

3.4.2.1 Marine Vessel Activities

Marine vessel activities in and around regional harbors contribute contaminated particulates to the bottom sediments in the coastal waters of the Region. Release of contaminated particulates can be associated with the sloughing, sanding, and scraping of antifouling vessel bottom paints, spillage of oil and wastes, and corrosion and disintegration of metal components on vessels, among other causes. Released contaminated particulates tend to settle at the bottom in and around harbors and, particularly, at berthing locations.

Typical contaminants associated with the particulates include tributyltin (TBT), metals and PCBs from antifouling paints, PAHs from oil spillage, bacteria from boat wastes, and metals from corroded fragments of vessel metal components. Although the particulate fractions of contaminant loadings from marine vessel activities in the regional harbors have not been quantified or estimated, prior studies have indicated that the total loadings of contaminants from marine vessel activities are comparable to the combined loadings from wastewater plants and runoff in the Region for certain constituents (SCCWRP 1973 and SMBRP 1994a). It is, therefore, expected that marine vessel activities can be a significant source of contaminated sediments in regional harbors (Soule and Oguri 1987 and SMBRP 1994a). Further study, however, is needed to provide loading estimates for the particulate fractions of the total contaminant releases from marine vessel activities.

3.4.2.2 Port Operations

Port operations in the LA/LB Harbors contribute contaminated particulates to the coastal waters in San Pedro Bay. Industrial activities such as cargo handling and heavy machinery operations at the shipping terminals tend to release contaminated particulates to the harbor waters either directly, by wind, or as runoff. Contaminated particulates can originate from spillage of oil, chemicals, and operational wastes, spillage from bulk cargo, and industrial dusts. Wind transports the contaminated particulates on the ground at terminals and wharves into the harbor waters on a year-round basis. Storm water runoff washes the contaminated particulates into the harbors through local drains during storm events. The contaminated particulates released into the harbor waters tend to settle and accumulate on the harbor bottom, especially in the inner harbors where tidal flushing is typically weak.

Historically, sediments in the LA/LB Harbors were found to be contaminated at numerous locations including the Southwest Slip and Consolidated Slip in the Los Angeles Harbor, and the Southeast Basin, West Basin, and Pier J in the Long Beach Harbor (SWRCB 1998). A total of approximately 1.5 million m^3 (2 million cy) of contaminated sediments were dredged from the POLB Pier T in 1999 for capital improvement (USACE 2003b). Industrial or military port operations are a common contaminated sediment-producing attribute of the contaminated sites in the harbors. With the possible exception of the Consolidated Slip in the Los Angeles Harbor, where sediment contamination has been largely attributed to the storm water runoff from the Dominguez Channel, historical port operations are a potentially major source of contamination at terminal sites within the harbors where sediments were found contaminated.

3.4.2.3 Watersheds

Discharges to the estuarine and marine environments via storm water pathways contribute a variety of contaminants to sediments within the Study Area. Storm water discharge into the coastal environment is probably the single most important ongoing process impacting the sediment quality within the Study Area. Major storm water discharge areas associated with contaminated sediment within the study area include Ballona Creek, Dominguez Channel, the Los Angeles River, and the San Gabriel River. A map showing these four watershed areas is provided in Figure 3-1.

<u>Ballona Creek Watershed</u>

Ballona Creek is a nine-mile long flood protection channel that drains an area of approximately 337 square kilometers (130 square miles). The major tributaries include Centinela Creek, Sepulveda Canyon Channel, Benedict Canyon Channel, and numerous storm drains.

Ballona Creek is designed to discharge to Santa Monica Bay approximately 2,022 m^3 per second (m^3/sec) (71,400 cubic feet per second [cubic ft/sec] from a 50-year frequency storm event. The watershed is comprised of all or parts of the cities of Beverly Hills, Culver City, Inglewood, Los Angeles, Santa Monica, West Hollywood, and unincorporated Los Angeles County (LACDPW 2003a). Approximately 90 percent of the watershed is developed.

<u>Dominguez Channel Watershed</u>

The Dominguez Channel Watershed is comprised of approximately 285 square kilometers (110 square miles) and defined based on systems of storm drains and smaller flood control channels. The watershed is highly urbanized with 96 percent of the area developed (LACDPW 2003a) including transportation and industrial land uses.

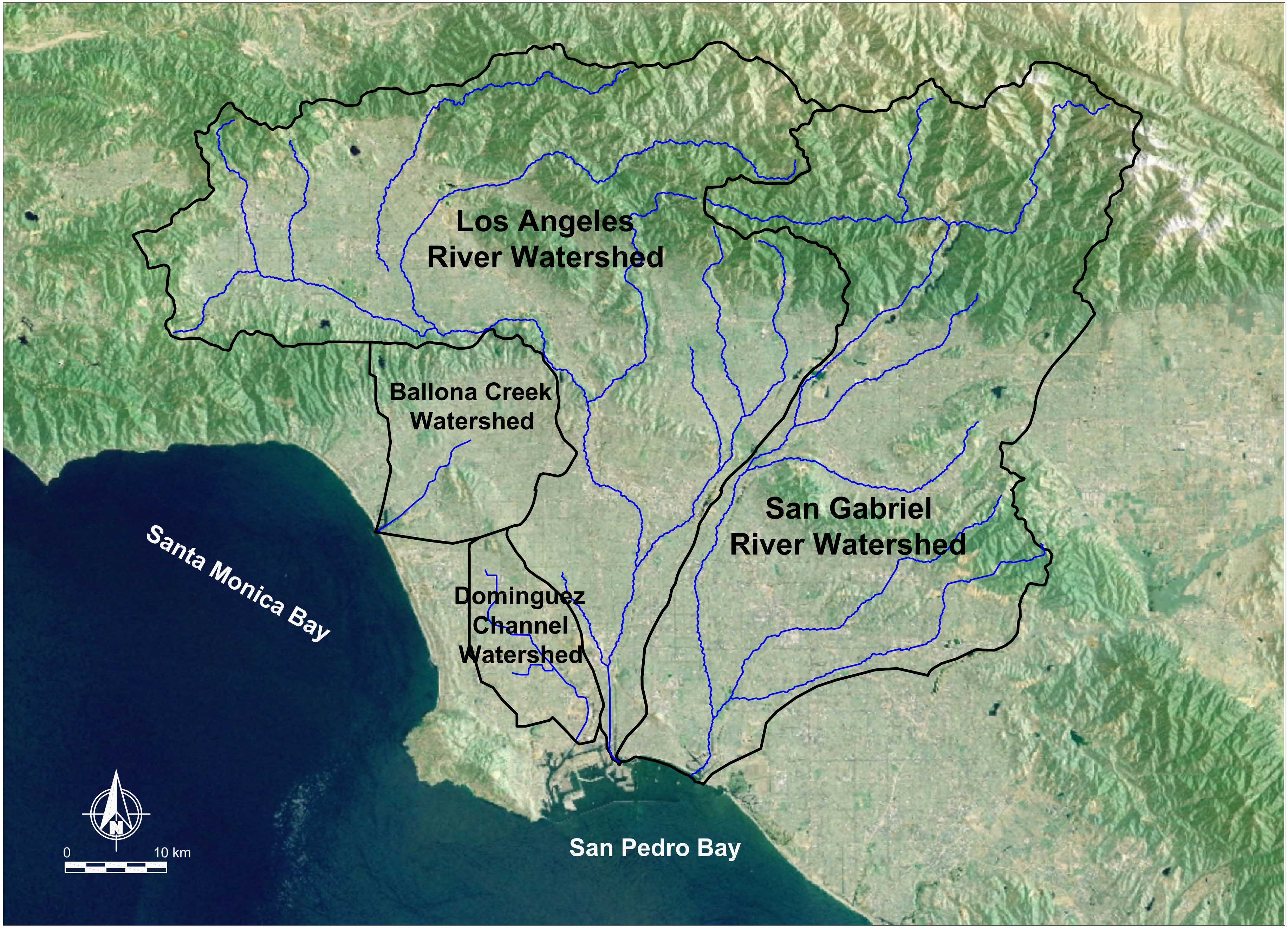

Figure 3-1
Major Watersheds in the CSTF Study Area

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The Dominguez Channel Watershed Management Area (WMA) defined by the LARWQCB includes both the Dominguez Channel Watershed and drainage area for the inner LA/LB Harbor Complex. The Dominguez Channel receives about half of the 141 National Pollutant Discharge Elimination System (NPDES) general permit discharges in the WMA and the remaining are discharged into the inner LA/LB Harbor Complex. Major dischargers in the WMA include a secondary-treated effluent of a publicly owned treatment works (POTW), two generating stations, and six refineries. There are additional 424 discharges under the general industrial storm water permit and 115 sites with construction storm water permits. Majority of the industrial and construction discharges are located within the Dominguez Channel Watershed in the cities of Gardena, Wilmington, Torrance, and Carson and include warehousing, auto wrecking, and metal plating facilities (LARWQCB 2001).

Los Angeles River Watershed

The Los Angeles River Watershed drains an area of over 2,135 square kilometers (824 square miles) from the eastern portions of Santa Monica Mountains, Simi Hills, and Santa Susana Mountains to the San Gabriel Mountains in the west. The upper portion of the watershed is covered by forest or open space in the mountainous Angeles National Forest, while the remaining portion is highly developed with commercial, industrial, or residential land uses. The formerly free flowing Los Angeles River was channelized between 1914 and 1970 to control runoff and reduce the impacts of major flood events in the region. Today, 94 percent of the Los Angeles River is lined (77 kilometers out of 82 kilometers).

Tributaries in the San Fernando Valley include the Pacoima and Tujunga Wash flow from the San Gabriel Mountains and the Burbank Western Channel and Verdugo Wash flow from the Verdugo Mountains. The Los Angeles River bends around the Hollywood Hills towards Griffith and Elysian Parks and then turns southwards through the Glendale Narrows, where a high water table prevented concrete lining. South of the Glendale Narrows, the river is again a concrete channel joined by the Arroyo Seco (which drains portions of Pasadena and the Angeles National Forest), Rio Hondo, and Compton Creek Tributaries. The Los Angeles River is hydraulically connected to the San Gabriel River via the Rio Hondo through the Whittier Narrows

Reservoir during large storm events. The concrete-lined channel continues until reaching Willow Street in Long Beach where the channel has a soft bottom and concrete sides and where tidal influence begins. The LARE continues for three miles before joining San Pedro Bay at Queensway Bay. There are 22 lakes or retention basins within the Los Angeles River Watershed including Devil Gates Dam, Hansen Basin, Lopez Dam, Pacoima Dam, and Sepulveda Flood Control Basin (San Fernando Valley). There are also a number of spreading grounds including sites at Dominguez Gap, the Headworks, Hansen Dam, Lopez Dam, and Pacoima Dam (RWQCB 2001).

Prior to channelization[3], the Los Angeles River had intermittent flow during much of the year with many of its tributaries only reaching the river during storm events. The current flow in the river is effluent dominated (majority of low flow from wastewater treatment) with approximately 80 percent originating from dischargers and 20 percent of flow coming from storm drain runoff and ground water reaching the surface. Water quality is impaired primarily in the middle and lower portions of the watershed due to runoff from the commercial, industrial, residential, and other urban land uses (LACDPW 2003b). There are 147 permitted discharges directly into the Los Angeles River, including four wastewater treatment plants. There are 1,307 dischargers under the general industrial storm water permit with the largest numbers from the cities of Los Angeles, Vernon, South Gate, Long Beach, Compton, and Commerce. A large portion of the discharges are from metal plating, warehousing, auto wrecking, and recycling businesses. In addition, there are 204 construction sites under construction storm water permits primarily located in the San Fernando Valley (LARWQCB 2001).

San Gabriel River Watershed

The 1,785-square kilometer (689-square mile) San Gabriel River Watershed starts in the San Gabriel Mountains in the Angeles National Forest. The upper portion of the watershed is primarily riparian and woodland habitats and open space with areas of high recreational use. In addition, there is a series of flood control dams or reservoirs that require frequent removal of deposited sediments to preserve the flood control capacities. Larger spreading grounds for ground water recharge are

[3] Straightening and lining with concrete to maximize flow.

located in the middle portion of the San Gabriel River Watershed. The San Gabriel River is hydraulically connected to the Los Angeles River via the Rio Hondo through the Whittier Narrows Reservoir during large storm events. The lower portion of the San Gabriel River is concrete-lined through the highly urbanized areas of the County (LARWQCB 2001). The major tributaries to the San Gabriel River include Walnut Creek, San Jose Creek, Coyote Creek, and numerous storm drains (LACDPW 2003b).

Thirty-nine of the 109 NPDES permittees discharge directly into the San Gabriel River, 21 into Coyote Creek and 12 into San Jose Creek. There are 10 major NPDES dischargers including four POTWs. There are 534 dischargers under the general industrial storm water permit, mostly in the cities of Industry, Irwindale, Pomona, and Santa Fe Springs. A large portion is from auto wrecking, lumber, metal plating, trucking, and die casting businesses. In addition, there are 175 construction sites under the construction storm water permit (LARWQCB 2001).

The Los Cerritos Channel and Alamitos Bay WMA is situated between the southern end of the Los Angeles and San Gabriel Rivers. The Los Cerritos Channel is concrete-lined above the tidal influence (Anaheim Road) and drains a small dense urban area of east Long Beach. The channel empties into the Los Cerritos Wetlands, which connects to Marine Stadium and Alamitos Bay. To the northwest of Marine Stadium, Colorado Lagoon receives discharges from five storm drains and is tidally connected to Marine Stadium via a culvert. Marine Stadium is a recreational facility connected to Alamitos Bay, and empties into the Pacific Ocean adjacent to the San Gabriel River. The Los Cerritos Channel has a small hydraulic connection to the San Gabriel River due to a power plant intake within Alamitos Bay Marina and discharges into the San Gabriel River Estuary. There are 12 permittees under the general NPDES permit that discharge into the Los Cerritos Channel or Alamitos Bay. In addition, there are two municipal storm water permits, 17 dischargers under an industrial storm water permit that include aircraft or watercraft production or maintenance in Long Beach, and 15 construction sites under the construction storm water permit (LARWQCB 2001).

Storm Water Runoff

Storm water runoff as a major source of sediments to the coastal waters in the Region comes from numerous upland sources including human activities, natural processes associated with land uses, and point dischargers. Land use related sediment sources are normally analyzed based on loading rates developed from monitoring or modeling studies. Sediment loading from point source discharge is generally documented through the NPDES reporting procedures. While point source dischargers primarily contribute fine particulates to coastal sediments and are generally the dominant sediment producer during dry seasons, storm water runoff from upland source areas under wet weather conditions produce the bulk of the sediments that shoal up the coastal navigation channels in the Region.

The primary sources of total sediment production in the watersheds of the Region include transitional lands (construction and development), foothills, canyons, and burned areas. Over one hundred debris basins are presently in place at the outlets of canyons and foothills to trap eroded sediment and thus reduce sediment delivery to the coast. In addition, over 200 soil stabilization structures were constructed and are functioning to prevent erosion in the canyons. Emergency structures have also been constructed downstream of burned areas in the watersheds to trap eroded sediment and debris.

It has been recognized based on sediment quality data from regional dredging areas that it is the fine-grained fraction of the sediment deposits that is frequently contaminated and creates management problems. Unlike coarse sediments, which tend to originate from pervious, erodible surfaces in the watersheds, such as foothills and canyons, fine sediments are more ubiquitous and can derive in significant quantities from urban commercial and industrial areas, where exposure to contamination is generally much higher than in foothill areas. Fine sediment loading from various land uses in the watersheds of the Region is, therefore, of great importance in identifying contaminated sediment source areas. A recent study conducted by the Southern California Coastal Water Research Project (SCCWRP) for the CSTF (SCCWRP 2003) examined mass emissions of total suspended solids (TSS) from various land uses in regional watersheds based on long-term, land use-based monitoring data from the Los Angeles County Department of Public Works (LACDPW) (LACDWP 2000 and 1998 to 2002). Table 3-12 presents the results of the study on wet weather TSS loadings from various land uses in the Los Angeles River Watershed.

Table 3-12
Distribution of Wet Weather TSS Loading Distribution: Los Angeles River Watershed

Total (tons/year)	Agriculture %	Commercial %	Industrial %	Residential %	Open %	Other %
39,742	3.9	11	24	22.1	38.5	0.5

The results indicate that approximately 57 percent of the total 36,053 metric tons/year (39,742 tons/year) of suspended solids emitted from the Los Angeles River Watershed originate from urban areas. This includes approximately 35 percent generated from industrial and commercial areas where exposure to contamination by metals, PCBs, and PAHs is typical, and 22 percent from residential areas where contamination by pesticides, herbicides and bacteria is common. Open areas including foothills and canyons produce approximately 39 percent of the total volume, which may be relatively uncontaminated compared with those from urban areas. Contamination by chemicals including pesticides and herbicides can also be of concern for fine sediment from agricultural areas, although it represents a relatively small 3.9 percent of the total loading.

3.5 Current Source Controls – Watershed Management Plans

Watershed management programs are being developed and implemented in the County on a regional and watershed basis. Most of the programs were developed with objectives that are not specific to contaminated sediments. However, since general improvement of water quality and reduction of contamination levels within the watersheds would reduce the exposure of sediments to contaminants, the implementation of these general management programs is compatible with, and beneficial to, the CSTF's mission-specific goal of contaminated sediment reduction on a long-term basis.

3.5.1 Regional Programs

3.5.1.1 Los Angeles Region Watershed Management Initiative

The Los Angeles Region Watershed Management Initiative (WMI) is a regional watershed management program conducted by the LARWQCB. The primary objective of the program is to integrate various surface and ground water regulatory programs, promote cooperative, collaborative efforts within individual watersheds, prioritize issues, and apply sound science in watershed management. Under the program, the LARWQCB has identified watersheds for management, prioritized management issues, and developed watershed management strategies as published in the Integrated Plan for the Implementation of the WMI (a.k.a. watershed management plan), which is updated annually. The plan identifies watersheds in the Region as WMAs. For each WMA, the plan provides detailed, annually updated summaries of water quality problems and management issues, and lists the 303(d) water quality limited waters, TMDL schedules, permits, and stakeholders.

3.5.1.2 Water Quality Control Plan (Basin Plan)

The Basin Plan for the Region was developed following the enactment of the Porter-Cologne Water Quality Control Act (California Water Code) in 1969 by the RWQCB. With the first interim plan adopted in 1971, which consolidated all existing water quality objectives and policies into one document, the Basin Plan has been amended over the years and reviewed on a triennial basis as required by the Porter-Cologne Water Quality Control Act and Section 303 (c) of the Clean Water Act (CWA). The primary objective of the Basin Plan is to preserve and enhance water quality and protect the beneficial uses of all regional waters. The Basin Plan designates beneficial uses for surface and ground waters, sets narrative and numerical objectives that must be attained or maintained to protect the designated beneficial uses and conform to the state's anti-degradation policy, describes implementation programs to protect all waters in the region, and documents all applicable plans and policies. The triennial review process provides the opportunity to identify high priority basin planning issues for the next three years, and review the State's water quality objectives on a triennial basis as required by Section 303 (c) of the CWA. The revisions resulting from reviews on a triennial or as-needed basis are implemented as amendments to the plan.

3.5.1.3 Total Maximum Daily Load Program

The TMDL program for the Region is being developed and implemented jointly by the LARWQCB, SWRCB, and EPA, and scheduled to be completed by 2011 as required by a consent decree signed in 1999 (Heal the Bay et al. v. Browner, Case No. 98-4825 SBA). The primary objective of the program is to develop and implement TMDLs for all pollutant-impaired water segments in the Region to attain state water quality standards. The TMDLs will be adopted as Basin Plan amendments. The LARWQCB has developed a TMDL development strategy (LARWQCB 2002) with the goals of increasing efficiency and enlisting the cooperation of stakeholders during TMDL development and implementation. At the core of the strategy is a master TMDL development schedule that lists by watershed, the impaired water segments, pollutants, and timelines for technical TMDL development, Implementation plan development, and Basin Plan amendment. Table 3-13 presents the projected completion schedule of TMDL activities for Marina del Rey, Ballona Creek, Dominguez Channel, POLA, POLB, Los Angeles River, Los Cerritos Channel and Alamitos Bay, and San Gabriel River (LARWQCB 2001).

Table 3-13
Draft TMDL Development Schedule for Completion

WMA	Bacteria	Metals	PCBs, DDT, and other sediment associated pesticides
Marina del Rey	2003-04	2004-05	2003-04
Ballona Creek	2003-04	2003-04	2004-05
Los Angeles River	2001-02	2003-04	2010-11 (Sepulveda Basin)
Dominguez Channel and POLA/POLB	2002-03	2006-07	2007-08 (includes PAHs)
Los Cerritos Channel and Alamitos Bay	2004-05 (Los Cerritos Channel)	2004-05 (Colorado Lagoon & Los Cerritos Channel)	2004-05 (Colorado Lagoon)
San Gabriel River	2002-03	2004-05	2005-06 (Puddingstone Reservoir)

Source: RWQCB 2001.

TMDLs have been developed for trash, bacteria, and nutrients for Ballona Creek and Los Angeles River. The Ballona Creek TMDL for metals and organics and the Los Angeles River TMDL for dissolved metals will be considered for adoption in July 2004. The Marina del Rey metals and organics TMDL could be ready for consideration in 2005. The Dominguez Channel TMDLs will take a couple more years for development. Full compliance (i.e. water quality improvements) with the TMDL requirements may require up to 17 years and significant water quality improvements will probably not occur within the next five years. More research is required for TMDL development for sediment-based impairment listings due to data gaps in understanding sediment fluxes and the associated contaminant transport.

In efforts to comply with both the NPDES and TMDL requirements, the LACDPW and the individual cities have also installed end-of-the-pipe BMPs for storm water. The BMPs that have been installed by various agencies are catch basin inserts, vortex separators (or gross pollutant separators), oil separators, infiltration/filtration devices, low flow diversion systems, and combination systems. The most common types are the catch basin inserts and vortex separators. Catch basin inserts, also called drain inserts, are manufactured filters or fabric placed inside of a drop inlet to remove sediment and debris. The various types of inserts fall within three categories: socks, boxes, and trays. The targeted constituents are sediment, nutrients, trash, metals, oil and grease, and organics. Advantages include easy access for inspection and maintenance and relatively inexpensive retrofit option. Disadvantages include clogging and limited applicability to large areas. Vortex separators or swirl concentrators are gravity separators that move water in a centrifugal motion. Targeted constituents are sediment (medium effectiveness), nutrients (low effectiveness), trash, metals (low effectiveness), oil and grease, and organics. Vortex separators offer desired performance in less space and cost, but are not effective for fine sediments and dissolved pollutants (CASQA 2003). Typical types of vortex separators are the Continuous Deflection Separator (CDS) and Stormceptor System. Installation of BMPs is discussed below for each major watershed.

3.5.1.4 Non-Point Source Program

The NPS program is a non-point source management program administered by the LARWQCB as part of the California Non-Point Source Pollution Control Program. The primary objective of the program is to improve water quality by implementing the management measures identified in the California Management Measures for

Polluted Runoff Report by 2013. The major current priorities of the program include oversight of work plans for the federally funded CWA Section 319 (h) (non-point source management) projects, establishment of regional strategies on agriculture, marinas, and septic tanks in areas of dense population and areas of ground water use as source of drinking water, investigation of loading contributions from agriculture, nurseries, golf course, and horse stables to assist in TMDL development, and expansion of public education and outreach.

3.5.1.5 Standard Urban Storm Water Mitigation Plan

The Standard Urban Storm Water Mitigation Plan (SUSMP) for the Region was developed and implemented by the County to fulfill the requirements under the 2001 NPDES permit issued to the County and 85 incorporated cities by the LARWQCB. Exceptions to this permit include the City of Long Beach, which has its own municipal storm water permit issued by the LARWQCB in January 1999. Approved by the LARWQCB in 2000, the SUSMP is a guidance document that designates best management practices that must be incorporated in specified categories of new development and redevelopment projects to control and mitigate storm water pollution. The co-permittee cities are required to use the plan as the model for developing their own urban storm water mitigation plan approval programs. A developer that triggers the SUSMP requirement is required to submit an Urban Storm Water Mitigation Plan that includes the BMPs required by the city in which the development is located. The City of Long Beach has also adopted similar requirements within the SUSMP and the Long Beach Storm Water Management Program (LBSWMP) being implemented for compliance with the Long Beach NPDES permit.

3.5.1.6 CSTF

As described in Section 1, the CSTF was established under the authority of SB 673 authored by Senator Karnette of Long Beach and signed into law by Governor Wilson in 1997. As a multi-agency task force, the CSTF includes representatives from the USACE, EPA, California Coastal Commission (CCC), LARWQCB, CDFG, National Oceanic Atmospheric Administration Fisheries (NOAA Fisheries), POLB, POLA, City of Long Beach, Los Angeles County Beaches and Harbors, Heal the Bay, and other interested parties. The primary mission of the CSTF is to prepare a long-term management plan for the dredging and disposal of contaminated sediments from the coastal water of the Region (i.e., this document). Aside from considering aquatic and upland disposal alternatives, treatment, beneficial reuse and other management methods, the plan includes a contamination source control and reduction component. The CSTF created five Strategy Development Committees to prepare specific parts of the long-term management plan addressing, respectively, sediment thresholds, upland disposal and beneficial reuse, aquatic disposal and dredging operations, watershed management and source reduction, and implementation. A study on contaminant mass emissions from major streams of the Region and contaminant contributions from various land uses has been completed (SCCWRP 2003). A storm water quality database is also being constructed to assist in the development of management strategy.

3.5.2 Watershed Specific Programs

3.5.2.1 Ballona Creek Watershed

The Ballona Creek Watershed is comprised of all or parts of the cities of Beverly Hills, Culver City, Inglewood, Los Angeles, Santa Monica, West Hollywood, and unincorporated Los Angeles County. Individual cities within the watershed, primarily Santa Monica and Los Angeles, have started to implement source control measures such as structural BMPs.

In 2001, the Santa Monica Urban Runoff Recycling Facility (SMURRF) began treatment of dry weather runoff. Treatment processes are: coarse and fine screening to remove trash and debris, dissolved air floatation (DAF) to remove oil and grease, degritting systems for sand and grit, micro-filtration to remove turbidity, and ultra-violet radiation to kill pathogens. SMURRF meets California Title 22 Standards for treated wastewater (since no criteria are established for treated urban runoff) and the LARWQCB has determined that SMURRF is to be considered a treatment BMP to reduce pollutants in dry-weather flows. The SMURRF has an average design flow of 0.5 million gallons per day (mgd) and a peak flow rate of 0.75 mgd from the Pico-Kenter (1,405-hectare [4,200-acre] drainage area) and Santa Monica Pier (900 acre drainage area) storm drains. Treated water is reused for landscape irrigation and dual-plumbed systems (City of Santa Monica 2000).

The City of Santa Monica has also installed hundreds of BMPs throughout the City. Approximately 100 catch basin inserts have been installed at 20 different locations and have been in place for approximately three years. There have also been approximately 100 DrainPac catch basin inserts installed and 185 catch basin screens. There are three CDS units near the intersection 26th Street & Michigan, the Pico-Kenter storm drain, and at a parking lot east of the Santa Monica Pier. At City facilities, there are catch basin inserts at the Big Blue Bus Facility and at the City yard trash transfer station. Additional BMPs being planned by the City of Santa Monica include the following (Shapiro, personal communication).

- Replacement of the existing 100 catch basin inserts over the next year
- 200 automatic catch basin screens (screen lifts during storm events)
- Additional vortex type units in the City of Santa Monica
- Two sanitary sewer low flow diversions at the end of Montana and at the end of Wilshire
- Two stage BMPs with vortex type and filtering system at the eastern end of the City of Santa Monica that ultimately drains into Ballona Creek

The City of Los Angeles is in the progress of conducting the Structural Trash Control System Project to construct and install various trash capture and pollution reduction devices to meet Ballona Creek TMDL requirements. The project includes installing 200 catch basin screen covers and inserts throughout the Ballona Creek watershed. Full capture systems (e.g. CDS units) are to be installed at three locations, intersection of Nicolet Avenue and Coliseum Street, intersection of 1st Street and Western Ave in Hancock Park, and Martin Luther King Jr. Blvd between Van Ness and Wilton Place in Leimert Park. The project will also include trash netting systems (Bureau of Sanitation 2003).

The City of Beverly Hills has inserted nine catch basin inserts throughout the city and plans to install additional catch basin inserts. There are no plans for other types of BMPs due to the low flow quantity. LACDPW has also installed a CDS unit in a residential area of Beverly Hills (Chee, personal communication). Culver City is planning on installing a CDS unit (Torres, personal communication). LACDPW has already installed 2 CDS units and several catch basin inserts in Culver City (Torres, personal communication). The City of West Hollywood has installed 53 catch basin screens and plans to install additional catch basin screens (Harmon, personal communication).

Watershed management programs specific to Ballona Creek include the following: Bay Restoration Plan, Ballona Creek Watershed Management Plan, Ballona Creek and Marina del Rey Sediment Management Plan, and the Clean Marina and In-Water Hull Cleaner Certification Program. Each is described in the following sections.

Bay Restoration Plan

Governor Wilson approved the Bay Restoration Plan for Santa Monica Bay and its watersheds, including the Ballona Creek Watershed, in 1994, and EPA Administrator Browner approved it in 1995. The Santa Monica Bay Restoration Commission (SMBRC), an independent state agency formerly known as the Santa Monica Bay Restoration Project (SMBRP) within the LARWQCB, administers the Bay Restoration Plan (SMBRP 1994b). The primary objective of the plan is to address critical problems, such as storm water and urban runoff pollution, and the resultant beneficial use degradation. The plan identifies approximately 250 actions, including 74 priority actions, specific programs, implementers, timelines, and funding needs to achieve the objectives. In keeping with the objectives of the plan, the SMBRC has funded multiple projects that reduce pollutants entering the bay. Recent Proposition 12 (the Safe Neighborhood Parks, Clean Water, Clear Air, and Coastal Protection Bond Act of 2000) funded projects include Ballona Creek Litter Monitoring and Collection Project, Ballona Creek Water Quality Improvement Project, Pollutant Removal Devices in the Storm Drain System, and Catch Basin Debris Excluder Devices.

Ballona Creek Watershed Management Plan

The Ballona Creek Watershed Management Plan is being developed by the County, SMBRC, Ballona Creek Renaissance, and City of Los Angeles under the oversight of the LARWQCB. The primary objective of the plan is to address urban runoff pollution, pathogens, trash and toxic chemical loadings, and habitat loss and degradation, and to set forth pollution control and habitat restoration actions needed to achieve an ecologically healthy watershed. Funded by a Proposition 13 grant, the plan will include a watershed monitoring program and provide the County and stakeholders specific projects to improve water quality and restore habitat area within the watershed.

Ballona Creek and Marina del Rey Sediment Control Management Plan

The Ballona Creek and Marina del Rey Sediment Control Management Plan is being developed by the USACE to address the excessive shoaling of the Marina del Rey Harbor navigation channels. The primary objective of the plan is to identify and implement management options to control sediments discharged from Ballona Creek. A reconnaissance study completed in 1999 identified federal interest in the project. A feasibility study (USACE 2000b) has been recently completed that evaluates management alternatives including an in-stream sediment basin in Ballona Creek, Ballona Creek jetty modification, and combination of sediment basin and jetty modification. The planning process focuses on sediment management opportunities within the jurisdictional limits of the USACE in the Ballona Creek/Marina del Rey area, with the expectation that upstream watershed management activities under the LARWQCB and County will achieve contaminated sediment source reduction over the long-term.

Clean Marina and In-Water Hull Cleaner Certification Programs

The Clean Marina and In-Water Hull Cleaner Certification Programs are boating pollution control programs for Marina del Rey Harbor funded by an EPA 319 (h) grant and administered by the SMBRC. The primary objective of the program is to raise awareness among hull cleaners and marina operators regarding the effects that certain boating activities have on water quality, and promote the implementation of boat-related BMPs and use of environmentally friendly products to reduce pollutant discharges. The program provides environmental criteria with which marinas and in-water hull cleaning businesses should seek to comply, structured guidance for businesses on the implementation of BMPs, criteria to track BMP implementation on a wider geographic basis, and easy access to simple information on the level of environmental services provided by a business to the public.

3.5.2.2 Los Angeles River Watershed

LACDPW has installed the most BMPs throughout the County. The Los Angeles County BMP Task Force is an on-going forum to facilitate the selection, implementation, and financing of effective BMPs. The Task Force has developed an electronic survey of BMPs used by the cities in the County. The survey summary (LACBMPTF 2002) as of June 2002 indicates 10 out of the 26 responding jurisdictions have no BMPs. The most used nonproprietary BMPs are covered trash bins, vegetated buffers, vegetated swales, covered material bunkers, dog parks, outdoor canopies, and extra trash cans. The most widely used proprietary BMPs are Fossil Filter and DrainPac catch basin inserts, CDS, Stormceptor, Elgin and Tymco enhanced sweeper, and Abtech OARS oil skimmer.

The City of Los Angeles Department of Public Works Sanitation Bureau manages the storm water program that covers portions of the Ballona Creek, Dominguez Channel, and Los Angeles River watersheds. The City of Los Angeles has installed various types of BMPs including filtration/infiltration systems, low flow diversion systems, vortex flow systems, catch basin inserts, and combination systems. Within the City, there are 800 catch basin inserts and 750 catch basin opening screen covers. There are demonstration filtration/infiltration systems installed at parking lots. Eight low flow diversion systems that include the Thorton Avenue storm drain and Temescal Canyon and Pacific Coast Highway storm drain. Other BMPs include three CDS units, four Stormceptor systems, trash netting systems, and separation systems for oil and grease (Sedrak, personal communication).

The City of Long Beach extends into both the Dominguez Channel and Los Angeles River watershed and currently has not installed any BMPs. LACDPW has installed two CDS units in Long Beach near Marine Stadium. The City of Long Beach, along with the City of Signal Hill and LACDPW, is currently working on the BMP selection for the Hamilton Bowl Trash Reduction project. Hamilton Bowl is a detention basin/pump station system being leased by the County. The City of Long Beach expects to complete installation of a CDS unit on 20th Street, west of Walnut Avenue and adjacent to Hamilton Bowl in January 2004. This CDS unit will assist with the Los Angeles River trash TMDL compliance. The City of Long Beach is awaiting approval to install another CDS unit near the Los Angeles River at 710 and 91 Freeways. The trash racks at six City-owned pump stations along the Los Angeles River are in need of repairs and improvement, thus there are plans to replace the trash racks with a trash netting system in the pump station forebay area. An additional trash netting system is being planned for Hamilton Bowl near 20th and Walnut (City of Long Beach 2003 and Stoudenmire, personal communication). The Long Beach Stormwater Management Division is also exploring alternatives to reduce bacteria levels in Colorado Lagoon and plans to install catch basin inserts at all city owned tributaries into Colorado Lagoon. The Colorado Lagoon Restoration Feasibility Study being conducted in 2004 will address water and sediment quality (City of Long Beach 2003).

Watershed management programs specific to the Los Angeles River include the following: Sub-watershed Management Plans and Upper Los Angeles River Watershed Urban Runoff Pollution Removal Projects.

<u>Sub-watershed Management Plans</u>

Three sub-watersheds tributary to the Los Angeles River, including the Compton Creek, Arroyo Seco, and Rio Hondo Watersheds, received Proposition 13 funding from the RWQCB in 2001 to develop individual watershed management plans. The primary objective of the plans is to protect and enhance the environment and beneficial uses of the sub-watersheds and support the implementation of comprehensive watershed management. The plans will address current and potential watershed problems, BMPs identification, project priorities, funding opportunities, and monitoring programs. The three plans will be developed respectively through three individual nonprofit organizations under the oversight of the RWQCB with the participation of the USACE, County, tributary cities, and other stakeholders.

<u>Upper Los Angeles River Watershed Urban Runoff Pollution Removal Project</u>

The Upper Los Angeles River Watershed (ULARW) Urban Runoff Pollution Removal Project (Project) is a Proposition 13-funded program conducted by the City of Los Angeles under the oversight of the LARWQCB. The primary objective of the Project is to prevent trash, debris, sediments, heavy metals, and oil and grease from discharging into the Los Angeles River, improve water quality and beneficial uses of the Los Angeles River, and contribute to the TMDL compliance for trash.

The Project aims to achieve the objective by implementing construction and installation of structural BMPs to remove trash, debris, sediments, heavy metals, and oil and grease. Individual projects are being implemented to install trash collection systems and vortex separators throughout the watershed. For example, the Pacoima Area ULARW Urban Runoff Pollution Removal Project has installed a netting Trashtrap system in a high density residential area and two Stormceptors to remove oil and grease from industrial runoff. One netting Trashtrap system and four BaySaver Separation Systems used for industrial and commercial areas have been installed by the ULARW Pollution Abatement Van Nuys/Canoga Project.

3.5.2.3 Dominguez Channel Watershed

The Dominguez Watershed Management Master Plan is being developed by the County, tributary cities, and other stakeholders under the oversight of the LARWQCB. The primary objective of the plan is to develop a holistic approach that integrates all existing and new water quality improvement and habitat/open space restoration efforts to achieve watershed protection on the ecosystem level. Funded by a Proposition 13 grant, the plan will provide a mechanism for consensus building among watershed stakeholders on important issues so as to facilitate efficient implementation of priority actions. The plan will also provide guidelines for and ensure the most effective implementation of actions that can achieve measurable environmental improvement.

3.5.2.4 San Gabriel River Watershed

The San Gabriel River Watershed Management Plan is a Proposition 13-funded program conducted by the San Gabriel Mountains Regional Conservancy under the oversight of the LARWQCB. The Watershed Management Plan will be developed through a stakeholder process and investigate three subwatersheds above Whittier Narrows located in the upper two-thirds (1,036 square kilometers [400 square miles]) of the San Gabriel River Watershed to provide regionally based regenerative management measures and recommendations. The subwatersheds are the Upper San Gabriel River, Walnut Creek, and San Jose Creek Watersheds. Substantial portions of the San Gabriel River, Walnut Creek, and San Jose Creek are also listed on the 1998 303(d) list due to ammonia, toxicity, excessive algae, elevated pH, trash, lead, and coliform bacteria. In addition, a number of lakes in the watershed are listed: Santa Fe Dam Lake (pH, lead, copper); Legg Lake (odor, trash, lead, copper); Puddingstone Reservoir (low dissolved oxygen, mercury, DDT, PCBs, chlordane); and Crystal Lake (low dissolved oxygen).

The short-term goals include improvement of water quality and reduction of NPS pollution, protection and enhancement of local water resources, protection and restoration of terrestrial and aquatic habitat and habitat connectivity, provide for open space protection and beneficial land use relationships, establishment of an on-going community and stakeholder process to guide development of the Watershed Plan, and identification of key pilot projects, citizen monitoring, and stewardship programs. Partner agencies include the LACDPW Watershed Management Division, Angeles National Forest, San Gabriel and Lower Los Angeles Rivers and Mountains Conservancy, Los Angeles-San Gabriel Rivers Watershed Council, Southern California Edison, Cal Poly Pomona, and the LARWQCB.

3.5.3 Opportunities for Coordinated Efforts

All major watersheds in the Region either already have in place or are in the process of developing watershed management plans. Most of the plans contain a contaminant source identification and control component. Although the source control components in the plans were generally not developed specifically for contaminated sediment reduction, the provisions do provide opportunities for future plan enrichment with contaminated sediment control issues, and a mechanism for coordinated efforts on contaminated sediment source reduction on a regional basis. A regional authority is needed to systematically and explicitly incorporate contaminated sediment source identification and control into the existing watershed planning processes in the Region.

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4 REGIONAL SEDIMENT SCREENING THRESHOLD EVALUATION

4.1 Background, Goals, and Objectives

As part of its overall strategy, the Contaminated Sediments Task Force (CSTF) identified reducing the uncertainty regarding the use of Sediment Quality Guidelines (SQGs) as one of the priority needs for the development of a strategy for the management of contaminated sediments. An understanding of the relationship between sediment contamination and biological effects in the Los Angeles area is needed to support the interpretation of sediment chemistry data and application of any type of SQG. Regional and national SQGs for the interpretation of sediment chemistry data have been established or proposed by multiple agencies. These guidelines include empirical approaches such as the effects range low/median (Long et al. 1995), probable effects concentration/threshold effects concentration (McDonald et al. 1996), and apparent effects threshold (Washington Dept. of Ecology 1990a and b). Causative approaches based on equilibrium partitioning models (Pavlou and Weston 1983; Pavlou 1987; and Di Toro et al. 1991) have also been developed.

The CSTF Sediment Thresholds Subcommittee was specifically tasked with addressing this issue and sponsored the Southern California Coastal Water Research Project's (SCCWRP) effort to evaluate available chemical and toxicological characteristics of sediment with available SQG methodologies. Among the objectives of the project were (1) to produce a database of available Southern California sediment data; (2) to evaluate the degree to which existing SQGs are predictive of a toxic response; and (3) to calculate new SQG values based on Southern California data. The ultimate products of the study were to provide the CSTF with a database of available local data and a comprehensive evaluation of existing SQGs using Los Angeles regional sediments.

The work also produced two sets of regionally appropriate SQGs: Level I SQGs, representing chemical concentrations of low concern for adverse biological effects that would likely pass additional biological testing; and Level II SQGs, representing contaminant concentrations in sediments that are likely to result in adverse biological effects.

Sediments with chemical concentrations below Level I guidelines were defined likely to be suitable for unconfined aquatic disposal, subject to regulatory agencies' final determinations. Sediments with chemical concentrations above Level II guidelines were defined as likely fail additional biological testing and would therefore be determined to be unsuitable for disposal in aquatic environments. Unfortunately these guidelines only segregated about 10% of the sediments typically dredged in the Los Angeles region. For this reason and based on national dredging policies these guidelines cannot be used as stand-alone decision making tools. The initial goal to aid dredging permit applicants in planning their dredging and disposal activities by providing an additional line of evidence documenting whether or not unconfined aquatic disposal is a feasible alternative was not achieved.

As part of this effort, the CSTF has proposed a framework to be used in characterizing sediments and determining when to apply respective Level I and Level II SQGs and under what circumstances Inland Testing Manual (ITM) testing procedures would be employed to determine suitability of aquatic disposal as a viable option (Figure 4-1).

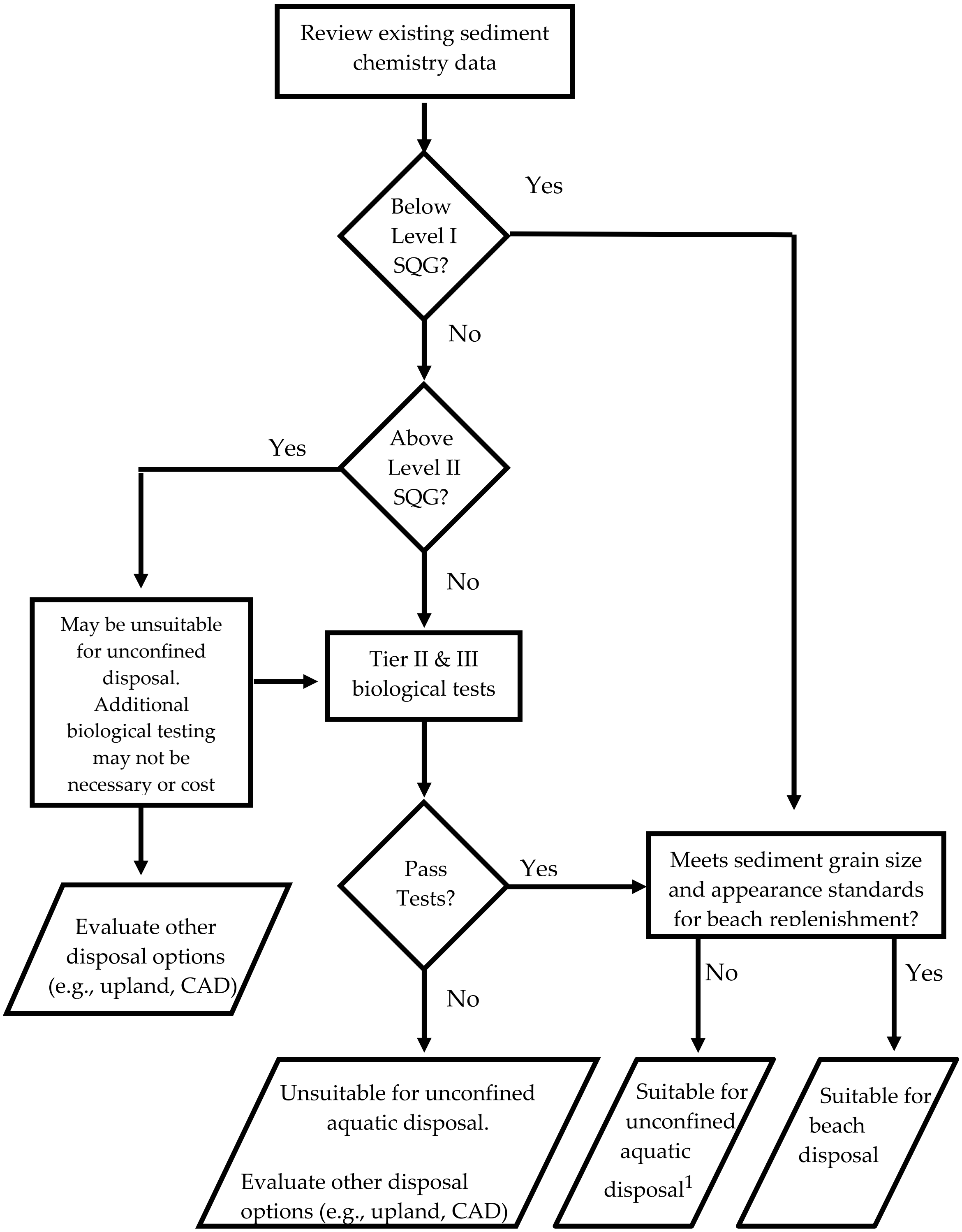
An additional goal of the effort is for the long-term maintenance of the CSTF Sediment Quality Database (SQD). Long-term maintenance will ensure availability of the SQD to regulatory agencies, contaminated sediment project proponents, and the general public. SCCWRP has agreed to maintain the SQD for the long term and a data submission template has been produced to allow future sediment data to be incorporated into the database as it becomes available.

4.2 Sediment Quality Database Project Description

The first step in the Sediment Threshold Subcommittee's strategy was to compile locally available sediment characterization results as a means of assembling a body of data most representative of likely future sediment characterization studies. The SQD incorporates a large number of data sets, including sediment chemistry, sediment toxicity, and benthic infauna data for Southern California. It is a relational database that enables varying combinations of the data to be retrieved for subsequent analysis by the user and was designed to facilitate the analysis of the correspondence between sediment contamination and biological effects, as well as the evaluation of spatial and temporal trends in sediment quality.

The SQD contains two major types of studies:

- Dredged material characterization studies from projects in Los Angeles County (County);
- Monitoring and research studies conducted throughout Southern California.



1. Subject to final determinations of regulatory agencies.

Figure 4-1

SQGs Application Conceptual Framework for the Evaluation of Dredged Sediments

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An extensive screening process was used to select the appropriate studies for the SQD. Dredged material studies conducted since 1990 were provided by the Port of Los Angeles (POLA), Port of Long Beach (POLB), and the Los Angeles District of the U.S. Army Corps of Engineers (USACE). Monitoring data included Marina del Rey studies (Los Angeles County), Bight '94, Bight '98, West Environmental Monitoring and Assessment Program (EMAP), the California Bay Protection and Toxic Cleanup Program (BPTCP), and the U.S. Environmental Protection Agency's (EPA's) National Sediment Inventory (NSI) Database. Generally, data prior to 1990 were excluded, unless deemed to be of particularly good quality. The compiled data represents approximately 2,200 marine and estuarine stations that extend from 35.4 °N (San Luis Obispo County) to 31.75 °N (beyond the US border in Mexico) (Table 4-1 and Figures 4-2 and 4-3).

A relational database is an efficient mechanism to store large amounts of data by keeping related information in separate tables that are related by one or more key fields (columns in the table). The SQD structure contains four levels of organization: Study, Station, Sampling, and Data (Figure 4-4). This organization reflects the very different sample designs between dredging characterization and monitoring data. The database structure is further described in SCCWRP's technical summary document (SCCWRP 2005) and is available to the public on their website (www.sccwrp.org).

4.3 Performance of Selected Existing Sediment Quality Guidelines for Southern California Sediments

The second phase in the CSTF's process was to evaluate the performance of existing SQGs relative to Southern California data. Ultimately, SQGs are narrative or numerical values intended to help in the interpretation of sediment chemistry data. SQGs are not intended to be a final assessment of environmental conditions at a site, but rather to assist in the determination of the potential for biological effects. They also allow the identification of contaminants of potential concern as well as they provide a tool for the prioritization of sites. Numerical SQGs have been developed using a variety of approaches that include statistical comparisons of the relationship between sediment chemical concentrations and measurements of adverse biological effects. All have a similar objective in general: to identify chemical concentrations that correspond to the occurrence and/or absence of biological effects (USEPA 2000).

Table 4-1
Summary of Database Information by Geographic Region

Geographic Region	Number of Stations With Data in Category			
	Sediment Chemistry	Toxicity	Tissue Chemistry	Infauna
Dredging Studies				
Southern California Bight	291	187	181	0
Los Angeles County	221	121	116	0
Orange County	58	54	53	0
San Diego County	4	4	4	0
Sonoma County	8	8	8	0
Port of Los Angeles	129	76	71	0
Port of Long Beach	49	32	32	0
Other Studies				
Southern California Bight	1933	1454	540	282
Los Angeles County	664	470	160	104
Orange County	352	184	69	30
Riverside County	7	0	0	0
San Bernardino County	6	0	0	0
San Diego County	531	507	144	67
San Luis Obispo County	54	7	0	0
Santa Barbara County	205	172	117	46
Ventura County	114	114	50	35
Port of Los Angeles	100	100	24	2
Port of Long Beach	122	63	24	2

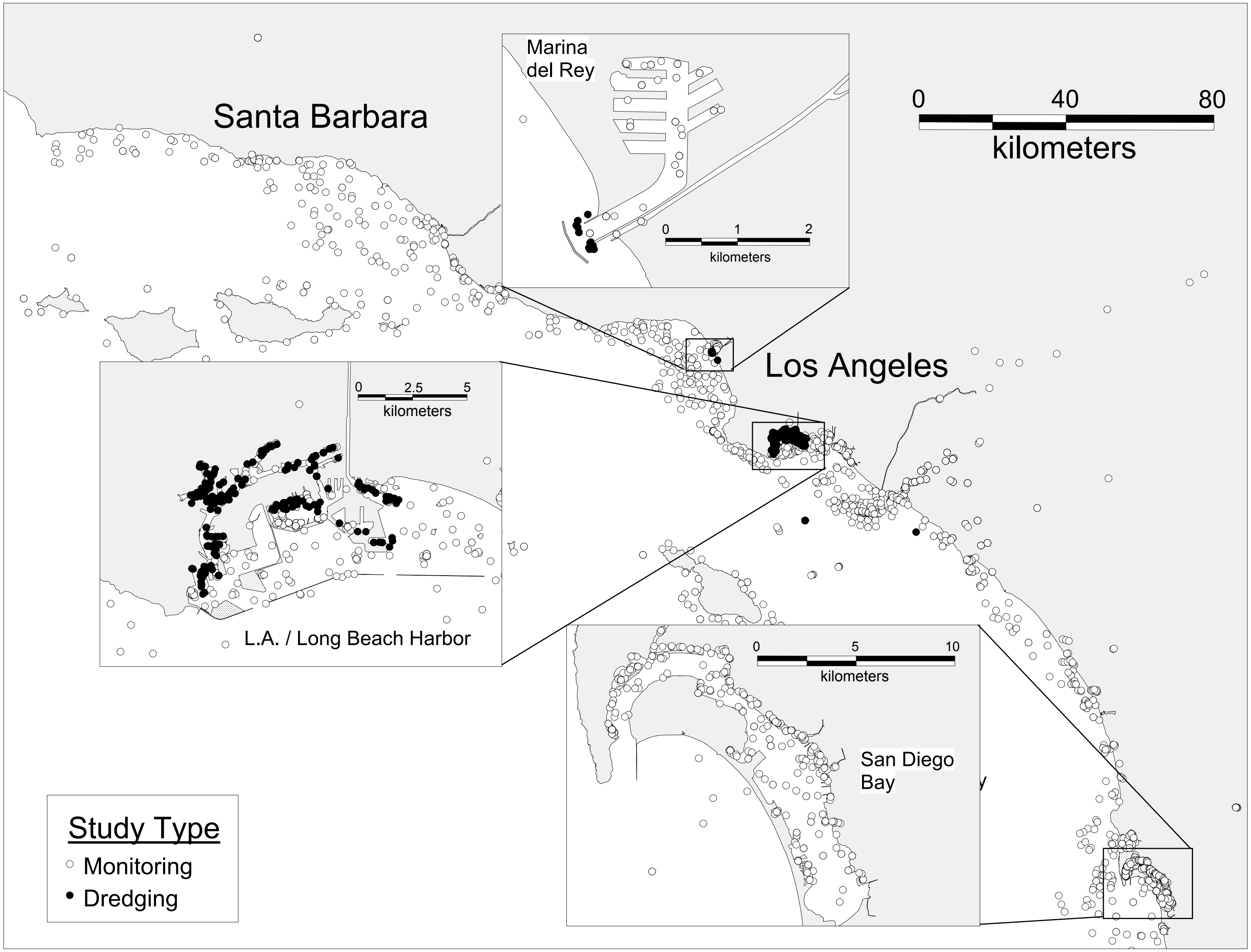

Figure 4-2

Sample Locations of Data Incorporated into the SQD

(Symbols located in inland areas represent data from rivers and other freshwater habitat features not shown on the map)

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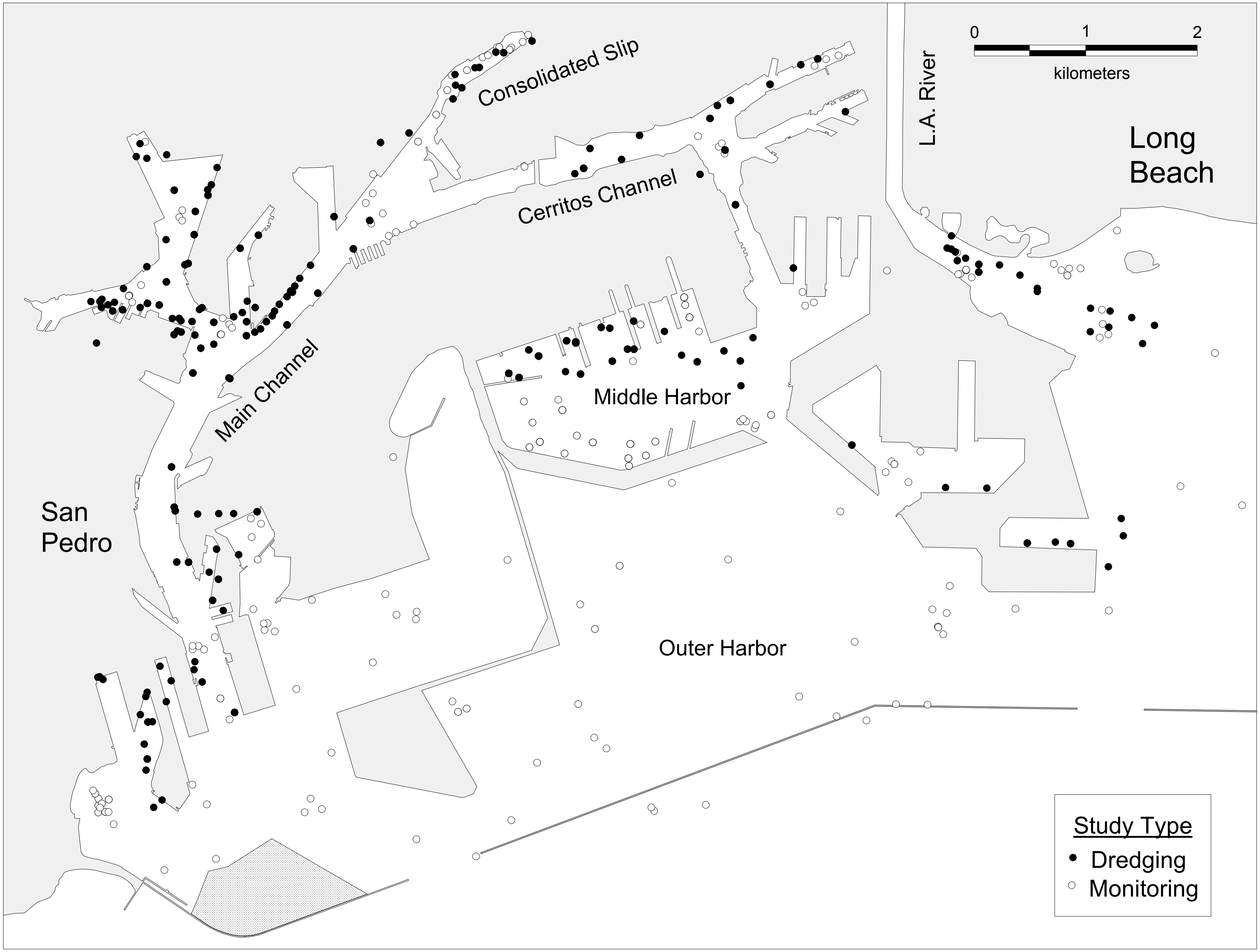

Figure 4-3

Sample Locations of San Pedro Bay Data Incorporated into the SQD

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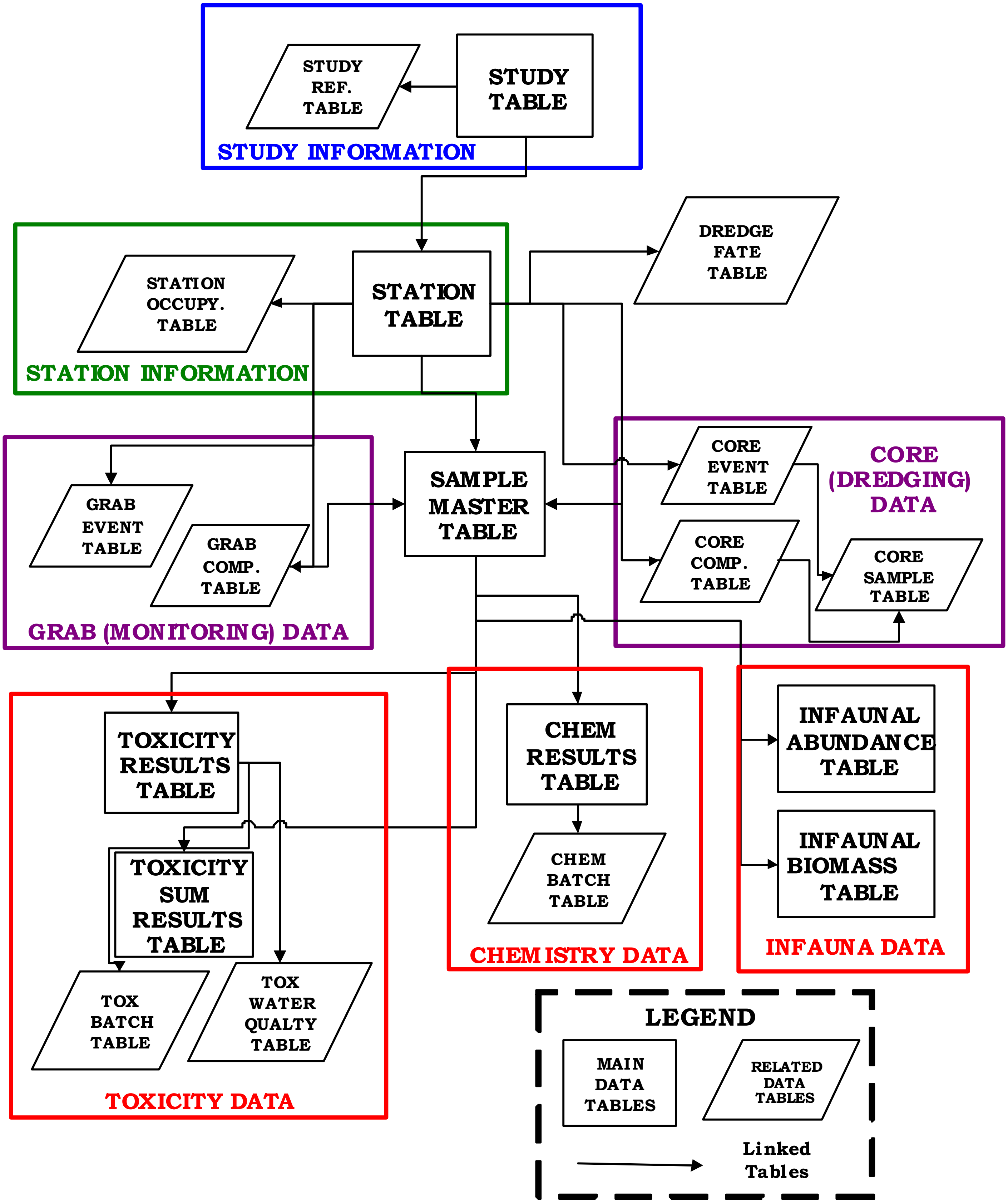

Figure 4-4
Organization of the Sediment Quality Database (SQD)

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A series of evaluation criteria were used to characterize the SQGs' suitability for this project; a subset of five approaches was selected for statistical evaluation. The performance of each SQG approach was described based on an analysis of the ability of the SQG to predict sediment toxicity to amphipods, using data in the SQD. The relationship between the SQGs and other measures of biological effect (e.g., sublethal responses, interstitial water toxicity, and benthic macrofauna community alterations) were not evaluated. Evaluation criteria include the availability of established guideline values and performance data from other studies that could be used for comparison, data requirements that were consistent with the contents of the CSTF database, and applicability to dredged material evaluation programs or Southern California sediments. SQGs were also assessed with regard to guidelines that included a mechanism for dealing with contaminant mixtures and those that were generally regarded to be useful for predicting the occurrence of sediment toxicity. The five provisional SQGs selected for consideration were: (1) the effects range median quotient (ERMq) (Long et al. 1995); (2) the Apparent Effects Threshold (AET) approach (TetraTech 1986); (3) the water/sediment equilibrium partitioning approach (EqP) (Pavlou and Weston, 1983); (4) the summary quotient approach (SQG Q-1) described by Fairey et al. (2001); and (5) the consensus approach (Consensus MECq) (SWDNR 2002). These approaches are defined in further detail in the final report (SCCWRP 2005).

The results of the SQG performance comparisons indicated that there were substantial differences in performance among the five candidate SQGs examined when applied to the Southern California dataset. The differences in performance among SQGs also varied depending on the application. Guidelines that performed best in identifying nontoxic samples (e.g., Level I applications) did not necessarily have the best performance in regards to identifying toxic samples (Level II). The AET and EqP approaches appeared to have the lowest overall performance when applied to this dataset, compared to the ER-Mq, SQG-Q1, and Consensus MECq. The AET and EqP approaches appeared to have less utility than the other SQG approaches evaluated for predicting amphipod toxicity in the CSTF database, and were subsequently excluded from further consideration. The results suggested that relatively simple modifications in specific guidelines or application thresholds may substantially improve the performance of some of these SQGs. A substantial effect on SQG performance was considered likely with further adjustment of the Level I or II threshold values.

4.4 Application of Selected Sediment Quality Guidelines to the CSTF Area of Interest

The goal of the analyses conducted in this task was to identify optimum combinations of SQGs and thresholds for use by the CSTF. There were two objectives of this task. The first objective was to determine the best overall SQG approach for application as a Level I or Level II SQG. The second objective was to determine the optimum SQG thresholds for each type of application (e.g., Level I or II). The analyses were conducted using data limited to the CSTF area of interest, a subset of the CSTF data used for analysis of the SQGs using the provisional guidelines (Section 5.3). The data represented 335 samples located within San Pedro Bay, Marina del Rey, or King Harbor.

Statistical analyses conducted in early phases of the study identified three SQG approaches that showed a relatively good predictive relationship with amphipod toxicity. These approaches were the mean ER-M quotient (excluding Dichlorodiphenyltrichloroethanes [DDTs]), the mean Consensus MEC quotient, and the SQG-Q1 quotient. In addition, the Logistic Regression Model (LRM) (e.g. Field et al. 1999) and floating percentile (FP) (Michelsen 2003) methodologies were introduced as additional approaches.

Two types of analyses were conducted in order to address these objectives within the context above. A new statistic, the average sensitivity or specificity, was developed that described the overall performance of each SQG and was used to compare the candidate approaches. In addition, the performance of each SQG for specific levels of efficiency was calculated so that the effect of using different numeric thresholds could be evaluated. Each of these SQG approaches were shown to be relatively good predictors of the presence or absence of amphipod toxicity for either Level I or II applications.

The analyses provided a more definitive comparison of the performance of candidate SQG approaches, compared to analyses using provisional guidelines. Comparisons of mean specificity and sensitivity indicated that the mean ER-Mq and mean SQG-Q1 had greater utility for predicting sediment toxicity to amphipods (e.g., higher specificity or sensitivity for equivalent efficiency) than the mean Consensus MECq or LRM, for sediments characteristic of the CSTF area of interest. The potential benefit of using SQG thresholds that are adapted to regional conditions was also demonstrated by the analyses.

Substantial differences in some performance measures were observed when the provisional thresholds were applied to the Southern California or Los Angeles CSTF datasets. Since all of the records in the Los Angeles CSTF dataset are contained in the Southern California dataset, a greater similarity in performance was expected. The cause of these differences was not determined, but it may be related to differences in the range of contamination between the datasets. The Southern California dataset contains samples from offshore areas where greater extremes of contamination appear to be present (i.e., this dataset contains both less contaminated and more highly contaminated samples). A greater number of "clean" nontoxic samples in the Southern California dataset would be expected to produce higher nontoxicity efficiency and specificity values for a given threshold, precisely the pattern observed.

Another factor potentially contributing to the difference in performance measures between datasets was the smaller number of samples in the Los Angeles CSTF dataset. The areas of irregularity that were noted in many of the performance plots may have been related to small sample sizes at the high and low extremes of the threshold range. Differences in the classification of just a few samples can produce relatively large variations in percentage measures such as toxicity efficiency and sensitivity.

4.5 Regional Sediment Quality Guidelines Development

Two approaches were investigated using information in the CSTF database to generate SQGs based on region-specific data: the CA AETs and the FP. AETs are the concentration of a contaminant in sediment above which significant biological effects are always observed. The FP approach optimizes the percentile value of individual chemicals which provide both low false negative and low false positive rates of predicting toxicity. The main objective of the analyses conducted in this task was to develop region-specific SQGs. A second objective of these analyses was to compare the performance of these regional SQGs to the other SQGs, previously examined in this project, with a validation dataset.

Regionally derived approaches were compared to nationally derived guidelines; the results indicated that the regional AETs and FP had performances lower or comparable to the other approaches. When the regional and national SQGs were applied to the Los Angeles validation dataset, the results showed that for Level I the highest nontoxicity efficiency performers were LRM and the SQG-Q1 approaches. The performances of ERM-q without DDT, Consensus and FP were moderate and comparable. For Level II the highest toxic efficiency performers were ER-Mq without DDT, SQG-Q1, and LRM. Consensus MECq and AET approaches had similar performances but lower than the other three approaches.

The results of the last step of the project indicated that regionally derived AET guidelines improved their performance when they were calculated with local data. However, regionally derived guidelines did not necessarily provide a better alternative than the nationally derived approaches. Two of the studied guidelines consistently exhibited better characteristics when compared to the others: the SQG-Q1 and the ERM-q (excluding DDT) approaches.

4.6 Conclusions of the Sediment Thresholds Study

The following consensus points were agreed to by the CSTF Sediment Thresholds Subcommittee regarding the results of the SCCWRP study:

- The relationship between the bulk sediment concentration of specific contaminants and toxicity is complex and variable. Examination of the CSTF database for acute amphipod toxicity and the bulk concentration of individual contaminants showed that there is a large region of overlap between the concentrations associated with toxic and nontoxic samples. Even at the extremes of the concentration range, very few samples are consistently toxic or nontoxic.
- Individual chemical-specific SQGs evaluated in this study are unreliable predictors of toxicity when they are used in isolation. The independent application of chemical-specific SQGs provided little reliability for predicting the occurrence of sediment toxicity.
- All of the SQG approaches evaluated had a poor ability to discriminate between toxic and nontoxic samples when chemical concentrations are at low-moderate levels.
- Empirical SQGs such as the ER-M and SQG-Q1 can provide reasonably accurate predictions regarding the toxicity of sediment samples when approaches that incorporate the presence of multiple contaminants are used and the sediments contain relatively low or relatively high contamination levels.

- No single SQG approach has been identified that provides high performance in all desired aspects of use.
- Regional differences in contamination patterns are present in the Los Angeles CSTF area of interest that impact SQG performance. Within the Southern California Bight, regional differences in the extent and concentration of several contaminants of concern exist. Two examples are DDT (high off Palos Verdes and at the mouth of the Dominguez Channel) and chlordane (high near storm water discharges in embayments). Regional differences in the performance of SQGs have also been shown and these differences have been associated with specific constituents (e.g., DDT) in some cases.
- The performance of SQGs can be improved through the use of regional application thresholds.
- Development of regional SQGs has the potential to improve overall performance, but substantial uncertainty is likely to remain.
- A quantitative and integrative method for SQG application, such as the mean quotient, is preferable over a categorical approach (e.g., number of guideline exceedances). An integrative approach such as the mean SQG quotient provides substantial advantages, such as the ability to include more information on the relative concentration of each contaminant, less sensitivity to missing data, and the ability to fine tune the application threshold (i.e., quotient value of concern) for optimum performance.
- The use of the effects range-low (ER-L) offers little benefit over the ER-M for assessing the potential for acute sediment toxicity.

4.7 Recommendations of the CSTF Sediment Thresholds Subcommittee

CSTF Sediment Threshold Subcommittee members also reached the following consensus recommendations on future application of threshold values:

- SQGs should not be used deterministically for making disposal suitability decisions. The high degree of uncertainty associated with applying SQGs to the majority of sediment types present in the Region precludes their use as the sole factor in determining the suitability of sediment for aquatic disposal. In addition, national policy for regulating open water disposal prevents the use of SQGs deterministically and as a substitute for biological testing in ocean disposal situations.

- SQGs may be used, but are not required, to provide additional lines of evidence to the decision-making process. SQGs provide a reliable measure of sediment quality for some sediment types and their use may assist applicants, regulators, or other groups in assessing the ecological risk of sediment disposal. If available, the results of SQG comparisons should be considered along with other information when making disposal suitability decisions.
- All available lines of evidence (e.g., toxicity, SQGs, bioaccumulation) should be considered for making disposal suitability decisions.
- The mean ER-M quotient (with DDT value) or SQG-Q1 should be used to assess the potential that a sediment sample either exhibits or lacks acute toxicity. The ER-M quotient is preferable to other SQG approaches that were shown to perform just as well because more chemicals of concern are included in the calculation.
- A revised value for the DDT ER-M should be considered that provides suitable performance results.
- CA AETs should be used as an additional line of evidence for making disposal suitability decisions. Regional AETs provide a tool to identify individual contaminant concentrations that are almost certain to result in toxicity. The use of AETs in conjunction with a SQG quotient is likely to provide greater confidence in evaluating the potential for sediment toxicity.
- Maintain and update the CSTF Sediment Quality Database (SQD) and periodically evaluate SQG performance and AET values. The CSTF should require its contractors to submit the data from future characterization studies and surveys in an electronic format that is compatible with the CSTF SQD.
- Incorporate improved analytical chemistry methods that relate to bioavailability in the dredged material evaluation process. Variation in contaminant bioavailability is believed to be a substantial factor in the high uncertainty observed when SQGs are applied to sediments that contain low to moderate chemical concentrations.

5 MANAGEMENT OF DREDGING & DISPOSAL OPERATIONS & DISPOSAL SITES

5.1 Description of Dredging Equipment

This section reviews the main types of dredge equipment and procedures commonly employed in the U.S., and discuss typical uses and limitations. Understanding how different types of dredging equipment operate is essential to understanding how and why sediments are resuspended during dredging operations and what potential environmental impacts these sediments may create. The relative levels of resuspended sediments for any one dredging operation may be a factor of the type of dredge, how it is used (operational considerations), best management practices (BMPs) employed, and site-specific issues (e.g., sediment grain size, currents, etc.).

Dredging in the U.S. is typically conducted by two basic methods (hydraulic or mechanical) depending on the volume to be removed, disposal option selected, the nature of the sediments and site conditions. While hydraulic dredges are typically used for unconsolidated sediments, such as those typically found in waterway maintenance removal projects, some types of hydraulic dredges can be used to excavate more consolidated sediments. Sediments are directed into the suction end of a hydraulic pipeline by various methods (e.g., rotating cutterhead) and transported to the water surface inside a pipeline and then to a selected discharge point.

Mechanical dredges excavate material using some form of bucket to carry dredged material up through the water column and to a barge for off-site transport. Mechanical dredges are used for removing loose to hard, compacted materials. Mechanical dredges are also the most commonly used method for removing contaminated sediments for several reasons. First, contaminated sediments are generally located along the shoreline or in close proximity to in-water structures where use of a hydraulic dredge would be difficult. Second, mechanical dredges can typically be operated more accurately when excavating to specific depths below the sediment surface, which is often required for contaminated sediment removal. Lastly, and perhaps most importantly, mechanical dredges produce much less excess water with the sediment that would also require disposal or management. Hydraulic dredges typically require that the sediments be slurried at a rate of 20 percent or less solids to allow for pumping to a containment area which produces significant excess water. There are other types of dredges that combine mechanical and hydraulic capabilities or are designed for special purposes, but their use is fairly limited. Hydraulic and mechanical dredges are discussed further in the following subsections.

5.1.1 Hydraulic Dredges

Hydraulically operated dredges can be classified into four main categories: pipeline (plain suction, cutterhead, dustpan, etc.), hopper (trailing suction), bucket wheel, and side casting (Herbich 2000). Hydraulic dredges are self-contained units that handle both the dredge and disposal phases of dredging operations. They not only dig the material, but also dispose of it either by pumping the material through a floating pipeline to a placement area, or by storing it in hoppers that can be subsequently emptied at or pumped to a disposal area. In a hydraulic dredge the material to be removed is first loosened and mixed with water by cutterheads or by agitation with water jets and then pumped as a slurry (Herbich 2000).

5.1.1.1 Cutterhead Dredge

The hydraulic pipeline cutterhead suction dredge is the most common hydraulic dredge used in the U.S. and is generally the most efficient and versatile. With this type of dredge, a rotating cutter at the end of a ladder excavates the bottom sediment and guides it into the suction. The excavated material is picked up and pumped by a centrifugal pump to a designated disposal area through a 15-centimeter (cm) (6-inch) to 112-cm (44-inch) pipeline as slurry with a typical solids content of 10 to 20 percent by weight. The typical cutterhead dredge is swung in an arc from side to side by alternately pulling on port and starboard swing wires connected to anchors through pulleys mounted on the ladder just behind the cutter. Pivoting on one of two spuds at the stern, the dredge "steps" or "sets" forward (Herbich and Brahme 1991 and Cleland 1997).

5.1.1.2 Hopper Dredge

Hopper dredges consist of a ship-type hull with an internal hopper to hold material dredged from the bottom. The material is brought to the surface through a suction pipe and draghead and discharged into hoppers built in the vessel. Suction pipes (drag arms) are hinged on each side of the vessel with the intake (drag) extending downward toward the stern of the vessel. The drag is moved along the channel bottom as the vessel moves forward at speeds up to 4.8 kilometers per hour (km/hr) (3 miles per hour [mph]). The dredged material is sucked up the pipe and deposited and stored in the hoppers of the vessel. Typical hopper capacities range from several hundred cubic meters (m^3) to 33,000 m^3 (43,000 yd^3) (Herbich 2000; CEM 1983; and Cleland 1997).

Once fully loaded, hopper dredges move to the disposal site to unload before resuming dredging. Unloading is accomplished either by opening doors in the bottoms of the hoppers and allowing the dredged material to sink to the open-water disposal site or by pumping the dredged material to upland disposal sites. Hopper dredges are mainly used for maintenance dredging in exposed harbors and shipping channels where traffic and operating conditions rule out the use of stationary dredges. While specifically designed dragheads are available for use in raking and breaking up hard materials, hopper dredges are most efficient in excavating loose, unconsolidated materials (Herbich 2000; CEM 1983; and Cleland 1997).

5.1.2 Mechanical Dredges

Mechanical dredges can be classified into ladder, dipper, or bucket dredges. Bucket dredges, specifically clamshell dredges, are the most common type of mechanical dredges. They are typically used in areas where hydraulic dredges cannot work because of the proximity of piers, docks, etc., or where the disposal area is too far from the dredge site for it to be feasible for a cutterhead dredge to pump the dredged material (Hayes and Engler 1986). They may be used to excavate most types of materials except for the most cohesive consolidated sediments and solid rock.

The most common type of mechanical dredge is the clamshell dredge. It consists of a clamshell bucket operated from a crane or derrick mounted on a barge. It is used extensively for removing relatively small volumes of material (i.e., a few tens or hundreds of thousands of cubic meters) particularly around docks and piers or within other restricted areas. The sediment is removed at nearly its *in-situ* density; however, production rates (relative to a cutterhead dredge) are low. The material is usually placed in barges or scows for transportation to the disposal area. Although the dredging depth is practically unlimited, because of production efficiency and accuracy clamshell dredges are usually used in water not deeper than 30 meters (100 feet). The clamshell dredge usually leaves an irregular, cratered bottom (Herbich and Brahme 1991 and Cleland 1997).

Variations of the clamshell dredge have been developed in recent years in an attempt to minimize loss of sediment and allow better precision. One example, the cable arm bucket, works on a two-cable system. One cable is attached to four spreader cables, which control opening and closing of the bucket. The second cable draws the clams together and lifts, thus creating a level-cut in the sediment that is essential for precision dredging. Other features such as one-way vents in the top of the dredge to reduce downward pressure during deployment and rubber seals to prevent loss of sediments have been added to further reduce sediment resuspension. Other, similar designs have been developed to mimic these features and are collectively referred to as "environmental" buckets.

5.2 Effects of Dredging and Disposal Operations

Effects associated with dredging and disposal operations include sediment resuspension, potential release of contaminants from sediments and pore water, noise and air pollution from the dredging equipment, impacts to navigation and shipping, historical and archeological impacts, and disruption to local recreational resources. The remainder of this section discusses each of these impacts in more detail.

5.2.1 Sediment Resuspension Physical Effects

Resuspended sediment effects can be broken down into two broad categories: (1) effects related to the physical properties of the sediment and (2) direct effects related to chemicals associated with the sediments or from partitioning. This section focuses on the former of the two. Resuspended sediments can also cause changes in the ambient water chemistry such as pH and dissolved oxygen content. Physical and chemical impacts associated with sediment resuspension are further detailed in the Contaminated Sediments Task Force (CSTF) document, Literature Review of Effects of Resuspended Sediments Due to Dredging Operations (Anchor 2003), which includes the following summary:

> A comparison of the dredging induced suspended sediment concentrations observed in the field and physical effects concentrations reported in the literature indicate that dredging is not likely to cause acute lethal effects in aquatic organisms (Figure 5-1). There is some overlap between potential acute sublethal and chronic effects ranges and observed suspended sediment

concentrations. However, because of the transient nature of dredging induced sediment plumes, more long-term chronic and sublethal effects from resuspended clean sediments are not expected to occur around most dredging operations. Further, chronic and sublethal effects reported for clean sediments in the literature appear to overlap with naturally occurring background suspended sediment concentrations in the Los Angeles Region indicating that regional aquatic life may be adapted to occasional exceedances of these chronic and sublethal effects levels. Very high levels of resuspended sediments and turbidity do have the potential to affect marine organisms; however, most of those impacts occur at resuspension levels and durations that are typically not present during dredging operations.

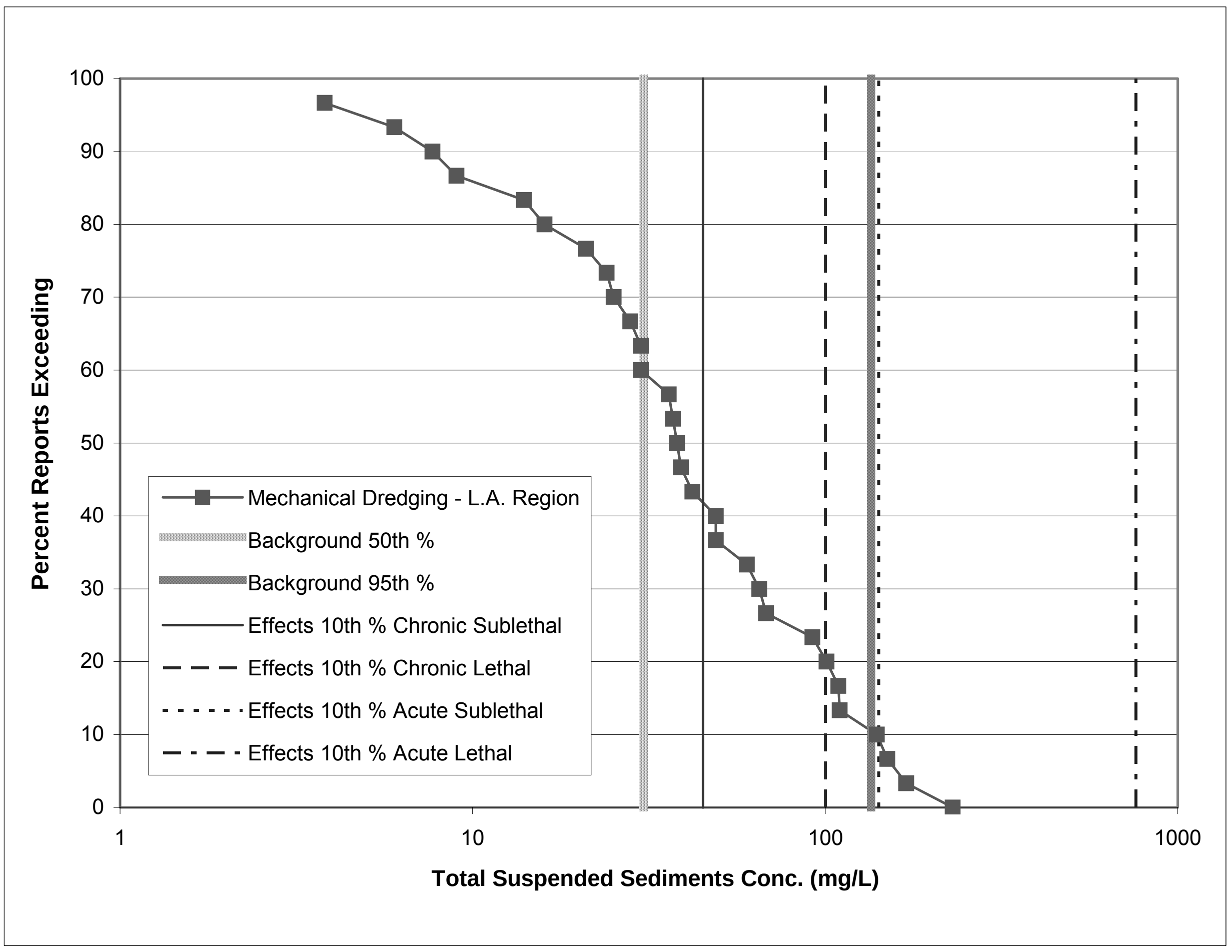

Figure 5-1

Los Angeles Regional Mechanical Dredging Total Suspended Sediment Concentrations Compared to Background and Effects Levels

5.2.2 Sediment Resuspension Chemical Effects

Potential impacts from dredging of contaminated sediments are more difficult to assess. Most of the information concerning the effects of contaminated sediments on marine organisms deals with the impacts of settled sediments. Few studies have dealt with resuspended contaminated sediments. Organisms exposed to resuspended contaminated sediments can develop physiological problems due to direct exposure to dissolved contaminants or bioaccumulation of metals and organic chemicals. However, much of the data suggests that significant adverse impacts do not occur at resuspension levels and durations typically associated with dredging projects. In general, previous studies indicate that potential effects from dredging are transient and not significant. There are, however, exceptions where highly elevated concentrations of specific chemicals (e.g., mercury and polychlorinated biphenyls [PCBs]) have been shown to cause significant bioaccumulation in organisms down current from dredging operations.

5.2.3 Release/Re-mobilization of Contaminants

Chemicals present in bottom sediments can exist in two basic forms: (1) adsorbed or otherwise bound to particulates and (2) dissolved in bottom sediment pore waters (the water between particulate grains in the sediment). When dredging of sediments occurs, these chemicals can be liberated to the water column and can either stay in their original forms (i.e., particulate-associated or dissolved) or be transformed from one form to the other (Brannon 1978; DiGiano et al. 1995; and EVS 1997). These transformations can be caused by a variety of processes including but not limited to physical agitation, changes in water chemistry (e.g., anoxic to oxic conditions), and dilution (Averett et al. 1999; Hirst and Aston 1983; and DiGiano et al. 1995).

Consequently, chemical measurements near dredging operations fall into two general categories: those that measure dissolved forms (particularly metals), and those that measure total concentrations (dissolved and particulate forms combined). The relationship between dissolved and particulate phases of chemicals in resuspended dredge sediments is important because it has long been understood that for many chemicals (including most metals and organic compounds) it is the dissolved form that represents the most bioavailable portion of chemicals present in naturally occurring waters, and is therefore most important when discussing direct toxicity (Eisler 2000 and

Suter et al. 2000). For most metals, U.S. Environmental Protection Agency's (EPA's) Office of Water recommends that the dissolved portion be analyzed for most water quality studies and comparison to water quality criteria (Prothro 1993). This is accomplished by filtering the water samples with a 0.45 μg filter to remove all particulates.

For organic chemicals, there is no indisputable federal guidance at this time on the interpretation of dissolved verses total organic chemicals in waters. One reason is that bioaccumulation of organic compounds and some metals species (e.g., mercury) in aquatic organisms can occur via exposure to both dissolved and particulate forms. More importantly, the behavior and toxicity of organic chemicals in water can vary widely depending on the specific structure of the organic compound in question. In addition, because many types of dissolved organics will adsorb to some extent onto most commercially available filters, there are also logistical difficulties in examining dissolved organics even when this is clearly desirable. Consequently, in most cases for organic chemicals, dredging studies (and many other types of water quality studies) focus on total organic chemicals (both dissolved and particulate form) and assume that this entire amount is bioavailable for both direct toxicity and bioaccumulation. This may result in conservative estimates of potential direct toxicity from organic chemicals dispersed during dredging operations.

5.2.4 Noise and Air Pollution

Noise and air pollution effects associated with dredging and disposal operations may include the following:

- Construction noise generated by the dredging equipment (derrick barge, hydraulic pumps and spuds, cable arms, generators, etc.);
- Construction noise generated by trucks and/or heavy machinery required for nearshore or upland disposal;
- Construction noise generated by the tugboat and other ancillary vessels required by the dredging contractor;
- Diesel engine emissions (Carbon Monoxide [CO], Nitrogen Oxides [NOx], Reactive Organic Gases [ROG], Sulphur Oxides [SOx], and Particular Matter 10 Micron [PM10]) from the dredging equipment and generators;
- Diesel engine emissions (CO, NOx, ROG, SOx, and PM10) from trucks and heavy equipment required for nearshore or upland disposal;

- Dust emissions during material transfer, storage, or processing; and
- Odor emissions during beach placement, processing, or upland reuse.

Within the Los Angeles Region (Region), short- and long-term noise standards are established by local city ordinances. For example, within the City of Los Angeles they are promulgated though various municipal codes. Example City of Los Angeles Municipal Codes include:

- Construction noise shall not create a loud, raucous, or impulsive sound within any residential zone or within 152 meters (500 feet) of a residences between the hours of 10:00 p.m. and 7:00 a.m. the following day;
- Construction noise shall be limited to 75 A- weighted decibel (dBA) as measured at a distance of 15.2 meters (50 feet) from construction machinery and power equipment within 152 meters (500 feet) of a residential zone between the hours of 7:00 a.m. and 10:00 p.m.; and
- Construction noise shall not raise ambient noise levels by more than 5 dBA at any residential land use (Chambers 1998).

Exceptions to these codes apply in areas deemed heavy industrial such as the waterfront areas of San Pedro and Long Beach where port operations, and hence dredging, typically occur. For example, Section 8.80.202 of the City of Long Beach Municipal Code states that construction activity noise regulations shall not apply to any construction occurring within the Long Beach Harbor district as established pursuant to Section 201 of the City Charter (Chambers 1998).

Air quality standards in Los Angeles and Orange County are established by the South Coast Air Quality Management District. Significance thresholds for air quality have been established for daily and quarterly construction emissions. Table 5-1 shows example regional thresholds.

Table 5-1
Example Los Angeles Regional Air Quality Threshold Values

Parameter	Daily Threshold (lbs/day)	Quarterly Threshold (tons/qtr)
ROG	75	2.5
NOx	100	2.5
CO	550	24.75
PM10	150	6.75
SOx	150	6.75

ROG = Reactive Organic Gases
NOx = Nitrogen Oxides
CO = Carbon Monoxide
PM10 = Particular Matter (10 Micron)
SOx = Sulphur Oxides

5.2.5 Navigation and Shipping

Navigation and shipping impacts associated with dredging and disposal are generally not significant because the practice of dredging around vessel berthing and transport areas is so commonplace, mitigation measures are included as standard procedures so operations are not disruptive. Occasionally, however, temporary delays or congestion in vessel traffic may occur during dredging operations in tight berthing areas or narrow channels.

5.2.6 Recreational Resources

In Los Angeles and Long Beach, most dredging and disposal operations occur in close proximity to active shipping and berthing facilities where recreational activities are highly limited. With the exception of occasional delays in vessel traffic, when the dredging equipment is being moved or around the discharge pipes, no significant impacts would be expected. If aquatic disposal options are exercised within San Pedro Bay, temporary impacts to recreational areas outside the perimeter of port operations may potentially occur. Potential impacts may include congestion or diversion of recreation boat traffic, disruption in passenger ferry traffic, and impacts to recreational fishing activities.

Potential impacts to recreational resources as a result of dredging and disposal operations are much more likely for projects in and around the entrance to Marina del Rey. Marina del Rey houses the largest concentration of recreational vessels in the U.S. With only one access point to the marina complex located in the area most prone for sediment accumulation, some level of impacts to vessel traffic are certain to occur.

5.3 Description of Dredging and Disposal Best Management Practices

BMPs are the actual practices, including the forms, procedures, charts, software references, etc, used by dredgers to minimize the consequences of dredging and disposal on water quality. This section provides an overview of the available dredging BMP technologies, a review of previous investigations regarding their effectiveness, and the presentation of a toolbox for .selecting the most appropriate BMP(s) for use in the Region.

5.3.1 Review of Available Technologies

Dredging BMPs can be separated into three main categories: silt curtains and gunderbooms, operational controls, and specialty dredging equipment (e.g., environmental buckets). The remainder of this section discusses each of these, along with the advantages and disadvantages for their use.

Silt Curtains and Gunderbooms

The objective when using silt curtains is to create a physical barrier around the dredge equipment to allow the suspended sediments to settle out of the water column in a controlled area. Silt curtains are typically constructed of flexible, reinforced, thermoplastic material with flotation material in the upper hem and ballast material in the lower hem. The curtain is placed in the water surrounding the dredge or disposal area, allowed to unfurl, and then anchored in place using anchor buoys. Silt curtains are most effective on projects where they are not opened and closed to allow equipment access to the dredging or disposal area. Because they are impermeable, silt curtains are easily affected by tides and currents and should not be used in areas with greater than 1-2 knot currents (Hartman Consulting Group 2001). Silt curtains can be deployed so that they extend to within 0.6 meters (2 feet) of the bottom, but this is seldom practical due to water currents. As such, most projects only use curtains that extend a maximum of 3 to 3.6 meters (10 to 12 feet) below the surface. Some of the key advantages of silt curtains are that, if they are deployed correctly, they can protect the adjacent resources and control surface turbidity. The main disadvantages for silt curtains are that they are not effective in high energy environments and they have no effect on bottom turbidity.
A gunderboom works in a similar way, except that the curtain is made of a permeable geotextile fabric that allows the water to pass through, but filters out the particulates. While silt curtains are typically deployed so that they extend downward through part of

the water column, gunderbooms are designed to be installed from the water surface to the project bottom. The advantages with gunderbooms are that they allow unlimited curtain depth and permit unrestricted water flow while the disadvantages are that they are more expensive than silt curtains and can become clogged with silt.

Operational Controls

For dredging projects, operational controls are defined as modifications in the operation of the dredging equipment to minimize resuspension of materials. Operational controls can be employed with mechanical dredges, hydraulic dredges, hopper dredges or barges.

Example operational control methods for mechanical dredges include:

- Increasing cycle time – longer cycle time reduces the velocity of the ascending loaded bucket through the water column, which reduces potential to wash sediment form the bucket. However, limiting the velocity of the descending bucket reduces the volume of sediment that is picked up and requires more total bites to remove the project material. The majority of the sediment resuspension, for a clamshell dredge, occurs when the bucket hits the bottom.
- Eliminating multiple bites – when the clamshell bucket hits the bottom, an impact wave of suspended sediment travels along the bottom away form the dredge bucket. When the clamshell bucket takes multiple bites, the bucket loses sediment as it is reopened for subsequent bites. Sediment is also released higher in the water column, as the bucket is raised, opened, and lowered.
- Eliminating bottom stockpiling – bottom stockpiling of the dredged sediment in silty sediment has a similar effect as multiple bite dredging; an increased volume of sediment is released into the water column from the operation.

Example operational controls for hydraulic dredges include:

- Reducing cutterhead rotation speed – reducing cutterhead rotation speed reduces the potential for side casting the excavated sediment away from the suction entrance and resuspending sediment. This measure is typically effective only on maintenance or relatively loose, fine grain sediment.
- Reducing swing speed – reducing the swing speed ensures that the dredge head does not move through the cut faster than it can hydraulically pump the

sediment. Reducing swing speed reduces the volume of resuspended sediment. The goal is to swing the dredge head at a speed that allows as much of the disturbed sediment as possible to be removed with the hydraulic flow. Typical swing speeds are 1.5 to 9 meters per minute (5 to 30 feet per minute).

- Eliminating the process of bank undercutting – dredgers should remove the sediment in maximum lifts equal to 80 percent or less of the cutterhead diameter.

Example operation controls for hopper dredges and barges include:

- Eliminating or reducing hopper overflow – eliminating or reducing hopper overflow reduces the volume of fine material that flows from the hopper in the overflow. One caution is that this control may significantly reduce project production for hopper dredges or when hydraulic dredging into a barge.
- Lowering the hopper fill level – lowering the hopper fill level in rough sea conditions can prevent material loss during transport.
- Using a recirculation system – water from the hopper overflow can be recirculated to the draghead and used to transport more material into the hopper.

An operation control that can be effective with any type of dredge is to halt dredging during periods of extreme tidal fluctuation when currents are at their strongest point. Another, more generic, operational control is to only work within environmental work windows. Work windows are periods of time when listed species (e.g., California least tern) do not necessarily restrict dredging and disposal activities. Work proposed for times outside these windows requires consultation with the appropriate resource agencies. While this practice in itself will not reduce resuspension, it will reduce the potential for an environmental impact by eliminating the pathway for exposure with a sensitive species.

The main advantages with instituting operational controls are that they do not require installing additional equipment and they can be less costly than installing barriers. The major disadvantages are that they provide a lower regulatory comfort level because the control measure is not usually visual as with a physical barrier like a silt curtain, and that they typically slow the project down and increase costs.

<u>Specialty Dredging Equipment</u>

The last category of dredging BMPs includes specialty dredging equipment and techniques designed to further reduce impacts from resuspended sediments. Examples include:

- Pneuma Pump – the Pneuma pump is used primarily for removal of fine-grained sediment. The Pneuma pump offers high solids concentration (up to 90 percent) in the dredge slurry, with minimal turbidity.
- Closed or Environmental Bucket – specially constructed dredging buckets designed to reduce or eliminate increased turbidity of suspended solids from entering a waterway.
- Large Capacity Dredges – larger than normal dredges designed to carry larger loads. This allows less traffic and fewer dumps, thereby providing fewer disturbances at a disposal site.
- Precision Dredging – dredging utilizing special tools and techniques to restrict the material dredged to that specifically identified. This may mean thin layers, either surficial or imbedded, or specific boundaries.

As with the operational controls described above, these specialty equipment options have the potential to reduce sediment resuspension, but also may increase costs.

5.3.2 Evaluation of Effectiveness of Best Management Practices

For nearly twenty years, the U.S. Army Corps of Engineers has been conducting research to develop techniques for reducing the rate of sediment resuspension during dredging through the development of new equipment and refinement of existing equipment (Raymond 1984). Numerous documents exist (USACE 1986; USACE 1988; Schroeder 2001; Herbich and Brahme 1991; and Hayes 1986) that discuss methods for selecting the proper equipment to reduce sediment resuspension rates depending on site conditions and the resulting effectiveness in the field.

Work conducted by the Corps in Boston Harbor on the effects of different bucket types concluded that "based on turbidity measurements, the conventional bucket produced the highest amount of sediment resuspension spread throughout the water column. Use of the cable arm bucket appeared to reduce sediment resuspension in the water column as the observed depth-averaged turbidity was 46 percent less than observed for the conventional bucket; insufficient total suspended solids (TSS) data were collected during the cable arm bucket operation to completely confirm this reduction, although the few data collected show an even higher reduction. The Enclosed bucket had the lowest overall turbidity and substantially less in the middle of the water column. Observed depth-averaged turbidity for the enclosed bucket was 79 percent less than observed for the conventional bucket. This compared well with observed TSS which showed depth-averaged TSS concentrations for the enclosed bucket 76 percent less than for the "conventional bucket." However, if the appropriate type of sediment (e.g., soft) is not present, these reductions may not apply to other sites.

Several researchers (Schroeder 2001; Fort James Corporation et al. 2001; and Averett et al. 1999) have found that the use of silt curtains, when used properly, are effective in reducing off-site transport of resuspended sediment during dredging. Schroeder (2001) evaluated the differences in metal partitioning and losses with and without the use of silt curtains and predicted that dissolved metals concentrations would be less when the silt curtains were used. Other studies have shown that simply controlling resuspended sediments does not equate to reducing contaminant release during dredging. QEA and BBL (2001) found that even though silt curtains were very effective at reducing off-site transport of resuspended sediments, PCB concentrations downstream of the dredge location became elevated during the dredging of hot spots. Similar results were observed with mercury by Alcoa (2000).

These data suggest that dredging BMPs if properly applied and used in appropriate site-specific conditions can be effective at reducing suspended sediments in the water column and controlling losses of contaminants during dredging, but that with some chemicals, elevations in the water column can still occur.

5.3.3 Toolbox for Selecting Best Management Practices

As presented in Section 5.3.1, there are numerous BMPs available for use under various situations and for controlling various potential environmental impacts. To assist users in the selection of appropriate BMPs for specific situations and for use with specific dredging equipment a BMP selection flow chart and toolbox were created and are presented in Figure 5-2 and Table 5-2.

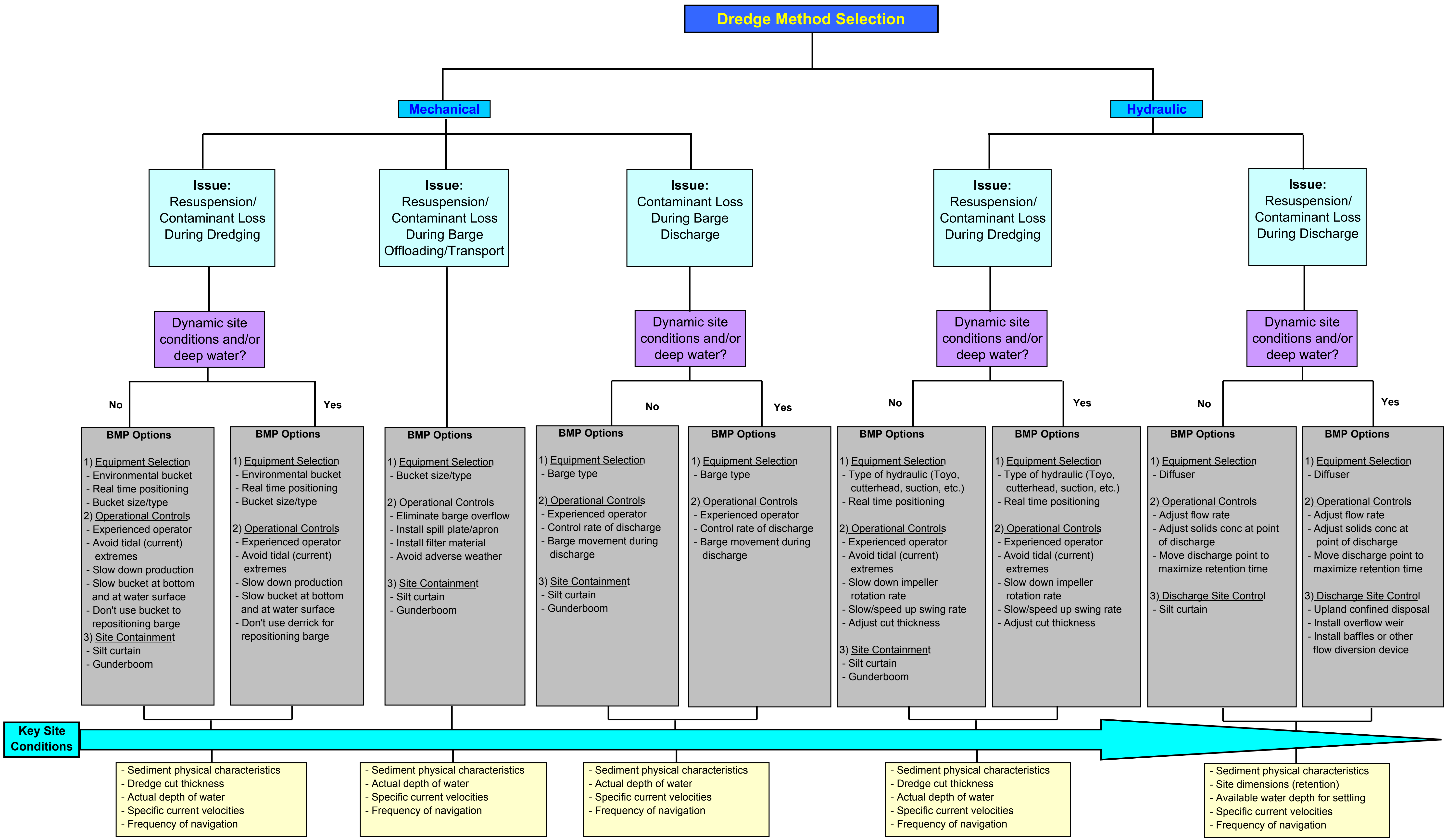

Figure 5-2
Guide for BMP Selection for Contaminated Sediments

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Table 5-2
Example BMP Toolbox for Dredging Contaminated Sediments

BMP Option	Technical Limitations/ Site Constraints	Potential Advantages	Potential Disadvantages	Effective Applications	Ineffective Applications
Mechanical Dredging, Equipment Selection					
Use environmental bucket (aka closed bucket)	• Typically effective only in loose, unconsolidated material • Ineffective at removing debris	• Some studies have shown that they can reduce sediment resuspension levels	• Variable results on previous projects • Significantly slower production rate • Effectiveness dependent upon sediment characteristics	• Typically used for loose, unconsolidated sediment or for contaminated sediments	• New work dredging • Dredging debris • Dredging medium to highly consolidated sediment
Select appropriate size and type of bucket when using standard bucket	• Dependent upon site conditions and sediment physical characteristics • Requires dredging experience	• Can reduce bucket overfill • Can reduce excessive water in bucket • Can reduce need to take multiple bites	• None	• Any mechanical dredging projects	• None
Use Real Time Kinematic (RTK) positioning	• DGPS coverage area/accuracy • Not all contractors may have equipment	• Better control over dredging location and bucket depth • Can reduce duration of dredging	• More expensive to purchase and operate	• Projects requiring precise vertical and horizontal control during dredging	• Projects where tight positioning control is not required, such as beach nourishment
Mechanical Dredging, Operational Controls					
Use experienced operator (i.e., pre-qualify contractor)	• None	• Experienced dredge operator will be significantly better than inexperienced operator at minimizing resuspended sediments and maintaining an effective production rate	• Experienced dredge operators are not always available and are often employed by the larger dredging companies. Low bidders at times may not be qualified in working with contaminated sediment. Specifying experienced operators may result in no bids.	• Any mechanical dredging project	• None
Avoid tidal extremes	• Site location may have high current velocities at all times	• May reduce the horizontal extent that resuspended sediment travels	• Depending upon season, could significantly increase project duration and cost	• Consider when tidal extremes cause high current velocities that impact water quality • Typically used as contingency measure	• Project schedule is tight and slowing production is not an option (e.g., emergency dredging events)

Table 5-2
Example BMP Toolbox for Dredging Contaminated Sediments

BMP Option	Technical Limitations/ Site Constraints	Potential Advantages	Potential Disadvantages	Effective Applications	Ineffective Applications
Slow down production rate (e.g., slow bucket near bottom when lowering and near surface when raising)	• None	• May reduce sediment loading to water column • May reduce sediment resuspended from bucket impact on bottom and drainage at the water surface	• Slower production rate means increased project duration and increased project cost	• Typically used as a contingency measure when water quality criteria can not be achieved during standard dredging	• Project schedule is tight and slowing production is not an option (e.g., emergency dredging events)
Do not allow derrick repositioning using clamshell	• None	• Minimizes resuspension during relocating derrick	• May slow down production since a secondary vessel is required to move the derrick • Increased project cost due to secondary vessel	• Any mechanical dredging project	• None
Mechanical Dredging, Site Containment Options					
Install silt curtain	• Does not extend to bottom of water column • Typically not effective in higher current velocities (>2 knots) • Need to be anchored, causing difficulty in relocating curtain • Interferes with navigation	• Provides visible control measure • Limits and defines potential impact area on the surface • Can reduce resuspended sediment concentrations outside of curtained area, generally limited to surface concentrations	• Typically ineffective in containing dissolved chemicals • Can become fouled with marine organisms and sink • Significant additional cost to project • Awkward to deploy and manage • Increased resuspended sediment concentrations within contained area • Ineffective in areas exposed to wave attack	• Non-navigation locations with infrequent equipment movement and low to moderate current • Nearshore areas where dredge area can be isolated	• Open water areas with deep water, and exposure to waves and high currents • Areas with active navigation • Projects requiring frequent equipment movement
Install Gunderboom (i.e., a type of silt curtain that is designed to extend to the sediment bed)	• Typically not feasible in high current velocities • Need to be anchored, causing difficulty in relocating curtain • Interferes with navigation	• Provides visible control measure • Limits and defines potential impact area • Can reduce resuspended sediment concentrations outside of curtained area throughout water column	• Typically not effective in containing dissolved chemical release • Significant additional cost to project • Awkward to deploy and manage • Increased resuspended sediment concentrations within contained area • Ineffective in areas exposed to wave attack	• Non-navigation locations with infrequent equipment movement and low to moderate current • Nearshore areas where dredge area can be isolated	• Open water areas with deep water, and exposure to waves and high currents • Areas with active navigation • Projects requiring frequent equipment movement

Table 5-2
Example BMP Toolbox for Dredging Contaminated Sediments

BMP Option	Technical Limitations/ Site Constraints	Potential Advantages	Potential Disadvantages	Effective Applications	Ineffective Applications
Mechanical Dredging Barge Disposal, Operational Controls					
Use experienced operator (i.e., pre-qualify contractor)	• See previous description	• See previous description	• See previous description	• See previous description	• See previous description
Control rate of discharge	• Dependent upon barge capability • Difficult to control	• Less impact on bottom, reducing near bottom resuspended sediment	• May increase dispersion within water column • May increase project duration	• Use when controlling bottom impact	• When schedule is critical
Move barge during discharge	• Disposal site boundaries may be limited	• May help reduce impact on bottom	• May increase dispersion within water column • May increase project duration	• Use when controlling bottom impact	• When precise disposal placement is required • When schedule is critical
Mechanical Dredging Barge Transport and Offloading, Equipment Selection					
Select appropriate type of barge (contractor responsibility)	• Select appropriate barge to meet project objectives, and environmental concerns	• Maximize production, minimize potential sediment loss	• Specifying type of barge to be used may limit available contractors	• Any mechanical dredging project	• None
Mechanical Dredging Barge Transport and Offloading, Operational Controls					
Avoid barge overfilling	• None	• May reduce spillage from barge	• Potentially requires either more barges or more barge trips, increasing costs	• Any mechanical dredging project	• None
Use spill plate/apron during offloading	• Wharf configuration/design may preclude this option	• Reduce potential for spillage into water at offload site	• Minimal increased cost	• When mechanically off-loading barges for upland or nearshore confined disposal	• When the elevation difference between the barge and the offloading top of deck are large
Use filter material on barge drainage ports	• Deep hulled barges typically are not used to dewater sediment • Typically used to reduce loss of sediment during dewatering from flat deck barges	• Reduces loss of sediment when free water drains from barge	• Minimal increased costs • May slow down dewatering process	• When using flat deck barges for transport to offload area • When controlled dewatering is preferred	• Bottom dump or split hull barges • When objective is to rapidly dewater the sediment
Mechanical Dredging Barge Transport and Offloading, Site Containment Options					
Install silt curtain	• See previous description	• See previous description	• See previous description	• See previous description	• See previous description
Install Gunderboom	• See previous description	• See previous description	• See previous description	• See previous description	• See previous description

Table 5-2
Example BMP Toolbox for Dredging Contaminated Sediments

BMP Option	Technical Limitations/ Site Constraints	Potential Advantages	Potential Disadvantages	Effective Applications	Ineffective Applications
Hydraulic Dredging, Equipment Selection					
Select appropriate type of hydraulic dredge (suction, cutterhead, dustpan, toyo, etc.)	• Dependent upon site conditions and sediment physical characteristics • Requires dredging experience	• Maximize production, minimize potential sediment loss	• Specifying hydraulic equipment to be used may limit available contractors	• Any hydraulic dredging project	• None
Use Real Time Kinematic (RTK) positioning	• See previous description	• See previous description	• See previous description	• See previous description	• See previous description
Hydraulic Dredging, Operational Controls					
Use experienced operator (i.e., pre-quality contractor)	• See previous description	• See previous description	• See previous description	• See previous description	• See previous description
Avoid tidal extremes	• See previous description	• See previous description	• See previous description	• See previous description	• See previous description
Slow down impeller speed	• Need to understand system limitations (e.g., potential for plugging or cavitation) • Depends on hydraulic pump capability	• Reduces flow rate which may reduce resuspended sediment at point of dredging	• Reduces production rate, increasing cost • May require higher maintenance due to plugging	• Any hydraulic dredging project	• None
Slow down or speed up swing rate	• Thin cuts require faster swing rates to maximize slurry solids concentration	• May reduce resuspended sediment by slowing or speeding up swing rate depending upon cut thickness	• Slowing down swing rate reduces production rate, increasing duration and costs • Potential to plug the discharge line	• Typically used as a contingency measure when water quality criteria can not be achieved during dredging	• Project schedule is tight and slowing production is not an option (e.g., emergency dredging events)
Hydraulic Dredging, Site Containment Options					
Install silt curtain	• See previous description	• See previous description	• See previous description	• See previous description	• See previous description
Install Gunderboom	• See previous description	• See previous description	• See previous description	• See previous description	• See previous description
Hydraulic Discharge, Equipment Selection					
Use diffuser	• Suitable for open water discharge, but not typically used in settling basins	• Slows down discharge velocity, limiting resuspension impact area	• Higher turbid plume within discharge area • Slightly higher maintenance costs	• Disposal site bathymetry and currents sufficient for adequate dispersal • Dredge material does not contain debris which could clog the diffuser	• Some beach replenishment projects may not support use of diffusers • Large amounts of debris • Projects requiring screening for UXO

Table 5-2
Example BMP Toolbox for Dredging Contaminated Sediments

BMP Option	Technical Limitations/ Site Constraints	Potential Advantages	Potential Disadvantages	Effective Applications	Ineffective Applications
Hydraulic Discharge, Operational Controls					
Adjust flow rate	• Need to understand system limitations (e.g., potential for plugging or cavitation) • Depends on hydraulic pump capability	• Slowing flow rate typically reduces sediment load being discharged, and increases retention time within settling basin	• Increases duration and costs • Potential to plug the discharge line • May required higher maintenance due to plugging	• Any hydraulic dredging project	• None
Adjust slurry solids concentration	• Need to understand system limitations (e.g., potential for plugging or cavitation) • Depends on hydraulic pump capability	• In settling basins, higher solids concentration in slurry may result in less overall resuspended sediment concentration at the effluent discharge location due to higher settling rates associated with higher solids concentration	• In open water discharge, higher solids concentration may result in higher resuspended sediment concentrations	• Settling basin discharge sites • Open water discharge sites • Increasing or decreasing slurry concentration may have variable results at different sites. Laboratory settling tests can assess how a site specific sediment will behave.	• None
Move discharge point to maximize retention time	• Discharge site boundaries limit discharge point location • Hydraulic discharge pipe length is dependent upon pump capability	• Increasing retention time in settling basin will allow more resuspended sediment to settle	• Locating discharge point to maximize retention time may require additional pipeline and booster pumps, increasing cost	• Settling basin discharge sites	• Open water discharge sites
Hydraulic Discharge, Discharge Site Controls					
Size appropriate overflow weir	• Dependent upon flow rate	• Prevents resuspension of settled sediments within settling basin	• None	• Settling basin discharge sites	• Open water discharge sites
Install baffles or other site flow diversion(s)	• Site storage capacity • Site configuration and flow rate	• Increases retention time	• Increased costs for structure(s) • Reduced storage capacity	• Settling basin discharge sites	• Open water discharge sites
Increase ponding depth	• Site storage capacity • Dependent upon flow rate	• Increases retention time • Reduces potential for resuspending settled sediment	• Requires larger containment berms • Potentially reduced storage capacity • Increased costs	• Settling basin discharge sites	• Open water discharge sites

Using the flow chart in Figure 5-2, a potential dredger or project sponsor would first select the method of dredging to be used (e.g. mechanical or hydraulic) since the available BMPs are specific for each. Next, the user selects the environmental issue of concern, and then answers some simple questions about the site conditions, thus revealing a selection of potential BMPs. There is also a list of key site conditions for each group of BMPs presented that may influence the effectiveness of the method and that should be further investigated.

Once potential BMPs have been identified, the user may then move on to Table 5-2 where each BMP option is described in more detail, including a summary of technical limitations and site constraints, potential advantages and disadvantages, and effective and ineffective applications. The goal for developing these tools is to provide the user sufficient information for proactively identifying potential environmental concerns and recommending BMPs to minimize the impacts.

5.4 Water Quality Certification and Water Quality Monitoring Requirements during Dredging and Disposal

Discharges of dredged material subject to the Corps' 404 permit program are required to obtain a Section 401 Water Quality Certification (WQC) from the Los Angeles Regional Water Quality Control Board (LARWQCB). A 401 Certification is an agreement that a proposed discharge of fill (not the activity of dredging) does not violate state water quality standards. The Corps' 404 jurisdiction is specific to the discharge, and does not cover the activity itself (i.e., hydraulic dredge moving material to the uplands is not a 404 activity) unless in very specific circumstances and extremely large projects. The activity of dredging, as well as proposed discharges of material in waters of the state, are also subject to water quality monitoring requirements promulgated by the LARWQCB under the Porter-Cologne Water Quality Control Act (as amended January 1, 2004). The Regional Water Board issues Waste Discharge Requirements (WDRs) for discharges including dredging and disposal operations under their Porter-Cologne authority. Commonly, the LARWQCB will issue combined WDRs and 401 WQC. Receiving water monitoring is conducted to ensure compliance with WDR provisions and that dredging/disposal operations are not creating turbidity plumes that adversely affect water quality. This section summarizes current water quality monitoring requirements for typical dredging and disposal operations in Southern

California. Proposed modifications for future dredge monitoring programs are presented later in Section 8.

5.4.1 Dredge Monitoring Requirements

Current water quality monitoring requirements for dredging and disposal projects include the following general specifications:

- Sampling for the receiving water monitoring shall commence at least one week prior to the start of dredging and fill operations and continue at least one week following completion of all such operations.
- Sampling shall be conducted down current of the dredge sites at least one hour after the start of dredge operations. The following stations shall apply:
  - 30.5 meters (100 feet) up current of the dredging operations, safety permitting (**Station A)**
  - 30.5 meters (100 feet) down current of the dredging operations, safety permitting (**Station B)**
  - 91.5 meters (300 feet) down current of the dredging operations (**Station C)**
  - Control site located in an area not affected by dredging operations (**Station D)**
- All samples shall be collected using a grab sampling device or with remote electronic detection equipment.
- All samples shall be analyzed for the parameters, and at the specified frequency, listed in Table 5-3.
- Water column light transmittance data from Stations C and D shall be averaged for the near surface (1 meter below the surface), mid-water and bottom (1 meter above the bottom). If the difference in percent light transmittance is 30 percent or greater (based on a comparison of the averaged values at the two stations), water samples shall be collected at mid-depth (or the depth at which the maximum turbidity occurs) and analyzed for trace metals, Dichlorodiphenyltrichloroethanes (DDTs), polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAHs). At a minimum, at least one water sample should be collected and analyzed for these parameters during each dredging operation.

- Color photographs shall be taken at the time of sampling to document the presence or absence of visible effects of dredging.
- Field observations shall be recorded on a daily basis during dredging and disposal operations, including the following parameters:
  - Date and time;
  - Direction and estimated speed of currents;
  General weather conditions and wind velocity;
  - Tide stage;
  - Appearance of trash, floatable material, grease, oil or oily slick, or other objectionable materials;
  - Discoloration and/or turbidity;
  - Odors;
  - Depth of dredge operations during previous day;
  - Amount of material dredged the previous day; and
  - Cumulative total amount of material dredged to date.

Table 5-3
Dredging and Disposal Water Column Monitoring Parameters

Parameters	Units	Station	Frequency
Dissolved Oxygen[1]	mg/L	All stations	Weekly[2]
Light Transmittance[1]	% Transmittance	All stations	Weekly[2]
pH[1]	pH units	All stations	Weekly[2]
Suspended Solids[3]	mg/L	All stations	Weekly[2]

1. Taken throughout the water column and at a minimum of 2-meter increments.
2. Sample two times per week for the first two weeks.
3. Sample at mid-depth.

5.4.2 Disposal Site Monitoring Requirements

Requirements for contaminated sediment confined dredge material disposal site monitoring may vary depending on the nature of the discharge and project sponsor. For discharges of fill in waters of the U.S. subject to Section 404 of the Clean Water Act (CWA) where the USACE is the sponsor, the discharge of dredge material requires a CWA Section 401 WQC from the LARWQCB. In practice, the USACE implements a standard water quality monitoring program, in consultation with the RWQCB,

developed by their Environmental Resources Branch (and similar to that conducted for dredging) to ensure environmental compliance with both state and federal law.
In cases where the project sponsor was a local government or port authority, discharges of dredged material subject to the Corps' 404 permit program are also required to obtain a Section 401 WQC from the LARWQCB. The LARWQCB also becomes the lead agency for enforcing water quality monitoring under the authority of the Porter Cologne Act. In practice, the RWQCB issues combined Waste Discharge Requirements (WDRs) and 401 certification to address the requirements of both state and federal law.

Unconfined "clean" dredge material disposal at a designated offshore disposal site is subject to the Corps authority under Marine Protection, Research and Sanctuaries Act (MPRSA) Section 103. Proposed ocean disposals are also subject to approval by the EPA, regardless of project sponsor. Open ocean disposal is subject to monitoring requirements based on site designation parameters established in the Final Environmental Impact Statement (EIS) and Site Management and Monitoring Plan specific to each site and developed from the dredged material ocean disposal site designation (DMODSD). Requirements are typically written into the USACE permit issued for the dredging project.

Return water from dredged material disposed at upland disposal sites is administratively defined as a CWA Section 404 jurisdictional discharge and is thus subject to 401 and WDR requirements. Dredged material placed in upland disposal sites and later transported to other upland sites is subject to Resource Conservation Recovery Act (RCRA) if the material fails the Toxic Concentration Leach Potential (TCLP). Environmental monitoring at upland disposal sites, be it for disposal or beneficial reuse, would be regulated under yet another set of State authorities. All landfills in the State of California are regulated by the Integrated Waste Management Board, one of six divisions within the California Environmental Protection Agency umbrella. Waste acceptance is determined by compliance with LARWQCB-issued WDRs for each landfill. Previously, dredge material disposal at inland landfills has not been permitted due to concerns regarding chloride leaching and potential impacts to the groundwater resources. Future disposal activities may be permitted if sufficient monitoring occurs, but this has not yet been developed.

6 MANAGEMENT ALTERNATIVES

Section 6 provides an overview of available management options for the treatment and/or disposal of contaminated sediments in Los Angeles County (County). An evaluation of the feasibility of these alternatives and criteria for alternative selection is presented in Section 7 of this report.

6.1 Overview of Alternatives

Management of contaminated sediments can occur actively in the form of source control measures, or reactively in the form of isolation, remediation or removal. Source control/reduction can occur either by controlling aqueous contaminant inputs to the watershed or by controlling sediment inputs to the watershed. Options for contaminated sediment isolation include various forms of *in-situ* and post-removal containment. If sediments are removed, potential management options include in-water or upland disposal. Some form of beneficial reuse with contaminated sediments is possible with nearly all sediment types. However, sediment treatment, market development, and/or policy development is needed before some of the beneficial reuse options can be implemented. Each of these issues is discussed in more detail in this section.

6.2 No Action

If the contaminated sediments are not located in an area where dredging is required for navigational or other purposes, a no action alternative may be possible assuming ecological and human health risks are not compromised. Potential risks resulting from leaving the material in place must be balanced against the potential risks associated with removal or isolation, including resuspension and remobilization. One example where the risks of leaving the material in place exceeded the risks associated with removal is the Lauritzen Channel in Richmond Harbor of San Francisco Bay. In this case, despite the lack of need for navigational dredging, the sediments were removed and transported to an upland permitted landfill.

While the preferred alternative is frequently removal, it is sometimes advantageous to leave contaminated sediments in place rather then risk increasing chemical bioavailability by dredging. This is because chemicals present in bottom sediments typically exist in two basic forms: (1) adsorbed or otherwise bound to particulates and (2) dissolved in bottom sediment pore waters (the water between particulate grains in the sediment). Contaminant releases from sediments tend to increase during resuspension due to increased surface area exposure and conditions suitable for increased chemical oxidation. This process, referred to as chemical partitioning, can allow chemicals previously bound to sediment particles to be released into the water column where they can be absorbed by aquatic organisms, possibly causing detrimental effects. This alternative may be suitable for low energy areas where natural sedimentation can assist in burying the contaminated sediment layers and only when source control has already been implemented.

6.3 Contaminant Source Reduction

Watershed-derived contaminated sediment is created when organic and inorganic contaminants released or deposited within the watershed come into contact with the sediment on erodible and impervious surfaces of the watershed through natural processes or human activities. Contaminated sediment can also be generated in the water bodies where elevated contaminant levels exist as a result of releases from local sources in the water bodies or discharges from upland. Hence, a potentially effective option for the management of contaminated sediment is through the control or reduction of contaminant releases in the watersheds and water bodies.

The sources of contaminants in the watershed of the Los Angeles Region (Region) include chemicals released from accidents, industrial, commercial, and residential activities, improper operation and maintenance of disposal systems, point sources, atmospheric deposition, and marine vessel activities. Watershed activities that are known to release chemicals include transportation and commercial activities on freeways and at parking lots and gas stations. Industrial activities in the Los Angeles/Long Beach (LA/LB) Harbors, including cargo handling and heavy machinery operations at the terminals, also have the potential to release contaminants to the harbor waters either directly or in runoff. Point sources, primarily POTWs, release contaminated particulates as well as dissolved contaminants into receiving waters. An example point source discharge is the Terminal Island Waste Water Treatment Plant, which discharges directly into the Los Angeles Harbor. Atmospheric deposition of contaminants occurs when contaminants in the atmosphere, originating from aerial emission during industrial, commercial, and transportation activities in the watersheds, bind to suspended particulates, and settle on land and in aquatic systems. Marine vessel activities may result in the release of contaminants from sources such as oil and petroleum products (hydrocarbons, lead, and polycyclic aromatic hydrocarbons [PAHs]), antifouling paint additives (metals and tributyltin [TBT]), and sacrificial anodes (metals).

Reduction of contaminant release from these sources through the implementation of control measures can reduce the amount of contaminated sediment in the watershed and water bodies in the area. Current contaminant control measures driven by the National Pollutant Discharge Elimination System (NPDES) permit requirements, Total Maximum Daily Load (TMDL) regulations, and watershed management plans were discussed previously in Section 3. In response to the NPDES and TMDL regulations, local agencies have been installing end-of-the pipe Best Management Practices (BMPs) for storm water. Structural BMPs that have been installed by various agencies include catch basin inserts, vortex separators (or gross pollutant separators), oil separators, infiltration/filtration devices, low flow diversion systems, and combination systems. Table 6-1 summarizes the types of structural BMPs that have been implemented or are planned by the different jurisdictions discussed in Section 3.3.3. As shown in the table, the most commonly used BMPs in the County are catch basin inserts and Continuous Deflection Separator (CDS) units.

Table 6-1
Summary of Structural BMPs Used in Los Angeles County

Jurisdiction	Vortex Flow System CDS	Vortex Flow System Stormceptor	Catch Basin Insert	Catch Basin Screen	Low Flow Diversion System	Netting System	Filtration System	Separation System (Oil & Grease)
LACDPW	✓	✓	✓				✓	
City of Los Angeles	✓⊗	✓	✓⊗	✓⊗	✓	✓⊗	✓	✓
City of Long Beach	⊗		⊗			⊗		
City of Santa Monica	✓⊗	⊗	✓⊗	✓⊗	⊗		⊗	
City of Beverly Hills			✓⊗					
City of Culver	⊗							
City of West Hollywood				✓⊗				

Legend: ✓ Implemented ⊗ Planned

Items marked with both a ✓ and ⊗ refer to area where items have been both implemented and future projects planned.

6.4 Sediment Source Reduction/Containment

Sediments deposited in the regional estuaries, harbors, navigational channels and coastal waters are composed of materials of both upland and littoral origins. Sediment movement and deposition as a result of littoral processes from wave and current action along the coast contributes to the accretion of sediment in harbor channels on the open coast. Sediment deposited at the mouths of regional streams such as Ballona Creek and the Los Angeles River Estuary (LARE) is primarily a result of watershed runoff during storms. Since an appreciable fraction of the sediment discharged from upland areas has been found to be contaminated, reduction and containment of sediment sources within the watersheds are, therefore, a potentially effective option for the management of contaminated sediment within the study area for this project.

The primary sources of sediment within the regional watersheds include erosion from construction sites, land development, foothills, canyons, and burned areas. For the Region, over a hundred debris catch basins are presently in place at the outlets of canyons and foothills to trap eroded sediment and thus reduce sediment delivery downstream and to the coast. In addition, over 200 soil stabilization structures were constructed and are functioning to prevent erosion in the canyons (LACDWP 2003). Emergency structures have also been constructed downstream of burned areas in the watersheds to trap eroded sediment and debris to protect downstream properties. Opportunities exist, however, to enhance the siting and trapping efficiencies of erosion control structures throughout the watershed to reduce bypassing and coastal delivery of eroded sediment. Opportunities also exist to improve management practices for erosion control at urban transitional lands and barren lands to reduce erosion.

Reduction and containment of sediment-producing sources within the watersheds can reduce the overall volume of coastal sediment requiring management in the Region. By trapping sediment from natural foothills and canyons above urban basins, this option reduces the amount of natural sediment that can be contaminated during migration through the urban areas en route to the ocean. Eliminating contaminated sediment-producing sources within the watersheds reduces the volume of contaminated sediment discharged to the coast, but also may deprive coastal beaches of natural supplies of sand.

An example of this is currently underway in Santa Monica where the U.S. Army Corps of Engineers, Los Angeles District (USACE) is evaluating alternatives for controlling sediment within the Ballona Creek watershed in an effort to reduce sedimentation in the Marina del Rey entrance channel. One of the alternatives under consideration is the construction of in-stream sediment traps to collect Ballona Creek sediment prior to discharge. It should be noted, however, that such control measures tend to be less effective for fine-grained sediment especially during large storm events.

6.5 Aquatic Disposal Options

Unconfined aquatic disposal of contaminated sediments is prohibited by law under the Clean Water Act (CWA), Section 404(b) and the Marine Protection, Research and Sanctuaries Act (MPRSA) of 1972. The U.S. Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (Corps) have jointly developed testing manuals to determine dredge material suitability for aquatic disposal proposed for ocean disposal (or Evaluation of Dredged Material Proposed for Ocean Disposal "Green Book" EPA 1991) and for disposal in inland environments (Inland Testing Manual, EPA 1998). Discharges for the purpose of waste disposal outside the baseline (breakwater) and within territorial seas are subject to testing under the Green Book and the requirements of EPA's ocean program. Discharges of dredged or fill material into waters of the U.S. are subject to the Corps' 404 Authority, including inland waters, rivers, and oceans out to 3 nautical miles, and are subject to testing under the Inland Testing Manual (ITM). Where authorities overlap, Green Book testing supersedes. Aquatic disposal of dredged sediments is regulated by the Corps – South Pacific Division, following federal guidelines. EPA provides oversight in 404 Situations, but the Corps makes final determinations where 404 only applies. In Section 103 Situations, EPA can veto or modify Corps permits for ocean disposal (Table 6-2). National Oceanic and Atmospheric Administration (NOAA) Fisheries as well as the U.S. Fish and Wildlife Service (USFWS) also play consultative roles in the permitting process. Additionally, the California Coastal Commission (CCC) and the Los Angeles Regional Water Quality Control Board (LARWQCB) ensure state water quality and coastal zone management act guidelines are met by providing input to the EPA and the Corps during the permit review process. To comply with the regulations set forth by the above state and federal entities, aquatic disposal options for contaminated sediments in the Region are limited to alternatives where confinement of the contaminants will be provided.

Table 6-2
Agency Oversight for Aquatic Disposal of Contaminated Sediments

Agency/Organization	Governing Authority
U.S. Army Corps of Engineers	Sections 9 and 10 of the Rivers and Harbor Act; Section 404 of the Clean Water Act; all in-water fill or construction activities
U.S. Environmental Protection Agency	Protection of ecological and human health resources – commenting authority in inland 404 Situations; authority to veto or modify Corps permits in ocean disposal (103) Situations
NOAA Fisheries	Protection of all marine resources – federal coordinating agency
U.S. Fish and Wildlife Service	Protection of fish and wildlife resources – federal coordination agency
California Coastal Commission	Ensure compliance with the Coastal Zone Management Act
Los Angeles Regional Water Quality Control Board	Protection of surface water resources; issue Waste Discharge Permits for disposal facilities and/or operations, ensure compliance with Section 401 of the federal Clean Water Act.

Potential aquatic disposal options considered in the evaluation process include submerged confined aquatic disposal (CAD), nearshore confined disposal, and shallow water habitat (SWH) creation. Each is described in more detail in the following sections and presented graphically in Figure 6-1.

6.5.1 Confined Aquatic Disposal

CAD is a procedure where contaminated sediments are typically placed into a submerged depression or pit and covered with clean sediments to form a cap that will prevent upward migration of contaminants into the water column or surficial sediment layer. Occasionally, sediments will simply be mounded and capped rather than placed in a depression. The primary issues associated with a CAD include: (1) the short-term effects from turbidity and potential contaminant release during placement; (2) cap stability under hydrodynamic stresses (waves and currents); (3) cap integrity under biological perturbations (bioturbation); (4) chemical diffusion through the cap layer; and (5) uneven site consolidation.

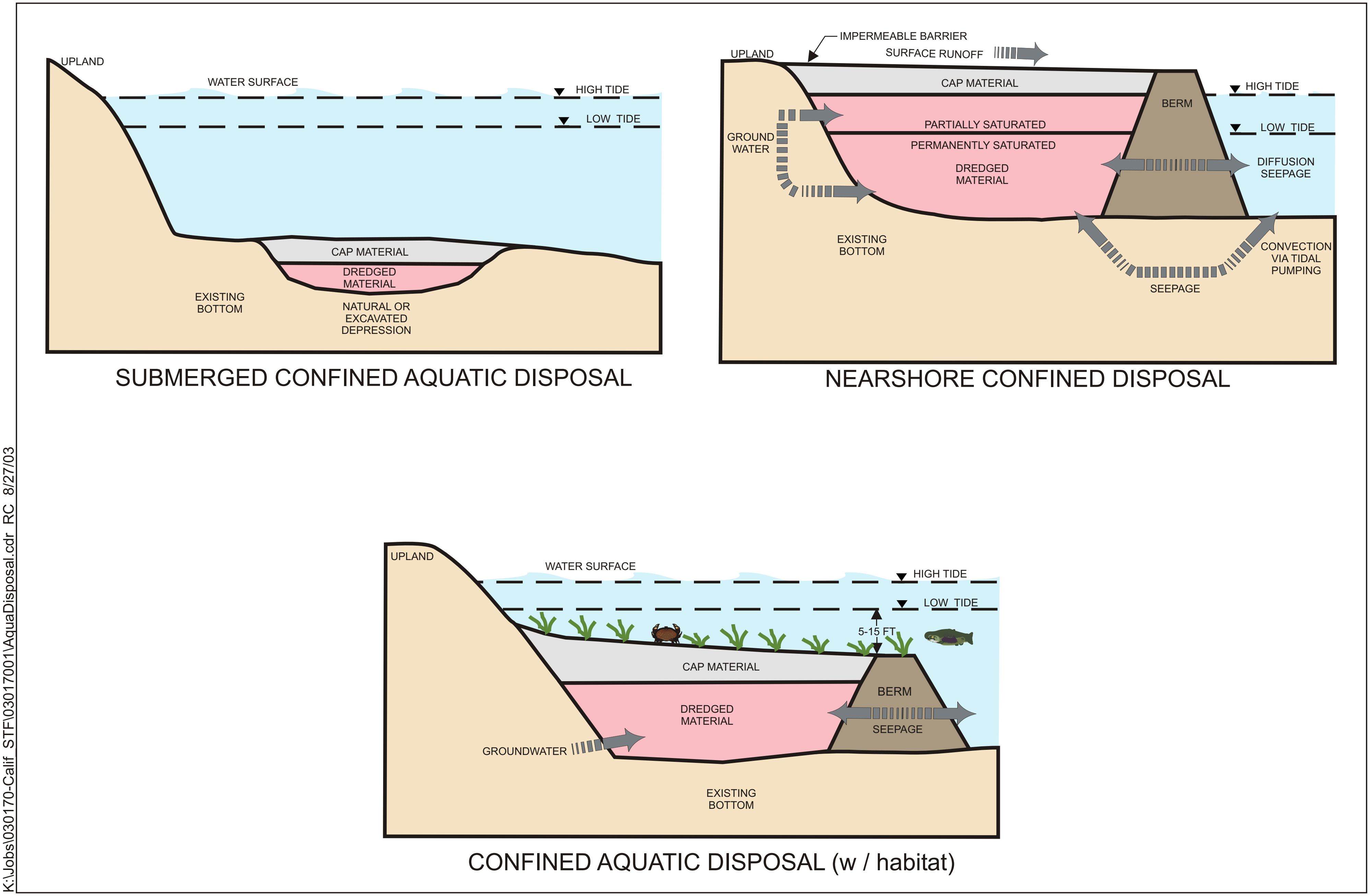

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Figure 6-1
Example Aquatic Disposal Options

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This method was evaluated in great detail by the Contaminated Sediments Task Force (CSTF) by conducting a pilot field study using contaminated dredge materials removed from the LARE and placed in the North Energy Island Borrow Pit (NEIBP), located in Long Beach. Approximately 100,000 cubic meters (m^3) of contaminated sediment was dredged for the pilot study and capped with approximately 60,000 m^3 of clean sediment from a previous maintenance dredging project. The pilot study, which was conducted between the summer of 2001 and the winter of 2002, relied on standard dredging equipment such as mechanical (re-handling) buckets and bottom dump scows. Dredge material placement and cap construction were designed to prevent uneven placement and smooth surface areas. A minimum of 1-meter cap thickness was ensured through daily bathymetric surveys and post construction monitoring. Water quality monitoring occurred both at the point of dredging and at the disposal location. Immediately following cap construction, field samples were collected to ensure accurate placement of the cap material, cap thickness and lack of mixing between the cap and LARE material.

Since construction, intensive monitoring of the cap surface has been conducted annually for the past three years. The results of the field monitoring conducted thus far indicate the following conclusions:

- The depth and thickness of the cap has been maintained;
- Visual observations and bathymetry data indicate the cap is intact (no sloughing or subsidence);
- The cap has been successful in limiting chemical migration;
- Chemical concentrations in the cap material are similar to the post construction results;
- Benthic organism burrow mounds were detected on the cap surface but contained low chemical concentrations indicating that the material was not LARE material; and
- A depositional layer of flocculent material has settled on the surface of the cap which appears to be fine-grained material from ongoing discharge of the Los Angeles River.

Additional details of the aquatic capping pilot study are contained in the final report for the Dredged Material Management Plan (DMMP) Pilot Studies, which is included in the Management Strategy Technical Appendices as part of this document.

6.5.1.1 Shallow Water Habitat Creation

SWH creation refers to a process that involves placing the contaminated dredge material in a diked sub-aqueous containment area (i.e., CAD) in shallow water and covering the material with a clean cap designed to provide the proper elevation and consistency needed to enhance the biological value of the site (Figure 6-1). Primary issues of concern with shallow-water habitat creation include: (1) final cap elevation determination, (2) cap material thickness and selection, and (3) target organism colonization, as well as all of the issues associated with aquatic capping of contaminated dredged materials. An example of this type of aquatic disposal option is the POLA Cabrillo Shallow Water Habitat (CSWH) project completed in 1999. The 64-hectare (190-acre) habitat area was created to mitigate for port development projects and included contaminated dredged sediments from Marina del Rey as foundation material (Los Angeles CSTF Advisory Committee Meeting Notes, 4/9/02). The concept for the Cabrillo habitat project was to create a subsurface disposal area that would effectively raise the bathymetry of the area to a point where light penetration could reach the bottom and provide conditions that support a more diverse habitat compared to a previously deep-water area.

6.5.2 Confined Disposal Facility

A nearshore confined disposal facility (CDF) involves placing contaminated dredged materials inside a diked nearshore area or island constructed with containment and control measures such as lining, covering and effluent control (Figure 6-1). Primary issues with nearshore CDF disposal include: (1) coastal land availability and costs; (2) wave protection; (3) short-term effects from effluent discharge during and after filling; (4) solids retention during filling; (5) contaminant containment structure design; and (6) long-term end use of the site after closure. Nearshore CDFs constructed with contaminated sediments as fill material have been constructed by the Port of Los Angeles (POLA) and the Port of Long Beach (POLB) for many years and have been the standard method for disposing of contaminated dredge sediments.

Examples of regional CDFs include the Pier 400 construction project at the POLA and the Pier E, and the Slip 2 project at the POLB. In both instances, dikes were constructed across the entrance to the slip or around the perimeter of the disposal area with open areas to allow vessel traffic. Sediments were then placed into the fill area, initially via bottom dump barge and then hydraulically as the fill area became too shallow to allow access via barge. As the sediment accumulated in the fill area, the dike walls were increased in height until they broke the surface of the water. Weirs were then used to drain the remaining water from the fill area. After de-watering, the fill areas were covered with asphalt and developed to support various port facilities.

The POLA Pier 400 project is a 197-hectare (590-acre) CDF constructed using over 58 million m^3 of dredged sediment. Construction began in 1994 and was completed six years later in 2000 at a cost of approximately $400 million (Port of Los Angeles website – www.portofla.org). The POLB Pier T, Slip 2 fill project was also completed in 2000. Approximately 2 million m^3 of dredged sediment was used to construct the 9-hectare (29-acre) CDF by filling a former slip at the California Unified Terminal (Los Angeles CSTF Interim Advisory Meeting Minutes, 8/21/98).

6.6 *In-Situ* Remediation

In-situ treatment/remediation of contaminated sediments is a developing science that has been used on a very limited basis in the Region at the time this report was prepared. Currently, two primary methods of *in-situ* remediation are being studied by researchers in the U.S. and Canada. One method relies on injecting chemicals into the sediments (primarily oxidants) to speed up the bacterial degradation processes or to inactivate reactive sulfides (e.g. with ferric chloride). Example projects have been conducted in Hamilton Harbor, Canada (Murphy et al. 1995a), and the St. Mary's River, Canada (Murphy et al. 1995b).

The other method uses a proprietary (Weiss Associates Electrochemical Remediation Technologies) Alternating Current/Direct Current (AC/DC) electrical signal to mineralize organic compounds and mobilize and remove metal contaminants (Doering et al. 2000). This process, which has been used in Europe, is being tested in the U.S. with support from the Remediation Technology Development Forum (RTDF). The RTDF was established in

1992 by the EPA to foster collaboration between the public and private sectors in developing innovative solutions to mutual hazardous waste problems. Since then, the RTDF has grown to include partners from industry, several government agencies, and academia who share the common goal of developing more effective, less costly hazardous waste characterization and treatment technologies.

Both methods have been tested on small pilot scale projects and are currently being investigated for more wide-scale use. As in the case with the no-action alternative, *in-situ* remediation of contaminated sediments is not feasible for areas where sediment removal is required for navigational or other purposes. In addition, costs for this alternative are currently much higher than with other alternatives, partially due to the proprietary nature of the technology.

A regional example where this technology has been attempted is a case at Naval Air Weapons Station in Point Magu, California where, in 1998, the electro-chemical process was used by Lynntech, Inc. to treat approximately 0.5 acres of soil contaminated with heavy metals (primarily chromium and cadmium). After 22 weeks, target remediation goals were not met; the high chloride concentrations in the groundwater were suspected to be the cause.

6.7 *In-Situ* Isolation/Containment

In-situ isolation/containment of contaminated sediment consists of capping the material in place using either clean sand, geo-textile material, or a combination thereof to provide an engineered isolation of the contaminants, thus preventing migration to the water column. The technical aspects of sediment capping design and implementation are similar to those employed during construction of a confined aquatic disposal facility, which are described in detail in the final report for the DMMP Pilot Studies (see Strategy Report Technical Appendices) and summarized in Section 6.5.1.

6.8 Upland Disposal

Upland disposal alternatives involve placing contaminated dredge material in an upland facility constructed with containment measures such as lining, diking, and covering. Typical upland disposal locations include upland CDFs and commercial landfills.

The primary issues of concern with upland landfill disposal of contaminated dredged materials include: (1) contaminant and chloride leaching; (2) availability of suitable existing landfills; (3) land availability and cost for new landfill facilities; (4) land availability and costs for dewatering facilities; and (5) transportation costs. The primary issues of concern with upland CDF disposal of contaminated dredged materials include: (1) land availability and cost for the facility; (2) contaminant leaching; (3) effluent control, solids retention and surface runoff control; and (4) the long-term end use of the site after closure.

There are currently no state or federal laws or regulations that apply specifically to upland disposal of contaminated dredge materials. The Corps recently prepared the Upland Testing Manual (USACE 2003d) which provides guidance and innovative testing procedures to address potential bioavailability pathways in upland CDF situations. Projects where material is dredged and transported only to upland sites are not subject to the Corps' 404 jurisdiction and a 401 WQC is not required, except for return water from upland handling. Potential upland disposal projects would be reviewed by the Corps, EPA, California Integrated Waste Management Board, California Department of Toxics and Substance Control, CCC, or LARWQCB, depending on the nature and location of the planned disposal.

Each organization would then determine compliance with existing regulations specific to their authority as they relate to standard waste disposal practices. Table 6-3 briefly summarizes the governing authority of each of these agencies, as they may relate to upland disposal of dredge materials.

To ensure the protection of human health and environmental resources, only two potential options currently exist for upland disposal of untreated contaminated dredged materials: containment in a confined upland disposal facility or disposal at a commercial landfill permitted to accept contaminated sediments. Both options are described in more detail in the following sections.

Table 6-3
Agency Oversight for Upland Disposal of Contaminated Sediments

Agency/Organization	Governing Authority
U.S. Army Corps of Engineers	Section 404 of the Clean Water Act for return water discharges in upland Situations
U.S. Environmental Protection Agency	Protection of ecological and human health resources – concurrence with Corps authority
California Integrated Waste Management Board	Disposal of solid wastes in upland landfills
California Department of Toxics and Substances Control	Oversight of state and some federal (e.g., Navy Installation Restoration program) cleanup sites
California Coastal Commission	Ensure compliance with the California Coastal Act and the Coastal Zone Management Act (and its amendments)
Los Angeles Regional Water Quality Control Board	Protection of surface water and ground resources; issue Waste Discharge Permits for disposal facilities and/or operations

6.8.1 Upland Confined Disposal Facility

A nearshore upland CDF is operated similar to a nearshore CDF, except that it is constructed entirely out of the water and in some cases many miles inland from the dredge location. Sediments are transported to the facility either via truck or hydraulically pumped into the containment area. The material is dewatered and then either reused or capped with clean soils. A clay base or synthetic liner may be required to prevent seepage of water from the CDF into the underlying groundwater. Decant water leaving the facility is typically treated to remove solids or contaminants and then discharged back to the dredge location via pipeline (subject to Waste Discharge Requirements [WDRs]). In the Los Angeles Region, a typical upland CDF would be located near the coast where groundwater resources are not utilized.

The use of contaminated dredge materials as general or engineered fill for nearshore upland areas is common practice in the Region and numerous examples exist for reference. Typically these events coincide with port expansion projects such that the contaminated sediments are used to fill newly diked areas slated for port development. Briefly, the fill areas are designed to meet seismic protection and load bearing capacity for the final surface grade, depending on the intended use. Construction generally entails hauling the partially de-watered dredge material to the fill location and then mixing the material with imported sand to reduce the moisture and increase the strength. A detailed discussion of this process, including specific geotechnical specifications for the fill material, can be found in the Sediment Blending Pilot Study report (USACE 2001) contained in the technical appendices to this document.

6.8.2 Upland Class I Landfill

Disposal of highly contaminated dredge materials at upland Class I landfills is permitted, if covered under the landfill's operating use agreement with the State Water Resources Control Board). This alternative is typically not preferred, except for the most highly contaminated material as the costs are very high and impacts to the upland environment can be significant as the material is transported to the landfill.

6.9 Dredge Material Beneficial Use Options

This section discusses issues associated with beneficial reuse of dredge materials, including current state and federal regulations, identification of treatment technologies, and potential end use products for the treated material. Further discussion on this subject, including the results of a market survey of potential end users for treated sediments in the Region can be found in the report entitled Contaminated Sediments Market Evaluation: A Report on the Market for Beneficial Use of Contaminated Dredged Sediments in the Greater Los Angeles Area (GeoSyntec 2003). A copy of the report is included in the technical appendices to this document. For this study, beneficial reuse is defined on the following page in Textbox 1.

According to GeoSyntec (2003), there are no state or federal laws or regulations that apply specifically and exclusively to the treatment and beneficial use of clean or contaminated dredged sediments. Treatment and beneficial use of dredged sediments is, however, subject to state and federal laws and regulations that pertain to any construction material or product involving borrowing, dredging, treatment, manufacture, transport, sale, purchase, use, environmental protection, and product liability.

6.9.1 Identification of Potential Treatment Technologies

Potential treatment alternatives for contaminated dredge materials include cement stabilization, sediment washing, sediment blending, vitrification, and soil separation. Each is briefly described in the following sections.

CSTF Definition of "Beneficial Reuse"

It is a goal of the CSTF strategy to eliminate aquatic disposal of contaminated and uncontaminated dredged materials and to maximize the beneficial reuse of these materials. For the purposes of this strategy, beneficial reuse of dredged materials can only result when these materials are not discharged in the aquatic environment for the purpose of disposal. Beneficial reuse involves the use of these materials for a purpose determined to have a value beyond the practical benefit of disposing of unwanted dredged material. The CSTF strategy uses a tiered approach to identify preferred reuse options that provide the greatest benefits, and mirrors the Clean Water Act 404(b)(1) guidelines. The different tiers are based on the best professional judgment of the CSTF regarding reuse options that provide the greatest positive impact on environmental quality and human health as well as the relative scarcity of material suitable and available for that reuse option.

The CSTF Advisory Committee will be responsible for assessing the dredging operations and making recommendations to maximize the amount of material being used for the highest tier of beneficial reuse. For uncontaminated materials, the beneficial reuse priorities are (from highest to lowest):

(1) Environmental enhancement (e.g., beach nourishment, habitat restoration);
(2) Creation of marketable products;
(3) Placement of material in authorized CWA 404 Port constructed fills, where the fill itself is separately authorized and mitigated;
(4) Other upland fill opportunities (non-404 fill);
(5) Upland landfill daily cover or other upland reuse options.

For contaminated dredged materials, the beneficial reuse priorities are (from highest to lowest):

(1) Creation of marketable products;
(2) Placement of material in authorized Port constructed fills, where the fill itself is separately authorized and mitigated;
(3) Treatment to produce other construction fill opportunities (non-404 fill);
(4) Landfill daily cover.

6.9.1.1 Cement Stabilization

The Stabilization alternative involves stabilization and solidification of contaminated dredged material with cement-based additive mixes to convert contaminants in the material into their least soluble, mobile or toxic forms and enhances the physical properties of the material. The technology, commonly known as cement stabilization, has been widely used in upland soil remediation projects. Its application to contaminated marine dredged materials, however, has been relatively limited, due partly to the large volumes of the materials involved per project, special material handling requirements, and special physical and chemical characteristics of marine dredged materials.

A cement stabilization process uses select cement-based binders (binders), such as Portland cement, based on their ability to precipitate metal ions, react with specific analytes, and bind/encapsulate specific contaminants. In a typical process, the binder is mechanically blended into the dredged material. The cement reacts with process water and pore water in the dredged material (hydration) to produce a binding gel (e.g. Tobermorite gel). The binding gel coats the contaminated fine particles, cements them into larger clusters, and fills up the pores in the material's microstructure. The reactions consume water through hydration, produce calcium hydroxide that reacts with siliceous particles to create additional binding gel, and generate heat that accelerates dewatering. Upon adequate curing, the reactions immobilize/encapsulate contaminants in the microstructure of the treated material and enhance the material's engineering properties such as shear strength, compaction, and consolidation characteristics.

In addition to processes using pure Portland cement, coal, or fly ash is often used in combination with cement for bulking and pozzolanic reactions to reduce binder cost while maintaining and, in some cases, improving treatment results. Fly ash generally relies on products from the hydration of Portland cement, primarily calcium hydroxide, to trigger pozzolanic reactions, produces cementing characteristics, and hardens on curing. With appropriate binder proportioning, cement/fly ash-treated product can exceed those of cement alone in strength characteristics. Since fly ash is typically less expensive than Portland cement, it has been used in combination with cement in cement stabilization projects.

Uncertainties remain, however, as to the effectiveness of cement-based stabilization to treat dredged materials predominantly contaminated by organics. The issue has been the subject of active research in the scientific community and soil remediation industry. The general consensus has been that, for materials predominantly contaminated by organics, cement-based stabilization can be successful only if the target organic contaminants are generally not mobile through air, soil, and water, such as polychlorinated biphenyls (PCBs) (Wiles and Barth 1992). The technology is not considered suitable for the treatment of volatile organics and many semi-volatile organics due to the normally significant volatilization during the process, although it has been shown that phenols (semivolatiles) can be effectively immobilized in the soil matrix upon treatment (Kolvites and Bishop 1989). Methods that include addition of cementing agents such as modified clays as part of the cement-based binders have indicated potential of success in treating organics (Sell et al. 1992). Given the organic-specific nature of the technology and the general paucity of data, detailed and sometimes iterative bench-scale tests are mandatory for designing an effective binder.

Cement-based stabilization studies were conducted by the USACE to evaluate the effectiveness, operation, cost, and environmental impacts of the technology for treating contaminated dredged material from the Region. The studies were composed of a bench-scale and a field-scale study; details are provided in the DMMP Pilot Studies report (USACE 2002c). The bench-scale study was undertaken to develop laboratory data on the effectiveness in treating contaminated sediments. It was conducted using sediment samples from Marina del Rey, LARE, POLB, and POLA with a relatively wide range of binder mixes including Portland cement, fly ash, and fluidized bed ash. Preliminary results from the bench-scale study were used to develop the field-scale study that was constructed at the POLA's Anchorage Road Soil Storage Site (ARSSS). Four treatment cells were constructed to test four different binders, each with a different ratio of Portland cement and fly ash. The mix of dredge material and binder was placed in each cell, allowed to cure, and then subjected to geotechnical, chemical, and leachate tests. The following conclusions were made for the use of cement stabilization on marine dredge material based on the pilot-scale study (USACE 2002c).

- Cement Stabilization appears to be an effective alternative for treating contaminated sediments. The technology was capable of enhancing many critical engineering characteristics of the dredged sediment, reducing the leachability of both metals and chlorides. The effectiveness is constituent-specific and requires conducting a bench-scale treatability study prior to full-scale field implementation to identify target contaminants and determine proper binder types, mix ratios and pH control.

- Cement Stabilization is considered an implementable alternative for treating contaminated sediments from the Region using a land-based process. The land-based system as implemented in the Pilot Study can also be adapted to a barge-based system with similar levels of implementability. The Pilot Study treatment system can readily be scaled up to a full-scale project without significant modification. Site selection for a full-scale project, however, will most likely be conducted opportunistically near the waterfront in view of the relatively short period of usage by a project that precludes retaining a permanent site. An adequate receiver project and site also needs to be identified to receive the treated dredged sediment.
- This alternative is not expected to result in significant environmental impacts if it is designed and conducted in a manner consistent with requirements implemented in the Pilot Study.
- The cost of a full-scale, land based Cement Stabilization project in the Region is expected to be approximately $46/m^3. That cost covers treatment activities from the point when the dredged sediments are delivered by barge to a port facility, to the point when the treated sediments are delivered by truck for placement at the receiver site. It does not include stockpiling or placement at the receiver end.

6.9.1.2 Sediment Washing

Sediment washing as a treatment technology for contaminated sediments typically refers to a process that involves slurrying the contaminated dredged material and subjecting the slurry to physical collision, shearing, and abrasive actions and aeration, cavitation, and oxidation processes while reacting with chemical additives such as chelating agents, surfactants, and peroxides. In doing so, the contaminants are transferred from the sediments to the water phase in the process. The washed material is then dewatered using hydrocyclones and centrifuges or by settling to a point where 70 to 80 percent of the solids remain. The process water containing the contaminants is collected and treated and the washed material beneficially reused. Primary issues of concern associated with the traditional sediment washing process include treatment requirements for the residual effluent water, and the end use of the dewatered fine material cake, which is a primary product if the dredged material consists predominantly of silt and clay.

For the Region, the sediment washing treatment alternative was modified to focus not specifically on chemical removal from the sediments, but rather salt removal so that the material could be beneficially reused as daily landfill cover without jeopardizing underlying groundwater reserves. A pilot laboratory study was conducted using material dredged from the LARE and the study results and contained in the DMMP Pilot Study report located in the Management Strategy Technical Appendices (USACE 2002a).

The Sediment Washing Bench Study was conducted at the USACE Engineering Research Development Center (ERDC) to evaluate the effectiveness of sediment washing for removing chlorides and sodium from marine sediments. Two test methodologies were evaluated to simulate potential field applications for regional dredging projects: active and passive washing techniques. Active (mechanical) washing was simulated in the laboratory by using a pressure filter to dewater the sediments and deionized water to wash salts from the dewatered sediment cake. Passive (gravity drainage) washing was simulated in the laboratory using a column leaching apparatus that diluted and removed the salts from the sediment cake. The two principal feasibility issues addressed in the Bench Study were:

- Determining the volume of water required to reduce chloride and total dissolved solids (TDS) levels to below State of California conservative groundwater quality criteria of 30 milligrams per liter (mg/L) for chloride and 500 mg/L for TDS in filtrate.
- Assessing the efficiency of chemical removal from the treated sediment and the potential for subsequent contaminant release following treatment.

Results of the Bench Study showed that Sediment Washing was effective at removing chloride and sodium from the dredged sediments using both laboratory approaches. Chemical constituents (e.g., metals) were not significantly reduced. The greatest variability was demonstrated for the unconsolidated column tests, with wash water requirements ranging from 1.5 to 60 void volumes. The least variability was observed for the pressure filter tests, with void volumes ranging from 7.6 to 21.

Based on the laboratory bench scale tests, treatment costs were estimated to range between \$34 and \$82/m^3, depending on the specific method selected. Also noted during this study were several issues that would need to be addressed before a field scale operation could be implemented, such as the very large surface area required for treatment, potentially long periods of time for complete removal of the chloride ions, and large inputs of freshwater that would be needed.

6.9.1.3 Sediment Blending

Sediment blending is not a true treatment technology in that is does not reduce or eliminate contaminant concentrations, except through dilution with cleaner material. The alternative involves blending the fine-grained contaminated dredged material with borrowed clean sandy material to create an aggregate that exhibits enhanced engineering properties and reduced apparent contamination levels. One of the primary issues of concern with sediment blending is the cost of obtaining large quantities of the clean sand required to achieve the treatment objective. Other issues include: (1) the availability of borrow materials; (2) costs associated with large-volume material handling; (3) the methods used to achieve the specified level of blending; (4) land availability for the blending facility; and (5) cost for dewatering. Also of concern are the environmental acceptability and the engineering properties of the material after blending.

The CSTF originally planned to conduct a laboratory pilot study to test the feasibility of the sediment blending option for use in the Region, but instead elected to conduct a detailed literature investigation of past uses within the region and opportunities and constraints for future use. This was done because preliminary results of the user's survey showed that the process, in its original form, would not currently be used by the most likely candidates in the Region, the POLA and POLB. Detailed study results are presented in the DMMP Pilot Study report which is included in the Management Strategy Technical Appendices.

The results of the literature review showed that no other studies have been conducted for the purpose intended in the DMMP Pilot Studies; however, studies are available in which dredged sediments have been blended with other materials and reused in upland applications. The available information showed that, under the right conditions, the Sediment Blending methodology could be effective.

The regional users survey, conducted in conjunction with the literature review, suggested that no contractors are currently blending fine-grained dredged sediments with additives to increase the structural properties of the sediments (for use as fill), largely because of the costs associated with the process. Instead, the fine-grained sediments are either placed in layers or placed in less structurally restrictive locations within the landfills. The overwhelming response from all potential users surveyed was that they would not adopt a sediment blending approach as described in the USACE 905(b) Reconnaissance Report for the DMMP studies.

6.9.1.4 Thermal Desorption/Vitrification

Thermal desorption system is an *ex-situ* technology applying direct and indirect heat to contaminated material, such as sediment, soil, or sludge, to vaporize the contaminants. Thermal desorption system is a thermal induced physical separation process and is not designed to destroy contaminants. Contaminants and water are vaporized from a solid matrix and transported by either a carrier gas or vacuum system to a gas treatment system. The bed temperatures and residence times designed into these systems will volatilize selected contaminants but will typically not oxidize them. This gas can then be treated by a number of secondary treatment processes. The residual contaminant levels achieved are usually low to non-detect (FRTR 2002 and NFESC 1998). There are a variety of thermal desorption systems available: rotary dryer, thermal screw, heated ovens, and hot air vapor extraction (HAVE).

Vitrification, another variant of this process is conducted at temperatures sufficiently high to melt the sediment particles, resulting in the formation of a glass aggregate. This process, known as vitrification, is currently offered for contaminated dredge sediments (McLaughlin et al. 1999) and has been shown to eliminate and sequester the contaminants, producing a final product that should be free from the liabilities associated with some of the less effective treatment alternatives. The downside to this technology is that the process requires significant electrical energy to generate extremely high heat produced by an electric arc furnace, and thus costs significantly more than many of the other treatment alternatives.

Issues of concern for use of these alternatives include: (1) contractor availability in the Region; (2) site-specific effectiveness (they have had limited if any use on the West Coast); (3) production costs; (4) space for a treatment facility; and (5) a disposal area or beneficial use for the treated product.

6.9.1.5 Cement Lock Technology

The Cement Lock Technology is a proprietary process developed by the Gas Technology Institute and marketed by Biomass Energy Solutions, Inc. The process uses extremely high heat (2400 to 2650°F) to convert contaminated sediments into a material called Ecomelt, which resembles a partially vitrified rock material. This material is then blended with Portland cement and used to create a variety of by-products. Test applications with the process have been completed with the following types of materials: dredged sediment from the New York/New Jersey Harbor, dredged sediment from the Detroit River, Michigan, contaminated building debris/concrete, PCB contaminated sediment/soil, petroleum contaminated soil, and organic contaminated soil.

Issues of concern for the use of this alternative include: (1) contractor availability in the Region; (2) site-specific effectiveness; (3) production costs; (4) space for a treatment facility; and (5) a disposal area or beneficial use for the treated product.

6.9.1.6 Soil Separation

Soil separation is a procedure where, through a series of mechanical processes, sediment particles are separated into sands and finer grained fractions for beneficial reuse. Since contaminants are typically bound to the organic layers of fine-grained particles, the first step (sand separation) is usually quite effective in producing a clean product, which can then be beneficially reused without further treatment, and a fine grained particle slurry containing most of the contaminants. The fine-grained particle slurry can then be subjected to a series of mechanical and chemical processes (e.g., flocculants) to further separate and concentrate the contaminants, eventually resulting in a manageable waste stream that can be de-watered and disposed of through conventional means.

Issues of concern for the use of this alternative include: (1) contractor availability in the Region; (2) high production costs due to variable dredge material supply; (3) nearshore space for a treatment facility; and (4) a disposal area or beneficial use for the treated product.

6.9.2 Class III Commercial Landfill

Disposal of contaminated sediments at upland (Class III) commercial landfills is not currently authorized by the LARWQCB due to concerns about chloride and contaminant leaching into the groundwater. Other issues associated with landfill disposal of contaminated sediments include reducing landfill capacity, and infrastructure impacts related to transporting the material to the landfill. An alternative more likely to be acceptable to regulatory agencies would be to beneficially use the material as daily landfill cover (see Section 6.9.5.2). Projects to reuse dredge material as daily cover are currently evaluated on a case-by-case basis by the LARWQCB.

6.9.3 Temporary Storage

Occasionally, contaminated sediments may be destined for reuse as future fill material or as feed material for a treatment program not yet fully implemented. In these instances, temporary storage is needed and may include either aquatic or upland facilities.

6.9.3.1 Aquatic Storage Sites

Dredged sediment may be stockpiled on a temporary basis at aquatic sites awaiting further transfer to end-use destinations if contaminant concentrations are sufficiently low enough that aquatic risks are not probable. Suitable types of aquatic stockpiling include placement in nearshore depressions, sub-aqueous mounds, or islands. The stockpiling sites need to be located in sheltered areas with minimum wave energy to ensure stability. The construction of temporary dikes or berms may be needed to confine the contaminated sediment within the stockpiling area. Given the involvement of open-water placement of dredged material, aquatic stockpiling would be subject to regulatory constraints and requirements similar to those for aquatic disposal, with emphasis on short-term impacts due to double handling in the form of placement and re-dredging within a relatively short period of time. These constraints would likely limit this option to include only sediments suitable for in-water disposal. Additional requirements may be necessary to prevent the creation of navigational hazards as a result of the alteration of existing nearshore bathymetry.

6.9.3.2 Upland Storage Sites

Dredged sediment may be stockpiled on a temporary basis at upland sites awaiting further transfer to end-use destinations. Suitable types of upland stockpiling include placement in existing sediment storage facilities in the Ports and any new storage areas that can be designated for the same purpose on a temporary basis. Existing facilities include the ARSSS at the POLA, which receives dredged materials from various berthing basins in Los Angeles Harbor.[4] Placement of dredged materials at existing facilities would be subject to similar regulatory constraints and requirements that are already in place for these facilities. New stockpiling sites could include CDFs, and new upland storage sites similar to the existing facilities in the Ports. Given the constraints on land availability and the limited capacities of existing sediment holding facilities, upland storage capacities are expected to be limited in the Region. Logistic arrangement and end-use timelines must be integrated into storage planning to ensure efficient use and uninterrupted service of existing and new facilities.

6.9.4 Potential End Use Applications

Left untreated, contaminated dredged sediments may only be beneficially used as fill material in an application that ensures they will not pose a threat to the aquatic or upland environment. Potential end uses within the Region include either nearshore fill (with nearshore defined as areas near the coast where saltwater intrusion has already

[4] The POLA ARSSS facility would not likely be available to others outside of the POLA.

impacted shallow groundwater), or as upland fill in areas where groundwater resources are not impacted. This section details potential fill alternatives and uses.

6.9.4.1 Nearshore Fill

Contaminated dredged sediment may be used as construction fill material in nearshore waters where confinement is provided. Suitable types of nearshore fill include harbor fill and wetland fill.

Historically, harbor fill has been, by far, the most important type of end use of dredged material in the Region. During the period of 1976 to 2001, approximately 42 percent of the 1.1 million m^3 (1.5 million cubic yards [cy]) from the Marina del Rey/Ballona Creek Entrance Channel maintenance, 97 percent of the 42 million m^3 (55 million cy) from Los Angeles Harbor capital improvement dredging, and 32 percent of the 8.4 million m^3 (11 million cy) from Long Beach Harbor capital improvement dredging were used as harbor fill for construction and improvement of harbor facilities.

Contaminated dredged materials can be placed in harbor and nearshore fills where the fills are CDFs. The mobility of contaminants within the dredged materials tends to decrease significantly with compaction of the fill over time or by mechanical means that reduces the leaching potential of the constituents present within the fill mass. Such effects are particularly pronounced with materials containing sufficient amounts of fines, which is the case with most of the contaminated dredged sediment generated in the Region. Harbor fill (CDF) is expected to continue to be a predominant end use for contaminated dredged sediment in the Region. Wetland fill using contaminated sediments, while a possibility, is very unlikely due to regulatory constraints.

6.9.4.2 Upland Fill

Contaminated dredged sediment may be used as construction fill at upland sites as long as groundwater resources are not put at risk from either contaminant or chloride leaching. Suitable types of upland fill include landfill daily cover, Brownfield development projects, mine reclamation fill, and transportation infrastructure construction fill.

Landfill Daily Cover

Contaminated dredged sediment may be used for landfill daily cover and closure works subject to regulatory constraints and requirements.

For placement in landfills, the LARWQCB requires testing by Waste Extraction Test (WET) and comparison with the Soluble Threshold Limit Concentrations (STLC) for acceptability determination. For placement on open lands, the LARWQCB generally requires testing by Synthetic Precipitation Leaching Procedure (SPLP) (EPA Method 1312) and comparison with the Maximum Contaminant Levels (MCL) of Title 22, California Code of Regulations, to determine acceptability for the protection of groundwater resources. For coastal sites such as harbor areas with saline groundwater aquifers, leach test results are to be compared with the Ocean Plan objectives for acceptability determination.

A particular concern regarding the use of marine dredged sediment at landfills is the water and salt contents in the material. Landfills require sediment to pass the paint filter test to limit water content to 12 to 15 percent. The LARWQCB does not have stated limits for chlorides in sediment, but does regulate salt concentration in waters entering groundwater (USACE 1997). The current State of California groundwater criteria is 30 (milligrams per liter) mg/L chloride and 500 mg/L TDS (USACE 2002a). Requirements for dewatering and chloride reduction tend to limit the economy of using marine dredged contaminated sediment at landfills, especially when large quantities of dredged materials are involved. Evidence suggests, however, that the mobility of chlorides tend to significantly decrease upon compaction of the material after placement (USACE 2002d).

In addition to constraints on sediment quality for use at landfills, few active landfills in the Region are within economical transport distance from potential dredge areas. The available capacity for this end use in the Region is, therefore, expected to be limited.

Brownfield Re-Development

Contaminated dredged sediment may be used as fill for development projects at Brownfield sites such as abandoned industrial sites and cleanup/remediation sites. The *in-situ* soil at a Brownfield site under development may contain contaminants at levels that are deemed acceptable for the project. Opportunity, therefore, exists for such a project to use contaminated sediment with constituent levels that are consistent with those permitted for the project. For substantially clean Brownfield sites, leach testing of dredged sediment by SPLP as described previously may be required by the LARWQCB before placement as fill. The issue of chlorides may also have to be addressed depending on the location of the site and quantities of the fill. Reduction of chloride leaching upon compaction of the fill as discussed previously may also be taken into consideration in the acceptability determination.

Because there are many historical industrial sites within close proximity of the study area, options for using contaminated dredged materials for Brownfield re-development should be available. Applicability will, however, be highly site-dependent (e.g., proximity to underlying groundwater resources, local use of groundwater, proximity to residential areas, etc.) and final acceptance by the regulatory agencies would likely be determined based on these conditions and possibly the results a risk assessment.

Mine and Pit Reclamation

Contaminated dredged sediment may be used as backfill at mine reclamation sites subject to regulatory constraints and requirements. Mine reclamation sites in the Los Angeles region include abandoned sand and gravel mining pits. Some of the existing mining pits are currently functioning as groundwater recharge facilities; backfilling these pits would conflict with regional conservation objectives. For the rest of the abandoned pits in the region, a recent survey (GeoSyntec 2003) found that there is generally ample supply of backfill material generated from mine development that has been stockpiled on site. The need for additional backfill material, therefore, is expected to be limited. Leach testing of dredged sediment by SPLP as described previously may be required by the LARWQCB before placement as backfill in the pits. Similar to other upland fill options, the issue of chlorides may also have to be addressed.

Transportation Infrastructure

Contaminated dredged sediment may be used as construction fill for transportation infrastructure projects such as construction of roadways, railroads, and airports. However, engineering and regulatory requirements of construction fill for these types of projects can be substantial (USACE 2002b). In general, construction fill material is required to exhibit sufficient engineering properties as determined by geotechnical testing. For contaminated dredged sediment, leach testing by SPLP as described previously may be required by the LARWQCB before placement. The issue of chlorides may have to be addressed on a case-by-case basis depending on the location of the site and quantities of the fill, among other considerations. Reduction of chloride leaching upon compaction of the fill as discussed previously may also be required.

6.9.5 Potential End Use Products

Treated contaminated dredged materials may be beneficially reused and several options exist for this process, including the production of manufactured soils, aggregates, cement-based products, or glass. The following sections briefly describe these potential end products.

6.9.5.1 Manufactured Soil

Pilot studies have been conducted to evaluate the feasibility of creating manufactured topsoil using dredged materials as the base; however, this process has not yet been fully evaluated to the point where a commercial application could be launched (USACE 2002b). The procedure involves mixing the de-watered dredge material with an organic biosolid, usually derived from municipal sewage sludge, and then blending and drying the material until the desired consistency is achieved. Two example studies utilizing this technology include a project conducted with freshwater dredged sediment from Toledo Harbor in Ohio (Sturgis et al. 2001a) and marine dredged sediments from New York/New Jersey Harbor (Sturgis et al. 2001b). Both studies concluded that while successful topsoil blends were produced, several limitations would make full-scale operation difficult. The two primary difficulties were (1) the fact that the optimal ratio of dredged material to organic additives was very site-specific and would need to be developed for each region and (2) the final process developed during the studies was proprietary, thus limiting its use by other firms.

6.9.5.2 Aggregates

A concrete aggregate generally refers to the mixture of sand and gravel material typically used in the preparation of concrete. It is possible that some contaminated dredge material may contain sufficient quantities of aggregate to make it cost effective to employ a mechanical process to separate the finer grained particles from the sand and gravel such that it could be beneficially reused for the production of concrete. Final acceptance of any material for use in load bearing forms would ultimately be determined by the engineering requirements of the final product.

6.9.5.3 Cement

Cement production using dredged materials, described in detail in Section 6.8.2.1, provides one of the most probable end use products for contaminated dredged materials. In this scenario, imported clean sand is substituted with contaminated dredge material, thus reducing the need for importing sand. Great quantities of contaminated material may be disposed of quickly and a direct cost recovery benefit may be observed. There are, however, several variables that could affect the success of this technology. One of the most critical is the nature of the dredge material, more specifically the ratio of sand and silt particles present in the material and resulting water content. The closer the material matches that of imported sand, the more successful this alternative will be for providing a beneficial product that result in costs recovery to the project. As with aggregate, final acceptance of any material for use in load bearing forms would ultimately be determined by the engineering requirements of the final product.

6.9.5.4 Glass

The end result of the vitrification process described in Section 6.9.2.4 is molten sand (glass). There is currently no known market for this material in the Region and it should not be considered as an alternative for producing a beneficially reusable product.

7 EVALUATION OF MANAGEMENT ALTERNATIVES

To assist in formulating recommendations to select dredge material management alternatives for contaminated sediments, a set of evaluation criteria were created based on qualities deemed most important by the Contaminated Sediments Task Force (CSTF) members. Four criteria were developed (Environmental Effectiveness, Engineering Constructability, Cost, and Regulatory Constraints), and are described below. The purpose of this review was to evaluate each alternative against the four criteria to provide the user a summary of strengths and weaknesses for each alternative, but not necessarily to compare one directly against another. Each alternative's strengths and weaknesses were then taken into account, along with other factors such as public acceptance, to create a recommended approach for selecting a disposal alternative for each specific project. The CSTF's recommended strategy is presented later in Section 8.

7.1 Evaluation Criteria

7.1.1 Environmental Effectiveness

Environmental Effectiveness refers to the ability of each alternative to effectively isolate, bind or eliminate chemical contaminants from becoming biologically available to the surrounding environment. This may occur by isolating the contaminated sediment within a confined barrier such that potential ecological or human health risk pathways are eliminated. This may also occur by treating the contaminated sediment in a way that binds or degrades the contaminants, leaving an inert material available for other beneficial uses.

7.1.2 Engineering Constructability

Engineering Constructability refers to the ease from a construction standpoint, to physically implement each alternative. This criteria does not account for potential public opposition to an alternative that may hinder its use, only the physical barriers that would need to be overcome for an alternative to be implemented. Factors included in this evaluation are availability of construction specifications and technical documents, proven use in the region, availability of experienced contractors and field equipment, and consideration for proprietary licenses and agreements associated with an alternative.

7.1.3 Cost

The Cost criterion is fairly straightforward. How much does each alternative cost, on a per unit basis? No adjustments were made for a baseline comparison and the cost information is provided to put a referenced scale to the range of alternatives, than as an evaluation tool. Costs associated with environmental monitoring and project permitting are not included and may be significant depending on project application.

7.1.4 Regulatory Constraints

Regulatory Constraints considers if regulatory guidelines are in place to facilitate and permit a specific alternative, and, if so, identify the agency(s) leading the process. The purpose for this criterion is to identify data gaps that need to be filled prior to implementing any one alternative, from a purely regulatory standpoint. By listing the regulatory constraints inhibiting implementation of an alternative, steps can be taken to address the constraints prior to the need to use the process. That way restrictions will be know in advanced and not be a hurdle for future use.

7.2 Consequences of No Action

A no-action alternative is presented in Section 6 which offers the option of leaving the contaminated sediments in place in lieu of removal or remediation. This alternative is not considered a feasible solution for use within the Study Area and is not evaluated in more detail.

7.3 Source Control

Chemical and sediment source control, although outside the immediate authority of the CSTF's mission, is included in the evaluation of management alternatives because of its significance to the regional problem identified at the beginning of this report. Reducing sediment and chemical loads to Ballona Creek, Dominguez Channel, and Los Angeles River and San Gabriel River watersheds could have tremendous positive impacts on future accumulations of contaminated sediments.

The engineering aspects of controlling future chemical and sediment loading to regional watersheds has not been fully addressed, but efforts are underway within Los Angeles County (County) to reduce both chemical and sediment sources (Section 3.5). The costs for such an effort are difficult to compile because of the sheer size of the land area affected and number of individual entities involved. From a regulatory perspective, efforts are underway to further reduce sediment loading to the waterways and TMDLs are being developed to reduce chemical loading. Full implementation of these programs throughout the study area is still several years away.

7.4 Aquatic Disposal/Containment Alternatives

To support the development of the Los Angeles Regional Dredged Material Management Plan (DMMP) and the CSTF Strategy, the U.S. Army Corps of Engineers, Los Angeles District (USACE) evaluated several aquatic disposal/containment alternatives (e.g., existing pits, new pits, mounds) and locations (e.g., ports, Santa Monica Bay, San Pedro Bay) for testing in the Los Angeles Region (Region). Ultimately, use of the existing pits in Long Beach was determined to be most feasible and was subsequently field tested.

7.4.1 North Energy Island Borrow Pit Confined Aquatic Disposal Site

Aquatic disposal at the North Energy Island Borrow Pit (NEIBP) in the City of Long Beach was extensively studied by the USACE and the CSTF over the past five years; the results of which are detailed in USACE (2002a). A pilot field study was initiated in 2001 using contaminated sediments from the Los Angeles River Estuary (LARE) (see Section 6.5.1) and the study results over the first three years showed that the confined aquatic disposal (CAD) site is an effective tool for isolating and containing contaminants. The preliminary results of a three year monitoring study at the CAD site has further revealed minimal disturbance of the clean cap material by deep burrowing benthic organisms, and no significant releases of contaminants. The surface of the cap has also been colonized by biota similar in structure and density to the sediments surrounding the borrow pit (ABC 2003).

From an engineering constructability standpoint, CAD site disposal has been proven feasible and experienced contractors are available within the region to implement construction. Using the example from the LARE, unit costs were $27 per cubic meter ($m^3$); however, this amount could be increased or decreased depending on the final dredge volume and clean cap thickness selected and the regulator requirements on a CAD site. Issues that have not yet been fully addressed by the CSTF are site ownership, operations, and management of the NEIBP as a disposal site, long-term liability, monitoring, and fee structure. In addition, while the pilot study was permitted, the long-term use of this site for aquatic disposal will likely require an extensive permitting effort, a long-term monitoring plan, and a contingency plan for any unexpected adverse impacts.

The portion of the inner harbor where the energy islands borrow pits are located (including the NEIBP) is currently held in a land trust agreement by the City of Long Beach from the State Lands Commission. Provisions of that agreement between the City and the State allow the land to be used to promote navigation and recreational benefits. However, depending on interpretation, this agreement may need to be modified before additional disposal of dredge material within the existing containment cells may occur. In addition, long-term operations, management and maintenance plans need to be developed to address permit approval issues with the Los Angeles Regional Water Quality Control Board (LARWQCB), U.S. Environmental Protection Agency (EPA), and USACE. Lastly, the issue of legal liability has not yet been addressed between the City, State and Federal regulators, and prospective disposers. It is anticipated that many of these issues, including a full environmental impact analysis, will occur as part of the USACE Dredged Material Management Plan (DMMP) project.

7.4.2 Nearshore Confined Disposal Facility

Nearshore confined disposal facility (CDF) disposal is the most commonly used contaminated sediment disposal process in the Los Angeles Region (Region) for several reasons: it is cost effective, provides much needed fill material to support capital development projects, and is environmentally protective. Because the contaminated dredge material is confined within the fill site, the potential for chemical release is very small. CDF structures in the form of port development projects have been constructed almost continuously for the past 50 years and numerous design specifications are in existence to guide their implementation. Established regulatory review, permitting and oversight procedures are in place and well defined, and the costs for CDF disposal can be as low as $10/m^3 (USACE).

A downside to using nearshore CDF's in the Region is that most are located with the Los Angeles/Long Beach (LA/LB) Harbor Complex and are subject to availability. Non-Port projects will likely receive lower priority than Port projects. As such, available fill space and project timing will both be critical issues for the success of this approach.

7.4.3 In-Situ Remediation

In-situ remediation is an emerging technology that is still in the development phase for use with contaminated sediments. Very few examples exist for projects on the West Coast of the U.S. and limited results are available from independent resources regarding environmental effectiveness of the technology. Engineering plans and specifications exist to implement this alternative, but, in most cases, require the use of proprietary equipment and/or vendors. The costs for *in-situ* remediation are highly project specific, but tend to be higher than other available alternatives. Because the technology has not been routinely used in the Region, regulatory guidance for implementing a project utilizing this technology is not well established and would likely occur on a case-by-case basis.

7.4.4 In-Situ Isolation/Containment

In-situ isolation of contaminants (also known as aquatic capping) is similar to confined aquatic disposal in technology and environmental protectiveness. Instead of relocating the contaminated material to a pit or depression and capping it with clean sediment, the material is left in place and capped. The advantage of this approach is that there is less disturbance of the contaminated sediments, which is very important because the highest chemical concentrations are typically in the subsurface layers. In addition, re-suspending subsurface sediment and exposing it to oxygen rich water can expedite the release of chemicals and make them more bioavailable to aquatic organisms. The main disadvantage to this approach over the use of a CAD is that the water depth is reduced by leaving the material in place and adding a cap to the top, which may impact navigability.

Aquatic capping would require similar regulatory approvals as CAD site disposal, and experienced contractors and engineering specifications for constructing them are readily available. Because this technology does not include sediment removal, unit costs are not applicable or provided. Instead, project costs would be site-specific and determined more accurately by determining the surface area to be capped and desired thickness of the cap layer.

7.5 Upland Disposal Alternatives

7.5.1 Upland Nearshore Fill

Disposal of contaminated dredge materials as upland nearshore fill is common practice within the Ports when material is needed to fill depressions or as surcharge for capital improvement projects. For this document, upland nearshore fill is differentiated from CDF disposal by the median waterline. Material placed below the waterline is considered CDF fill and material above the waterline is considered upland nearshore fill. Further, nearshore is defined as the area within the local coastal zone where groundwater resources are not considered potable.

Upland nearshore fill is considered environmentally protective because it effectively removes the material from the aquatic environment and prevents transport back into the water column. As mentioned above, this alternative is commonly used and the technology exists, as do experienced contractors, to permit its continued use in the region. The process is cost effective (range of $10 to $20/m^3 [USACE]) and no regulatory constraints exist to preclude its use.

7.5.2 Class I Landfill Disposal

Although considered to be environmentally protective to aquatic species, upland disposal of contaminated sediments as general fill material within a Class I landfill is not preferred because of its high unit costs, potential for upland transportation impacts and reduction of landfill capacity for other, more suitable (hazardous) disposables. Regulatory processes governing Class I landfill disposal are well defined by the California State Integrated Waste Management Board, and subject to individual landfill Waste Discharge Requirements (WDRs). Unit costs for this alternative have been as high as $88/ m^3 (Anchor 2003).

7.6 Beneficial Use/Treatment Alternatives

7.6.1 Class III Landfill Daily Cover

Use of contaminated sediments as Class III landfill daily cover has been identified for consideration in several recent projects within the Region, but never initiated due to concerns over chloride leaching and/or high transport costs to the landfill. Assuming these obstacles could be overcome, the beneficial reuse of dredge material as daily landfill cover is considered environmentally protective to the aquatic environment because the material is permanently removed from the water and upland contaminant threshold concentrations are much higher than aquatic values. Care would need to be taken, however, to ensure that upland resources are not significantly impacted during transport to the landfill or to the groundwater resources while used at the landfill.

From an engineering constructability standpoint, the use of dredge materials as landfill daily cover does not require any special techniques or equipment. Many landfills import clean fill material to use as daily cover on a routine basis and it is expected that dredge materials of suitable physical quality could easily supplement or replace imported fill from other areas. The cost to implement this process is highly dependant on the location of the target dredge area in relationship to the landfill. A cost estimate included in a recent feasibility study conducted by the USACE for dredge materials from Port Hueneme showed disposal costs of approximately \$21/m^3 for a project totaling 70,0000 m^3 (Anchor 2003) where the landfill was located less than 50 miles away.

Within the County, the LARWQCB has not previously permitted the use of dredge materials as landfill daily cover over concerns about chloride leaching and resulting potential impacts to the underlying groundwater resources. Before regulatory approval is received for this alternative, data will need to be collected to ensure these concerns are not substantiated. Limiting use of marine dredge materials to lined portions of the landfill may alleviate most of these issues.

7.6.2 Cement Stabilization

Cement stabilization has been shown, regionally, to be environmentally protective for treating sediments contaminated with high metal concentrations (USACE 2002b and c). Tests with high concentrations of organic contaminants have not yet been conducted in the Region, but it is expected to be effective as well based on studies conducted elsewhere (Myers and Zappi 1989). In 2001, the USACE conducted a pilot field study to evaluate full scale implementation and costs associated with this technology. Study results showed that the process was technically implementable, environmentally protective, produced a high grade compactable fill product, and cost approximately \$46/m^3 to treat the material (land costs excluded). Because this process is not routinely used in the Region, regulatory permitting procedures are not well defined. Instead, permitting is handled on a project-to-project basis by the LARWQCB, EPA, and USACE. Depending on the specific project application, a temporary storage area may be needed to implement this procedure.

7.6.3 Sediment Washing

A laboratory pilot study conducted in 2001 by the USACE showed that sediment washing was an effective technique for removing chloride ions from LARE sediment, but was not effective at removing other contaminants (USACE 2002d). Two test methods were evaluated: active and passive washing. The main disadvantages identified were that both processes required very large amounts of wash water and a significant amount of time for effective chloride removal to occur. Treatment costs were estimated to range between $34 and $82/m^3 (land costs excluded), depending on the wash method selected.

The original objective for conducting the sediment washing pilot study was to test a treatment technique that allowed marine sediments to be used as landfill daily cover without the concerns for chloride leaching. However, given the high treatment costs (which combined with the costs for landfill daily cover are estimated at $55 to $103/m^3), other treatment alternatives and beneficial uses for the washed material may be more appropriate.

From a regulatory perspective, sediment washing has not been used previously in the region and would need to be addressed on a case-by-case basis with the LARWQCB. The USACE pilot study showed that the process is implementable using standard construction equipment, if the need were present. Depending on the specific project application, a temporary storage area may be needed to implement this procedure.

7.6.4 Sediment Blending

Sediment blending was also evaluated by the USACE in 2001, but was limited to a detailed literature review and end user's survey (USACE 2002e). The concept of sediment blending is to take fine-grained contaminated material and blend it with clean sand to produce a less contaminated, higher-quality fill material primarily for use in the nearshore environment. In practice, a similar process already occurs within the Port of Los Angeles (POLA) and the Port Long Beach (POLB) at a cost of approximately $49/m^3. Rather than true "blending" sediments are typically layered and then compacted.

From an environmentally protective standpoint, sediment blending is effective for aquatic protection, but only because it requires removing the material for upland disposal or reuse. The process itself does not treat or reduce contaminants, instead achieves chemical reduction simply through dilution. Because this process is routinely used with the region, engineering specifications are readily available and regulatory permitting requirements clearly defined. Depending on the specific project application, a temporary storage area may be needed to implement this procedure.

7.6.5 Thermal Desorption/Vitrification

As with *in-situ* remediation, thermal desorption is an emerging technology that is still in the development phase for use with contaminated sediments. Very few, if any, examples exist for projects on the West Coast of the U.S. and limited results are available from independent resources regarding environmental effectiveness of the technology.[5] Engineering plans and specifications exist to implement this alternative, but, in most cases, require the use of proprietary equipment and/or vendors. The costs for this process are highly project specific, but tend to be higher than other available treatment alternatives. Because the technology has not been routinely used in the Region, regulatory guidance for implementing a project utilizing this technology is not well established and would likely occur on a case-by-case basis. Depending on the specific project application, a temporary storage area may be needed to implement this procedure.

7.6.6 Cement Lock Technology

The cement-lock treatment process is similar to cement stabilization except that is uses a proprietary system offered by a single vendor and incorporates a thermal process at the beginning that essentially melts the sediment. The melt is then rapidly quenched and pulverized before being mixed with the cement additives. According to the

[5] Most of the available studies are sponsored by the treatment vendors, as opposed to independent clientele or regulatory agencies.

manufacturers, this process is effective in removing organics and immobilizing metals. A large scale field demonstration project was recently conducted in New Jersey using 22,900 m^3 (30,000 cubic yards [cy]) which should yield additional data on technology effectiveness, once fully evaluated.

Current costs for this technology are approximately $92/$m^3$, based on the New Jersey pilot study conducted with just less than 23,000 m^3. Because the technology has not been routinely used in the region, regulatory guidance for implementing a project utilizing this technology is not well established and would likely occur on a case-by-case basis. Depending on the specific project application, a temporary storage area may be needed to implement this procedure.

7.6.7 Soil Separation

Soil separation is a process where clean sand is mechanically separated from the fine-grained (and generally more contaminated) sediments using equipment like hydro-cyclones. The process itself does not remove contaminants, but a secondary benefit is that the fine-grained fraction of the sediment where the contaminants are generally found is separated and can be treated using a separate technology (e.g., cement stabilization). The alternative can be considered environmentally protective because it removes the material from the aquatic environment and effectively reduces the amount of contaminated material. As with other upland alternatives, however, caution must be exercised not to simply transfer impacts from aquatic to upland resources.

Previous demonstration projects using this technology have shown that, once constructed, hydro-cyclones can operate very efficiently, treating the sediment at a rate of only $6/$m^3$. The disadvantages of this approach are the large space requirements for the equipment and sediment storage, and limited processing rate. Although not routinely used in the Region, the technology exists for construction. Regulatory guidance for implementing a project utilizing this technology is not well established so its approval would likely occur on a case-by-case basis. Depending on the specific project application, a temporary storage area may be needed to implement this procedure.

7.6.8 Temporary Aquatic Storage

Temporary aquatic storage is not a treatment alternative itself, but rather an option for managing contaminated sediments after treatment. The advantage of this approach is that it allows material to be stored until a project is available for its use. The process is currently employed using clean (untreated) dredged materials at the ports (e.g., Western Anchorage Storage Site), but has not yet been used to store treated materials. The cost to use this alternative is project specific (depending on volume) and would be in addition to the treatment method selected.

7.6.9 Temporary Upland Storage

As with aquatic storage, temporary upland storage of dredge materials is not a treatment alternative, but rather an option for managing contaminated sediments for future reuse. The process is currently employed with marginally contaminated dredged materials at the ports (e.g., Anchorage Road Storage Site) and the costs are project specific, depending on volume.

7.7 Evaluation Summary

A wide range of alternatives for managing contaminated sediments has been evaluated against four criteria: environmental protectiveness, engineering constructability, costs, and regulatory constraints. As mentioned at the beginning of this section, the purpose for the evaluation was not to compare the alternatives to each other, but to examine their strengths and weaknesses relative to a series of criteria critical for solving the regional contaminated sediment problem in the County. Table 7-1 summarizes the results of the evaluation for each category.

The information developed through this exercise is used in the following section to formulate a strategy and recommended project sequencing for managing contaminated sediments. Because each project will contain a different set of conditions (volume, location, chemical, and physical characteristics, etc.) no one alternative is preferable for all situations. Instead, the goal of the CSTF was to provide a management tool to select the most appropriate alternative for each specific project.

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Table 7-1
Evaluation Summary of Contaminated Dredge Material Management Alternatives for Los Angeles Region

Alternative	Environmental Effectiveness	Engineering Constructability	Range of Unit Costs	Regulatory Constraints
Chemical Source Control	• Problem of on-going sources of contaminant sediment is eliminated if chemical sources are controlled.	• Given an unlimited budget, eliminating chemical sources is technically feasible.	• Not determined, but would include implementing planned toxics TMDLs and adding additional source control systems.	• Programs are in place with the RWQCB and EPA to control chemical sources, but not at the level needed to provide 100% elimination of chemical input.
Sediment Source Control	• Unless combined with chemical reductions, would not eliminate contaminated sediment problem.	• Given an unlimited budget, eliminating most sediment sources is technically feasible.	• Not determined, but would require constructing additional sediment catch basins to prevent storm flow discharge.	• Programs are in place with the RWQCB and EPA to minimize sediment transport during storm flow events, but not at a level that would eliminate all releases.
NEIBP CAD Site	• Data collected for first two years indicates that chemical isolation has occurred and physical stability is intact. • CAD surface provides for suitable re-colonization of benthic organisms.	• CSTF/DMMP pilot studies proved that CAD sites could be effectively constructed in Southern California.	• DMMP Pilot Study conducted on volume of 100,000 m^3 was $27/$m^3$. (Note 1)	• Projects would be permitted under 404 authority from Corps, with 401 certification from RWQCB. • Permitting process may be lengthy. • CAD site ownership/management, long-term monitoring, and contingency issues need to be addressed. • CCC consistency determination likely required.
Nearshore CDF	• Provides for effective isolation of contaminants.	• Common practice for San Pedro Bay in the form of Port development projects.	• USACE Port Hueneme estimate as low as $10/$m^3$.	• None – projects would be permitted under 404 authority from Corps, with 401 certification from RWQCB. • Established procedures in place.
In-Situ Remediation	• Various technologies have proven effective at removing contaminants or rendering them inert.	• Few examples of projects used locally. • Typically contractor specific processes using proprietary equipment.	• Not applicable – based on surface area of contaminated location, COCs and target treatment depths.	• Not typically used in the region so would be handled on a case-by-case basis. • Oversight agencies would include RWQCB, Corps, and EPA.
In-Situ Isolation/Containment	• Sediment capping is a commonly used method in other regions of the U.S. • Proven effective for most contaminants (PAHs, pesticides and metals). • Not as effective for soluble or mobile contaminants, or when upwelling is present.	• Common practice for many regions of the U.S.; engineering design procedures and qualified contractors readily available.	• Not applicable – based on surface area of contaminated location and target cap thickness.	• None – projects would be permitted under 404 authority from Corps, with 401 certification from RWQCB. • Coastal Commission consistency determination likely required for nearshore capping projects.
Upland Nearshore Disposal	• Effectively removes contaminants from the water. • Must ensure that nearshore groundwater and soil resources are not impacted.	• Common practice by the Ports in the region during capital development projects and experienced contractors readily available.	• USACE Port Hueneme estimate as low as $10 to 20/$m^3$.	• None – projects would be permitted under 404 authority from Corps, with 401 certification from RWQCB.
Class I Landfill Disposal	• Effectively removes contaminants from the water. • Must ensure that upland groundwater and soil resources are not impacted. • Trade aquatic impacts for upland impacts associated with disposal.	• Common construction procedures – no specialized engineering design required. • Dewatering likely required ensuring no water losses during transport.	• Feasibility study conducted by the Corps, Los Angeles District for Port Hueneme estimated transport and disposal costs for a project containing 70,000 m^3 at $88/$m^3$. (Note 2)	• None – disposal regulated by the Integrated Waste Management Board and RWQCB. • Disposal must not preclude compliance with landfill WDRs. • Chloride leaching issue may need to be addressed by the RWQCB.
Class III Landfill Daily Cover	• Effectively removes contaminants from the water. • Must ensure that upland groundwater and soil resources are not impacted. • Trade aquatic impacts for upland impacts associated with disposal.	• Common construction procedures – no specialized engineering design required. • Dewatering likely required ensuring no water losses during transport.	• Feasibility study conducted by the Corps, Los Angeles District for Port Hueneme estimated transport and disposal costs for a project containing 70,000 m^3 at $21/$m^3$. (Note 2)	• None – disposal regulated by the Integrated Waste Management Board and RWQCB. • Disposal must not preclude compliance with landfill WDRs. • Chloride leaching issue may need to be addressed by the RWQCB.
Cement Stabilization	• Effectively removes contaminants from the water by removing material. • Not yet proven effective for organics using regional material.	• CSTF/DMMP pilot studies proved that cement stabilization could be effectively implemented in Southern California.	• DMMP Pilot Study baseline case estimate for a volume of 100,000 m^3 was $46/$m^3$. (Note 1)	• Not typically used in the region so would be handled on a case-by-case basis. • Oversight agencies would include RWQCB, Corps, and EPA.
Sediment Washing	• Effectively removes contaminants from the water by removing material. • Not directly effective for removing contaminants.	• CSTF/DMMP pilot studies showed that sediment washing provided limited effectiveness in removing chloride ions and metals. • Required large work area, constant source of freshwater and method for discharging a potentially contaminated waste stream.	• DMMP Pilot Study baseline case estimate for a volume of 100,000 m^3 ranged from $34 to $82/$m^3$, not including real estate lease rates. (Note 1)	• Not typically used in the region so would be handled on a case-by-case basis. • Oversight agencies would include RWQCB, Corps, and EPA.
Sediment Blending	• Not directly effective for removing contaminants – only provides dilution.	• CSTF/DMMP pilot studies showed that sediment blending is frequently used by the Ports to manage dredge materials, not from a contaminant reduction standpoint, but from a construction standpoint. • Engineering design specifications do not exist, but experienced contractors are	• DMMP Pilot Study baseline case estimate for a volume of 100,000 m^3 was estimated at $49/$m^3$, not including real estate lease rates for the work area. (Note 1)	• Typically handled on a case-by-case basis by the RWQCB, Corps, and EPA.

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Table 7-1
Evaluation Summary of Contaminated Dredge Material Management Alternatives for Los Angeles Region

Alternative	Environmental Effectiveness	Engineering Constructability	Range of Unit Costs	Regulatory Constraints
		available in the region.		
Thermal Desorption/Vitrification	• Has been shown to be effective at removing/ immobilizing organics. • Not as effective for metals.	• Few examples of projects used locally to treat contaminated sediments. • Typically contractor specific processes using proprietary equipment.	• \$45 - \$330/ton or \$25-\$180/m^3. (Note 3)	• Not typically conducted in the region, but would likely be handled on a case-by-case basis by the RWQCB, Corps, and EPA.
Cement Lock Technology	• Effective at removing organics and immobilizing metals.	• No examples of projects used locally. • Contractor specific processes using proprietary equipment.	• Demonstration project conducted in New Jersey using 30,000 yds^3 of sediment showed a processing cost of \$50/ton (not including capital expenditures). Equates to approximately \$92/m^3. (Note 4)	• Not typically conducted in the region, but would likely be handled on a case-by-case basis by the RWQCB, Corps, and EPA.
Soil Separation	• Not effective at directly removing contaminants; however, separation of fine-grained material will likely serve same purpose.	• No example of projects used locally, but technology exists elsewhere to facilitate implementation in the region.	• Previous demonstration projects have shown that, once constructed, hydro cyclones can be run very efficiently and produce processing costs as low as <\$6/m^3. (Note 5)	• Not typically conducted in the region, but would likely be handled on a case-by-case basis by the RWQCB, Corps, and EPA.
Aquatic Storage	• Not a process for treating contaminated sediments – only used for storage of treated material.	• Process used routinely by the Ports for storing clean material directly from dredging – similar technology needed for placing treated materials at designated storage sites.	• Costs are project specific and depend on quantity of material and proximity of storage site to treatment site.	• Not typically conducted in the region for treated material, but would likely be handled on a case-by-case basis by the RWQCB, Corps, and EPA.
Upland Storage	• Not a process for treating contaminated sediments – only used for storage of treated material or untreated material used for upland beneficial reuse.	• Process used routinely by the Ports for storing clean or marginally contaminated material for upland reuse.	• Costs are project specific and depend on quantity of material and proximity of storage site to dredging and/or treatment site.	• Typically handled on a case-by-case basis by the RWQCB, Corps, and EPA.

Notes:

1. Source: USACE 2002. DMMP Pilot Studies for Aquatic CAD site disposal, cement stabilization, sediment washing, and sediment blending. Prepared for the U.S. Army Corps of Engineers, Los Angeles District. November 2002.
2. Source: Anchor 2003. Evaluation of dredge material disposal options for channel deepening at Port Hueneme Harbor. Prepared for the U.S. Army Corps of Engineers, Los Angeles District by Anchor Environmental. March 2003.
3. Source: US Army Engineer District. 1993. Pilot-Scale Demonstration of Thermal Desorption for the Treatment of Buffalo River Sediments, EPA-905-R93-005. Chicago, Ill.: U.S. Environmental Protection Agency
4. Source: Rehmat, A., Lee, A., Goyal, A. and Mensinger, M.C. Construction-grade cement production from contaminated sediments using cement-lock technology. Presented at WEDA Annual Conference 1999.
5. Source: U.S. EPA 1994. ARCs Remediation Guidance Document. EPA 905-B94-003. Chicago, IL: Great Lakes National Program Office.

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8 CSTF MANAGEMENT STRATEGY AND RECOMMENDATIONS

This section presents the Contaminated Sediments Task Force (CSTF) recommended approach for selecting dredge material management alternatives for contaminated sediments in Los Angeles County (County). This section also presents a series of recommendations for additional steps to further assist in achieving the group's long-term goals of minimizing ongoing sources of contaminants to the coastal waters of the County and moving towards 100 percent reuse of contaminated dredge materials.

Also included is a brief review of how the CSTF addressed its objectives, including information on objectives that were completed, modified, addressed, or discarded. Example objectives that were implemented include agreement on a unified regulatory approach for managing contaminated sediments, the creation of a master dredging permit application, and standardization of dredging and disposal best management practices (BMPs).

8.1 CSTF Management Strategy

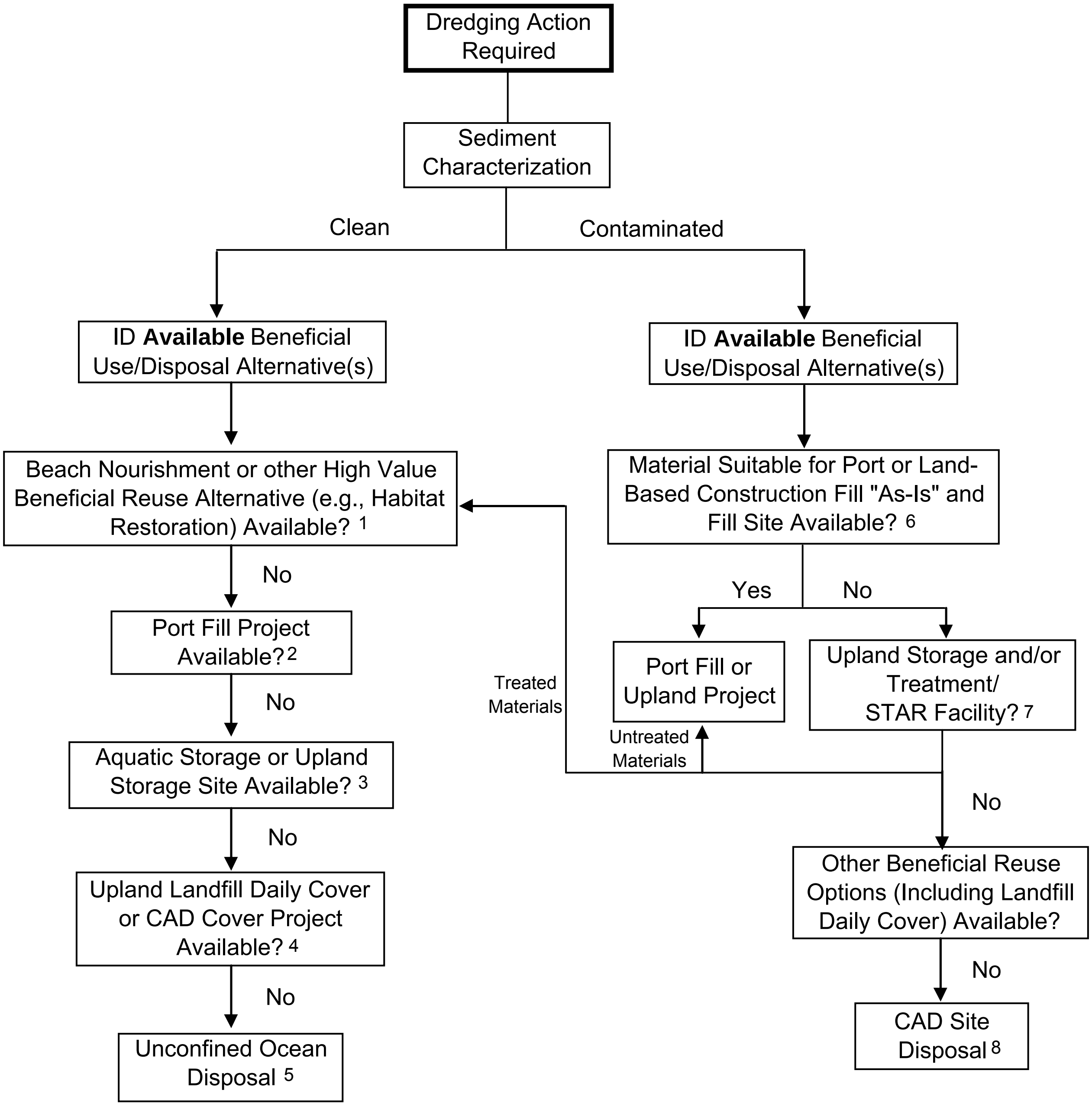
In 2003, the CSTF decided to develop and promote treatment and beneficial reuse of contaminated sediments, so that these alternatives could compete with aquatic disposal alternatives. This effort to create a better balance between disposal and reuse options is called the "balanced approach" and is recommended as an initial step in reducing the need for aquatic disposal. The long-term goal of the CSTF is to eventually achieve 100 percent beneficial reuse of contaminated sediments, eliminating the need for aquatic disposal of contaminated sediments. Achieving this goal, however, will require that several key initiatives be implemented. Recommendations for implementing those initiatives are presented in Section 8.2, including promotion of effective upland source control programs, ongoing tracking of contaminated sediment dredging and beneficial reuse efforts, and development of one or more regional sediment Storage, Treatment and Reuse (STAR) facilities for contaminated sediments.

A host of dredge material management alternatives are described in Section 6, followed in Section 7 by an evaluation of those alternatives against a series of technical, economic, and regulatory criteria. CSTF Management Committee members reviewed the evaluation summary presented in Table 7-1 and created a decision tree for dredge material management that relies on the technical information for each method, federal and state laws and regulations, and considers previously unaccounted for information such as anticipated public acceptance. That decision tree forms the basis for a recommended approach to project sequencing presented in Section 8.1.1.

8.1.1 Recommended Project Sequencing

The recommended steps for evaluating and selecting appropriate contaminated sediment management alternatives are presented in Figure 8-1. While the focus of the CSTF is on contaminated sediments and dredged materials, management options for clean material are also incorporated into this strategy because management of clean dredged materials can affect the suite of reuse and disposal options available for contaminated dredged materials. Joint management of both clean and contaminated materials is necessary to ensure that opportunities to handle contaminated materials are not pre-empted by clean material for which greater flexibility for reuse and disposal exists. Additionally, the CSTF Strategy provides for the treatment of contaminated dredged material which may provide options for cleaning the sediments, creating another source of clean materials available for beneficial reuse. The Los Angeles Regional Dredged Material Management Plan (DMMP) will evaluate in more detail the complete range of alternatives for uncontaminated dredged materials.

The steps outlined in Figure 8-1 are provided to assist in achieving the CSTF's goal of 100 percent beneficial reuse of contaminated dredged materials. As such, aquatic disposal at the confined aquatic disposal (CAD) (contaminated materials) and ocean disposal (clean materials only; disposal of contaminated dredged materials is prohibited under the Marine Protection, Research and Sanctuaries Act [MPRSA]) are provided only as last options, after beneficial reuse of the material "as is" at a port fill site, treatment of the material for beneficial reuse, or some other direct beneficial reuse of the material have been evaluated or attempted. This goal and the use/disposal alternative hierarchy displayed in Figure 8-1 complies with the requirements of both the Clean Water Act (CWA) and MPRSA to maximize beneficial reuse of dredged materials and minimizing discharges of dredged materials to the aquatic or ocean environment.



Notes:

1. Assumes that materials are chemically suitable and physically compatible for specific beneficial use alternative.
2. Assumes no near term sources of contaminated material (including material stored at TSR sites) suitable for constructed fill which would be precluded from inclusion in the Port fill by these clean materials. Contaminated materials suitable for construction fill have priority over clean material.
3. Storage for future benficial reuse at a designated unconfined aquatic site or upland site . Storage sites managed to prevent contamination of clean stored material.
4. Use of contaminated materials for upland daily cover has priority over use of clean material.
5. Assumes no less environmentally damaging practicable alternative, including other beneficial uses, are available.
6. Assumes coordination of dredge and fill schedules.
7. TSR site provides storage until constructed fill project becomes available, or treatment to transform material to be suitable for constructed fill.
8. Assumes no documented near term need for fill material (i.e., schedule dredging activity to coincide with fill project); assumes no available TSR capacity; assumes no other practicable beneficial reuse opportunities available.

Figure 8-1
Los Angeles CSTF Sediment Management Decision Tree

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When a dredging project is identified, the first step is to evaluate the suitability of the dredge material for ocean disposal or for unconfined aquatic beneficial reuse options by determining the chemical and physical character of the material using testing procedures provided in joint U.S. Army Corps of Engineers (Corps)/U.S. Environmental Protection Agency (EPA) guidance. For material that is determined to be clean and of appropriate grain size, the first priority is to use the material for beach nourishment, given the critical need in Southern California to maintain public beaches. Additionally, other high value beneficial reuse alternatives, such as habitat restoration, should have top priority for appropriate materials. If the materials are not physically suitable for beach nourishment or if use of the dredged materials for these high priority beneficial reuses is not practicable (as defined in the Section 404(b)(1) Guidelines), the next priority is for the dredged material to be used as fill in an approved port development project. However, if no Port development projects are under construction when the dredging occurs, the materials should be stored temporarily in an approved aquatic or upland storage site until the next available port fill opportunity. Similarly, where contaminated dredged materials are available for use in a port fill project (either from a concurrent dredging operation or material stored at an upland site, such as a STAR facility), the clean materials should be routed to an aquatic or upland storage site, not to the port constructed fill project. The intent of this part of the CSTF Strategy is to prioritize the management of contaminated materials for beneficial reuse by taking advantage of the greater flexibility available for managing clean dredged materials. This process would also serve to help retain capacity at the STAR facilities for future sources of contaminated dredged materials for which no direct beneficial reuse is available. Finally, if aquatic or upland storage is not a practicable alternative for these clean dredged materials, all beneficial reuses for the material should be considered before a request is made for ocean disposal, consistent with the requirements of MPRSA. These other options include, but aren't limited to, using the materials as daily landfill cover, for upland construction fill materials (e.g., transportation fill material), or as CAD cover.

For dredged material determined to be unsuitable for unconfined aquatic disposal, the first priority should be to use the material within an approved port development project. In addition to providing a mechanism for isolating the contaminants, thereby managing potential future exposure risks, this option also reduces the need to mine or import fill material from other areas. Direct use at other approved upland sites is also considered a high priority use for contaminated dredged materials. In instances where the dredged material is not physically appropriate for use as construction fill or when no fill sites are available at the time the dredging must occur, a mechanism is necessary to treat and/or store the material to provide other reuse options or to hold these materials until a port fill development project begins. The CSTF therefore supports the development of one or more STAR facilities, as discussed in Section 8.3. In this case, dredged material would be transported to a STAR facility where it would be either treated and converted to a beneficial use product (e.g., cement), or stored temporarily for use at a later time. If STAR facilities are not available when dredging occurs, or if there is no capacity in the STAR facilities, other upland reuse options would be considered before a request for CAD (e.g., North Energy Island Borrow Pit [NEIBP] CAD site). Other upland options include landfill daily cover (for lined landfills only) or transportation projects construction fill.

While the recommended project sequencing approach presented in Figure 8-1 does not initially guarantee achieving the CSTF goal of 100 percent beneficial reuse of contaminated dredged materials, it is anticipated that the majority of projects will be successful in finding a beneficial reuse alternative for the dredged material. As noted previously, several key elements of the CSTF Strategy need to be implemented before the goal of 100 percent beneficial reuse can be achieved, most notably of which is the creation of one or more regional STAR facilities. This and other recommendations to support the CSTF goals are described in more detail in subsequent sections. The CSTF Strategy is intended to be flexible and to recognize that specific reuse, reprocessing, storage, disposal, etc., decisions will be made taking into consideration a wide range of variables. The Advisory Committee will be responsible for ensuring that these decisions, to the maximum extent feasible, are made to reflect the CSTF goal of 100 percent beneficial reuse of contaminated dredged material in a manner consistent with the beneficial reuse requirements of CWA and MPRSA.

8.1.2 Suitability Determinations

Disposal or discharge of dredged or fill material into waters of the United States, including several of the beneficial reuse alternatives being considered in the CSTF strategy, require authorization under Section 404 of the CWA. This authorization is provided by the Corps with review from EPA and requires an assessment of the impacts contaminants in the dredged materials would have on the aquatic environment. The Corps must make a finding that the proposed discharge is consistent with several regulatory requirements (detailed in the Section 404(b)(1) Guidelines) before the discharge can be permitted. As noted in Section 8.1.1, the first step in selecting reuse or disposal options is to determine the chemical and physical character of the material using testing procedures provided in joint Corps /EPA guidance.[6] While the regulations implementing CWA Section 404 (and, similarly, MPRSA Section 103 for ocean disposal) provide certain factual determinations that must be made to assess the suitability of the materials for aquatic disposal, they do not provide specific criteria (e.g., numeric chemical criteria) for making the suitability determination. (See Section 4 for CSTF's evaluation of using Sediment Quality Guidelines (SQGs) in order to make dredged material suitability determinations.)

The CSTF strategy seeks to ensure protection of aquatic resources from the discharge of contaminated dredged materials back into the water, as well as to provide the dredging community with greater certainty and predictability about the results and the decision making process for suitability determinations. To help meet these goals, the CSTF recommends the following definitions be used for the various aquatic storage and disposal alternatives that provide the basis for the strategy. As improvements to these protocols or advances in testing of dredged materials are made, these definitions of what is suitable for these different disposal options should be revised accordingly.

[6] Testing and evaluation to determine suitability of sediments for unconfined open water disposal, as well as other disposal alternatives, is dynamic and will continue to evolve as testing protocols and the science of assessing sediment quality and its impacts on the physical, chemical and biological environment evolves. While the results of Tier II and III tests are not always conclusive or sufficiently robust to fully assess all environmental impacts, reliance on these testing protocols (as described in the Corps/EPA Inland Testing Manual) coupled with other lines of evidence currently provides the most reliable determination of environmental impacts from discharges of fill or dredged materials.

Aquatic Disposal for Storage (e.g., Western Anchorage Temporary Sediment Storage Site)

To be determined acceptable for aquatic storage, dredged material must comply with restrictions on discharges at §230.10[7]; and, (1) material must pass Tier II and III Inland Testing Manual (ITM); or, (2) coarse grained materials meeting criteria in §230.60(a).[8] Conditions for site use include preparation of a site management plan and identification and characterization of an appropriate reference site.

Confined Disposal Facility (Port Fills)

To be determined acceptable for CDF (port fills), dredged material must not be designated as hazardous by either the state or federal governments, and (1) appropriate engineering constraints applied to reduce contamination to acceptable levels at the site and prevent contamination being carried beyond the site (§230.60(d)[9]; or, (2) materials passing Tier III or consistent with criteria for coarse grained materials (§230.60(a).

[7] §230.10(b)(1-4) – no discharge of dredged or fill material shall be permitted if it causes or contributes to violations of any applicable State water quality standard; or, violates any applicable toxic effluent standard or prohibition; or, jeopardizes the continued existence of endangered or threatened species or is any adverse modification of critical habitat; or, violates any requirements imposed to protect any marine sanctuary.
§230.10(c) – no discharge of dredged or fill material shall be permitted which causes or contributes to significant degradation of waters of the United States, including significant adverse impacts on human health or welfare; or, significant adverse effects on life stages of aquatic life and other wildlife dependent on aquatic ecosystems including the transfer, concentration and spread of pollutants or their byproducts outside of the disposal site through biological, physical or chemical processes; or, significant adverse effects on aquatic system diversity, productivity and stability; or, significant adverse effects on recreational, aesthetic and economic values.

[8] §230.60(a) – if an assessment of the proposed dredge site leads to a determination that the site is sufficiently removed from sources of pollution to provide reasonable assurances that the proposed discharge material is not a carrier of contaminants (factors to be considered are listed at §230.60(b)) and that the dredged or fill material is not a carrier of contamination, then the required determinations pertaining to the presence and effects of contaminants (§230.11 Factual Determinations) can be made without testing. This section states that dredged or fill material most likely to be free from chemical, biological, or other pollutants where it is composed primarily of sand, gravel, or other naturally occurring inert material; these type of materials are typically found in areas of high current or wave energy.

[9] §230.60(d) – even if it is determined that the proposed dredge materials are likely carriers of contamination (e.g., occurrence of spills, known discharges of contaminants, previous testing, etc.) testing may not be necessary if constraints are employed to reduce contamination to acceptable levels within the disposal site and to prevent contaminants from being transported beyond the boundaries of the disposal site.

CAD

To be classified as acceptable for CAD, (1) dredged material must be substantially similar to materials found naturally at the site and confined (capped); or, (2) dredged material is substantially similar to contaminated materials from Los Angeles River Estuary (LARE) used for CAD pilot project and capped as per the CSTF pilot project; or, (3) dredged material with generally greater levels of contamination than in the CSTF pilot project, but where acceptable confinement criteria are established as conditions of use (i.e., cap and management procedures have been demonstrated to provide confinement protection equal to confinement baseline established in the CSTF pilot project), as per the requirements of CWA Section 404.

Beach Nourishment

Acceptable material for beach nourishment must be determined to be (1) physically compatible material meeting criteria of §230.60(a); or, (2) physically compatible material which passes Tier III testing and which does not exceed contamination levels acceptable for human exposure.

All available lines of evidence should be used in making the suitability decision. The CSTF Strategy recommends comparisons of SQGs (if available) and using data from toxicity testing, SQGs, and bioaccumulation evaluations in making suitability determinations. The Strategy also supports use of the mean effects range median quotient (ERMq) (with dichlorodiphenyltrichloroethane [DDT] values) or SQG-Q1 to assess the potential that a sediment sample either exhibits or lacks acute toxicity. Additionally, the Strategy supports CA Apparent Effects Thresholds (AETs) as an additional line of evidence, with the use of AETs in conjunction with a SQG quotient being likely to provide greater confidence in evaluating the potential for sediment toxicity. See Section 4.7.

8.2 Recommended Regional Source Control Measures

The most efficient way to manage contaminated sediments in the Study Area is to eliminate chemical and sediment sources before they are deposited in Santa Monica and San Pedro bays, essentially eliminating the problem before it exists. Numerous activities, including development of Total Maximum Daily Loads (TMDLs), are underway by federal, state, and local agencies to reduce and eliminate sediment and chemical loading in the Ballona Creek, Dominguez Channel, and Los Angeles River watersheds. The CSTF recommends that these source control activities continue and that the CSTF Management Committee members stay abreast of the TMDL development process and provide input into its refinement and implementation.

8.3 Completed CSTF Initiatives

Successfully implementing the Management Strategy presented in Section 8.1 requires that several additional steps be taken within the Los Angeles Region (Region). These steps are presented as recommendations from the CSTF members to state and federal agency representatives and project proponents. Some of these have already been implemented and are in practice today. They include:

- Development of a unified regulatory approach for managing contaminated sediments in the Region through ongoing coordination of regulatory agencies and Advisory Committee review of controversial projects;
- Ongoing support for meetings of CSTF participants to take responsibility for ensuring the recommendations are put into practice;
- Development of a master dredging permit application to provide a single resource for project review by multiple agencies;
- Development of standardized list of BMPs for managing environmental impacts associated with dredging and disposal activities; and
- Ongoing support for the CSTF Advisory Committee to review and discuss proposed projects, as they develop and make recommendations for appropriate disposal alternatives.
- Identify regional source control measures to be implemented by other organizations to assist in eliminating future accumulations of contaminated sediments; and
- Identify additional coordination activities to assist in addressing steps for solving the problem at the watershed level.

8.3.1 Unified Regulatory Approach

As described in Section 1, the Management Committee was the main evaluation and decision making body for the CSTF. Under the direction of the Management Committee were five Subcommittees charged with identifying and resolving technical issues related to the development of the CSTF Management Strategy. The five subcommittees include the Upland Disposal and Beneficial Reuse Subcommittee, Aquatic Disposal and Dredge Operations Subcommittee, Watershed Management and Source Reduction Subcommittee, Implementation Subcommittee, and Sediment Screening Threshold Subcommittee. These groups were charged with preparing specific technical components of the strategy.

An Advisory Committee was also created and met as necessary when specific dredging and disposal projects were proposed prior to completion of the strategy. This group was formed to support concurrent review and potentially build consensus among interested parties regarding potentially controversial dredging projects. The Advisory Committee includes representatives from the state and federal regulatory agencies (e.g., EPA, Los Angeles District U.S. Army Corps of Engineers [USACE], California Coastal Commission [CCC], and Los Angeles Regional Water Quality Control Board [LARWQCB]) and project proponents from the Ports, City of Long Beach, or County of Los Angeles.

8.3.2 CSTF Implementation Subcommittee

In 1999 the CSTF Implementation Subcommittee prepared a Streamlining Report (included in the Management Strategy Technical Appendices) to summarize ways agencies involved with the CSTF might improve the review and approval process for dredging projects while protecting the coastal environment. Through this report, the Implementation Subcommittee proposed mechanisms that would make this review and approval process more efficient and economical while improving protection of water quality and biological resources.

Some of the challenges for the project proponents outlined in the Streamlining Report included: (1) coordinating among various state and federal agencies with overlapping jurisdictions and sometimes with conflicting goals or requirements; (2) not knowing agencies' concerns prior to submittal of an application; and (3) getting agencies to comment on or approve a project within a timeframe that allows for meeting budget and contract bid deadlines. Such challenges can cause projects to be constantly modified and increase the project costs, particularly at the planning stage.

Regulatory and resource agencies are also faced with their own challenges when project environmental documents and applications get submitted. Examples of such challenges include: (1) not having all the project information, including disposal alternatives, sediment analyses and mitigation measures, submitted concurrently; (2) receiving information with insufficient review time allotted by the project proponent; and (3) not always being able to comment on projects prior to submittal of an application. Thus, projects may not be designed to meet regulatory requirements, or may adequately avoid or mitigate for potential environmental impacts.

Solutions were defined by the Implementation Subcommittee to address these challenges and improve the review and approval process. These solutions were developed in an effort to reduce the potential for projects to be developed without considering cumulative impacts, addressing watershed efforts, or coordinating environmental concerns. Short-term, immediate solutions, including continuing with the Advisory Committee and the development of a joint permit application, were agreed upon and implemented prior to development of the Long-Term Contaminated Sediment Management Strategy.

8.3.3 Master Dredging Permit Application

The Implementation Subcommittee developed a single (master) permit application that allows project proponents to submit one consistent package to all concerned agencies (e.g., CCC, LARWQCB, and USACE) as a means of streamlining the regulatory process. A copy of the permit application is contained in the Management Strategy Technical Appendices.

8.3.4 Standardized Best Management Practices

The Implementation Subcommittee recommended that standardized list of BMPs be identified because they represent a key mechanism in ensuring that dredging projects would have minimal impacts to water quality and aquatic biological resources. Through the Aquatic Disposal and Dredge Operations and Management Subcommittees, potential BMPs to be utilized during dredge and disposal operations were identified and evaluated for use in the Region. The guidelines for BMPs (presented in Section 5 of this report) were developed to streamline the review process by allowing project applicants to know in advance what measures would likely be accepted by the regulatory agencies under various circumstances.

Baseline BMPs required by the USACE and the LARWQCB for dredging projects in the Region include dredge scow tracking and water quality monitoring (discussed in Section 8.6). Starting with these minimum requirements, a project proponent would be expected to use the BMP toolbox developed by the CSTF, in combination with review of site conditions, to determine if additional control measures are warranted. Those measures would then be proposed for use during the applicant's submittal of the preliminary sediment characterization report, one of first steps in the permit approval process. In addition, the proponent should identify additional BMPs to be used if dredge site monitoring identifies a greater than expected threat to water quality.

8.3.5 CSTF Advisory Committee

As mentioned above, an Advisory Committee was formed with representatives from the state and federal regulatory agencies (e.g., EPA, USACE, CCC, and LARWQCB) and project proponents from the Ports, City of Long Beach, and County of Los Angeles. Also in attendance were representative(s) from Heal the Bay. The objective of the Advisory Committee was, and still is, to provide a forum for discussing new dredging and disposal projects and potential solutions for material disposal or reuse before permit applications are submitted.

Meetings of the Advisory Committee can be called whenever a new project enters the planning stage. This typically occurs when a project proponent contacts a regulator and the regulator then requests a meeting; or when the project proponent directly requests a meeting. In instances where the project is less than 1,000 cubic meters (m^3), or the material is planned for 100 percent upland disposal, the USACE or EPA may not call a formal meeting, but instead will notify the Advisory Committee (and interested stakeholders) of their planned action.

8.4 Recommended Source Control Coordination Activities

The CSTF recommends establishing a mechanism to promote frequent coordination between CSTF members and staff responsible for implementing the regional source control measures presented in Section 8.4. Sections 6.3 and 6.4 detail the numerous efforts underway in the Los Angeles Basin to develop and implement chemical and sediment source control measures for the Ballona Creek, Dominguez Channel, and Los Angeles River watersheds. Ongoing coordination between Implementation Subcommittee members responsible for managing contaminated sediments post-deposition and agency representatives responsible for reducing source loading to the watersheds will be critical to the success of this strategy.

One option for coordinating activities between all stakeholders is to hold an annual, one-day, workshop for addressing the relationship of Los Angeles regional source control efforts to coastal sediment and water quality, with a focus on port, harbor, and estuarine issues. The workshop should include representatives from all the major watershed groups (e.g., Dominguez Channel Watershed Advisory Committee), local city and county watershed divisions, and USACE Watershed Division. Another option would be for all the stakeholders responsible for solving the problem at the regional level to include each other on their mailing lists so that project updates and meeting notes can be shared. The workshop would help to identify watershed-derived impacts to the coast and allow each watershed group and coastal stakeholders to share their progress and work together to solve challenges.

8.5 Recommended Modifications to Water Quality Monitoring

The CSTF recommends several improvements to the standard Monitoring and Reporting Program (MRP) developed by the LARWQCB for Waste Discharge Requirements (WDRs) issued for dredging and disposal of clean and contaminated sediments (Section 5.4). The following changes will be incorporated into the MRP:

1. Modify the transmissivity trigger used to require additional water sampling. The current MRP requires a comparison of the average light transmittance values measured throughout the entire water column at stations C (300 feet downcurrent from dredging) and D (control station); additional water sampling is required if the difference in light transmittance is 30 percent or greater. The MRP will be changed to require that the near surface measurements (1 meter below the surface) from stations C and D be compared to one another, and that the near bottom

measurements (1 meter above the bottom) from stations C and D be compared to one another, and that the average mid-water light transmittance (remainder of the water column) from stations C and D be compared to one another. This method will be more sensitive to the detection of surface or bottom turbidity plumes, while still detecting mid-water plumes.

2. Add a reference site for water sampling for trace metals and trace organics. The current MRP requires additional water sampling at station C, the station likely to be affected by dredging operations, when the transmissivity trigger is exceeded. However, no sampling is required at any other stations. The MRP will be changed to require water sampling for trace metals and trace organics at station D, a control station unaffected by the dredging. This will provide a measurement of background levels in ambient harbor waters for comparison to the levels found within the dredging plume.
3. Extend water quality monitoring following a transmissivity exceedance. The current MRP does not require additional light transmittance measurements in the days following exceedance of the transmissivity trigger; monitoring simply occurs according to the normal schedule (usually the following week). The MRP will be changed to require additional light transmittance measurements for 3 days following an exceedance of the transmissivity trigger. This will allow determination of whether the increase in turbidity was a transitory event or a recurring problem and will help determine the need for implementation of additional best management practices to reduce turbidity.
4. Require faster notification of the regulatory agencies when the transmissivity trigger is exceeded. The current MRP does not require specific notification to the LARWQCB in this case, although the standard provisions require the discharger to report any noncompliance with Waste Discharge Requirements that may endanger health or the environmental orally to the LARWQCB within 24 hours of becoming aware of the circumstances. The MRP will be changed to require notification to the LARWQCB, the CCC, EPA, and the USACE within 24 hours of an exceedance of the transmissivity trigger.
5. Require an assessment of corrective actions by the permittee when the transmissivity trigger is exceeded. The current MRP does not require specific corrective actions in response to an exceedance of the transmissivity trigger. The MRP will be changed to

require implementation of certain best management practices in response to such an exceedance (e.g., check for obvious operational problems). However, if the turbidity problem continues, the discharger will be required to look for other causes and/or evaluate the need for implementation of additional, more aggressive best management practices and will consult with the regulatory agencies to develop a solution.

8.6 Recommended Application of Los Angeles Regional Sediment Quality Guidelines

Development of regional sediment quality guidelines was considered by the CSTF as described in Section 4. Based on this evaluation, the CSTF recommends the following future applications of regional sediment quality guidelines:

- SQGs should not be used deterministically for making disposal suitability decisions. The high degree of uncertainty associated with applying SQGs to the majority of sediment types present in the Region precludes their use as the sole factor in determining the suitability of sediment for aquatic disposal. In addition, national policy for regulating open water disposal prevents the use of SQGs deterministically and as a substitute for biological testing in ocean disposal situations.
- SQGs may be used, but are not required, to provide additional lines of evidence to the decision-making process. SQGs provide a reliable measure of sediment quality for some sediment types and their use may assist applicants, regulators, or other groups in assessing the ecological risk of sediment disposal. If available, the results of SQG comparisons should be considered along with other information when making disposal suitability decisions.
- All available lines of evidence (e.g., toxicity, SQGs, bioaccumulation) should be considered for making disposal suitability decisions.
- The mean ER-M quotient (with DDT value) or SQG-Q1 should be used to assess the potential that a sediment sample either exhibits or lacks acute toxicity. The ER-M quotient is preferable to other SQG approaches that were shown to perform just as well because more chemicals of concern are included in the calculation.
- A revised value for the DDT ER-M should be considered that provides suitable performance results.

- CA AETs should be used as an additional line of evidence for making disposal suitability decisions. Regional AETs provide a tool to identify individual contaminant concentrations that are almost certain to result in toxicity. The use of AETs in conjunction with a SQG quotient is likely to provide greater confidence in evaluating the potential for sediment toxicity.
- Maintain and update the CSTF sediment quality database and periodically evaluate SQG performance and AET values. The CSTF should require its contractors to submit the data from future characterization studies and surveys in an electronic format that is compatible with the CSTF sediment quality database.
- Incorporate improved analytical chemistry methods that relate to bioavailability in the dredged material evaluation process. Variation in contaminant bioavailability is believed to be a substantial factor in the high uncertainty observed when SQGs are applied to sediments that contain low to moderate chemical concentrations.

8.7 Recommendations not Implemented

Recommendations made by the Implementation Subcommittee that did not receive CSTF consensus approval include:

<u>Reducing the Number of Permits</u>

Several options were considered, including: (1) development of a single overall permit; (2) having one state permit and one federal permit; or (3) having either the LARWQCB or the USACE issue a single permit instead of both agencies issuing permits. Some of the complications associated with these options include identifying a lead agency, having a lead agency give up regulatory control, developing interagency agreements, and changing existing regulations to designate that authority. The participants have agreed that the concurrent review of dredging projects through the CSTF Advisory Committee significantly improves the review process and that efforts to combine permits are not needed at this time.

<u>Streamlining Regional Board Permitting</u>

The LARWQCB currently issues WDRs for dredging activities. One proposal would be to issue Section 401 Water Quality Certifications (WQCs) in lieu of WDRs. The WQCs could then become a part of the USACE Section 404 permits. One advantage to this approach is that WQCs could be issued more quickly because Board approval would not be required.

However, there was concern about eliminating the public review opportunity associated with Board review procedures, even though such opportunity already exists through the USACE public notice process and when the application is submitted to the LARWQCB. There was also concern regarding the extent to which the LARWQCB could enforce conditions that become a part of the USACE permit.

The LARWQCB currently does not have direct authority to issue WQCs. Instead, the LARWQCB recommends actions to the State Water Resources Control Board (SWRCB), which is the lead agency that certifies or denies projects under the Water Quality Criteria process. However, the SWRCB is proposing to change regulations to allow it to delegate its authority to the LARWQCBs.

Another proposal would be for the LARWQCB to develop general WDRs for specific dredging activities, similar in approach to municipal storm water permits. These WDRs would outline provisions, conditions, and reporting and monitoring requirements. The public comment period would occur prior to the adoption of the WDRs. Once the general WDRs are adopted, then projects could be given administrative approval from the LARWQCB. However, there would be no further comment period for each individual project qualifying for such a permit.

<u>Integrating Environmental Review</u>

When a project proposal is submitted to the Advisory Committee, most of the environmental review has already been completed. However, comments made during the permitting process often are different from those provided earlier during the environmental review process. If the agencies and environmental groups could utilize this latter process more effectively to let project proponents know what specific concerns exist, then those concerns could already be addressed when the project gets evaluated during the permitting process. Nevertheless, the Implementation Subcommittee did not support this solution at the time because changing current practices might involve changing the organizational structure or mindset of the agencies concerned. Although there was support in theory and the committee could develop approaches to accomplish this option, there was resistance in implementing such change. Currently, the Advisory Committee tries to integrate environmental reviews as much as possible within the permitting processes of the various agencies.

Changing Local Coastal Program/Port Master Plan

As part of the 1999 Streamlining Report, the CSTF considered whether the approval of dredging, disposal and/or reuse projects could be streamlined by including those projects in either a Local Coastal Program (LCP) (for the Cities or County) or in a Port Master Plan (PMP) (for the Ports). Both the Port of Los Angeles (POLA) and the Port of Long Beach (POLB) have approved PMPs, while the City of Long Beach and Marina del Rey have approved LCPs. In the case of Marina del Rey, the Los Angeles County Regional Planning Department administers the LCP, which covers only the land area. However, there is no approved LCP for the City of Los Angeles or for the County. Proposed changes to LCPs or PMPs would have to be reviewed and approved by the CCC.

The CSTF investigated the feasibility and the willingness of the local agencies to modify their LCPs or PMPs. After deciding to coordinate dredging and disposal policy in the CSTF strategy and agreeing to conduct concurrent review of critical projects through the CSTF Advisory Committee, the CSTF choose not to recommend changes to those plans. Streamlining dredging, disposal and reuse projects in this manner would have eliminated CCC oversight of individual projects (unless the projects were appealed to the CCC) and reduced public input.

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9 FUTURE ACTIVITIES OF THE CSTF

9.1 Future Meetings of the Advisory Committee

Future meetings of the Advisory Committee are expected to occur at the same frequency as they currently do − whenever a new project is identified that involves dredging or disposal of contaminated sediment. As stated in the previous section, meetings are typically scheduled either when a project proponent contacts a regulator and the regulator decides it is prudent to request a meeting; or when the project proponent directly requests a meeting. In instances where the project is less than 1000 m^3 or the material is planned for 100 percent upland disposal, the regulatory agencies may elect to forgo a formal meeting in lieu of an email to the Advisory Committee members and interested parties notifying them of the planned action.

State and federal funding for future participation in Advisory Committee meetings will occur through each agency's normal budgeting process for staff responsible for managing the review of permit requests related to contaminated sediments. Those processes are already in place for staff at the U.S. Environmental Protection Agency (EPA) Region 9, U.S. Army Corps of Engineers, Los Angeles District (USACE), California Coastal Commission (CCC), and the Los Angeles Regional Water Quality Control Board (LARWQCB).

9.2 Updates or Revisions to Long-Term Management Plan

It is the intent of the Contaminated Sediments Task Force (CSTF) that this Long-Term Management Strategy be a living document, updated when possible using the information for new technologies and re-visiting the evaluation of current alternatives. Although no funding is currently designated for this purpose, staff at the CCC and the LARWQCB will make attempts to secure funding for revisions and updates in the future.

9.3 Maintenance of Storm Water/Sediment Monitoring Electronic Database

The CSTF storm water and sediment database is currently maintained at the offices of the Southern California Coastal Water Research Project (SCCWRP) in Westminster, California. At this time funding does not exist to maintain or update the database after completion of this document; however, work is in progress by the State of California to develop a statewide database of sediment characterization data. Once completed, it is anticipated that the Los Angeles database will be merged with that from the rest of California.

9.4 Long-Term Monitoring and Management of the North Energy Island Borrow Pit Confined Aquatic Disposal Site

The chemical and physical data available at the time the Strategy Report was prepared (June 2004), indicates that the North Energy Island Borrow Pit (NEIBP) confined aquatic disposal (CAD) site has successfully isolated and contained the contaminated sediments placed there by the USACE in mid 2001. Post construction field monitoring data, collected annually for the past three years, verifies that all project objectives were met. Based on these results, the CSTF recommends that the NEIBP be included in the group's management strategy as a disposal option for limited use, pending individual permit approval by the USACE, EPA, and CCC.

The CSTF's recommendation includes a request that future disposal activities in the NEIBP be limited to other sub-cells of the pit so that additional long-term monitoring may occur for the portion filled during the pilot studies. No additional monitoring events, however, have been planned or budgeted by any of the participating members. While the technical issues surrounding use of the NEIBP as a disposal site have been addressed by the CSTF, other administrative and legal issues related to CAD site management remain unresolved.

The portion of San Pedro Bay where the energy island borrow pits are located is within the boundaries of a Tidelands Trust Agreement between the City of Long Beach and the California State Lands Commission. As such, management of the NEIBP as a dredge material disposal site would be under the jurisdiction of the City of Long Beach, who has tentatively agreed to act in that role. In this capacity, the City would need to develop a long term operations and maintenance plan for the site, including details on planned disposal events, quantities, estimated chemical concentrations, disposal methods, and target cap layer thickness, frequency and source(s).

For example, the CSTF pilot study for the CAD site included a 1.5-meter thick cap over the contaminated sediments. While this cap thickness has proven successful during three years of monitoring, other successful sediment caps constructed elsewhere have been much thinner. As such, it is possible that a thinner cap may also be successful at the NEIBP. Also, because it appears that sediments from the Los Angeles River Estuary (LARE) are routinely deposited in the energy island pits during typical runoff events, it may be sufficient to only require capping on an intermittent basis rather than after each project. The USACE Los Angeles District is currently seeking funds to investigate some of these issues to assist in the development of a long term operations and maintenance plan.

Regulatory permitting for disposal at the NEIBP would occur through the standard regional dredging process and on a project by project basis. The USACE and EPA would issue the project sponsor a 404 permit to authorize in water construction activities and placement of the dredge materials; and the LARWQCB would issue a 401 water quality certification (WQC) for dredging and disposal of contaminated sediments. While the NEIBP is technically outside of the authority of the CCC, associated dredging activities would likely require a CCC consistency determination as well.

9.5 Coordination with the Los Angeles Dredged Material Management Plan

Future coordination activities between the CSTF Implementation Subcommittee and the USACE Dredged Material Management Plan (DMMP) project will occur via two primary routes. First, because the USACE is a participating member of the Implementation Subcommittee, routine updates on the DMMP and input from the CSTF members will occur during scheduled meetings. Second, all of the members of the CSTF are currently included in the document distribution and public notice announcement list for DMMP activities so all future updates and revisions will be made available for review and comment.

The current schedule for the DMMP Feasibility Study is slightly behind that for completion of the CSTF Strategy Report. As such, the USACE will be afforded the luxury of having the CSTF information available for incorporating into the DMMP to ensure consistency between the two documents.

9.6 Development of Regional Processing/Treatment Facilities and Fill Sites

As mentioned in Section 8.1.1, one of the steps identified by the CSTF as a critical need for successfully achieving the goal of providing 100 percent beneficial reuse of contaminated dredged materials is to locate and construct a regional processing facility for marine sediments as well as additional nearshore fill sites. Current estimates of contaminated sediment dredging vs. available disposal (e.g., port development projects) for the next five to 10 years indicates that there is a net abundance of material for which no treatment, reuse, or disposal options have been identified (Section 3). In addition to the projected need identified for the County in this document, contaminated sediment dredging projects have also been identified for material in Port Hueneme (Ventura County) and Newport Harbor (Orange County).

In order to meet this projected need, cost effective treatment or reuse alternatives must be developed or additional fill sites must be constructed. Because the construction of nearshore fill sites is usually tied to economic development, and hence only occurs periodically, the focus of the group includes both planning to maximize beneficial reuse opportunities (including port fill projects) as well as developing cost effective means for treating and reusing contaminated sediment. As shown in the evaluation of alternatives presented in Section 7, sediment treatment options almost always cost significantly more than construction fill and disposal alternatives. In instances where construction fill sites are not available, it is very costly to treat sediments compared to other reuse or disposal alternatives. Therefore, CSTF members focused on developing a plan for reducing the costs to treat and reuse sediments so that it could be implemented more often, without causing undue economic stress.

One approach that has been used in New Jersey to accomplish this task is the development of centrally located processing facilities where dredge materials can be stored and/or treated as a precursor for beneficial reuse. This management technique, termed a sediment Storage, Treatment and Reuse (STAR) facility by the CSTF Management Committee, has been successful elsewhere because it allows the normally high capital costs of setting up one or more treatment facilities to be absorbed over larger timeframes and has been shown to produce a sellable product at the end, providing a margin of cost recovery to the process.

The concept for STAR facilities is to be either mobile or centrally located close to where the majority of dredging occurs. Material could be offloaded to the facility either by derrick or hydraulically pumped if the facility was located a short distance inland from the waterfront. Upon receipt, the material would be dewatered, with the decant water returned to the waterfront and treated, if needed.

The dredge material could then be subjected to one or more treatment processes, depending on its characteristics, to provide a reusable product. For example, sediment from the LARE or Marina del Rey, which typically contains 50 to 75 percent sands, could be processed using a series of hydro-cyclones to separate out the clean sand, leaving behind the fine-grained, contaminated material. The clean sand could then be shipped offsite for use as construction fill or for beach nourishment. The fine-grained material could then be treated with cement to bind the contaminants and produce a compactable nearshore fill material.

The advantages of this management approach include the following:

- Provides a long-term solution for managing contaminated sediments that is independent of unpredictable port construction fill projects
- Provides a location for short-term storage of contaminated and treated sediments to allow additional reuse opportunities to be located
- Provides a sellable product at the end to aid in cost recovery
- Helps achieve the CSTF's objective of 100 percent beneficial reuse of contaminated sediment in the Region

The disadvantages of this approach are:

- Requires space located in close proximity to the dredging activities which is costly and in short supply
- Requires potentially high capital expenditures to develop the site
- Optimal performance of the facility requires either a steady flow of dredge material throughout the year or a very large area for storage on site
- Details for constructing, operating, and maintaining the facility have not yet been developed within the Region
- End use recipients for the treated dredge material have not been identified

In an attempt to help better understand some of the limitations presented above, the USACE has requested federal funding to conduct a pilot field study to set-up and run a STAR facility using contaminated material from Marina del Rey. The purpose of the study would be to test various sand separation techniques and evaluate design (engineering and real estate) and production rate needs for implementing a full-scale operation. In the interim, the CSTF Management Committee developed a sediment STAR Implementation Plan with recommended steps and target completion dates, presented in Table 9-1.

Table 9-1
STAR Action Plan and Schedule

Action Plan Steps	Target Completion Date
1) Establish criteria and terms of use for a CSTF STAR facility; determine environmental review requirements and possible locations for a STAR facility; and develop specifications.	October 2005 (funding dependent)
2) Complete USACE Marina del Rey STAR pilot studies or equivalent.	October 2005
3) Revisit specifications after STAR pilot studies.	January 2006
4) Establish goal (target date) for STAR implementation after pilot studies.	January 2006
5) Develop criteria to evaluate STAR alternatives.	January 2006
6) Complete evaluation of STAR alternatives in the F4 stage of the Los Angeles DMMP process, including multiple locations for a STAR facility.	March 2006
7) Evaluate all management options including a regional entity through a Joint Powers Agreement of City, County, and Ports to own and operate a regional STAR facility.	March 2006
8) Identify final list of STAR alternatives – sites and management plans (including ownership conditions) and incorporate business and "operability" criteria and/or a cost: benefit analysis.	March 2006
9) Recommend preferred alternative site(s) and management plans (including ownership conditions) of the STAR(s). Note: if the USACE cannot implement the STAR facility as the preferred alternative in the DMMP, then the CSTF Management Committee will determine the next steps.	June 2006
10) Draft MOU on STAR site management.	June 2006
11) Create STAR.	After June 2006

10 ADOPTION AND IMPLEMENTATION OF THE STRATEGY

The primary goal of the Contaminated Sediments Task Force (CSTF) is the completion of this Long-Term Management Strategy for the dredging and disposal of contaminated sediments in the Los Angeles Region (Region). This strategy provides information on the volume and location of contaminated sediments likely to be dredged within the next five to 10 years; the sources of pollution contributing to the sediment contamination problems; available disposal alternatives, and the criteria for use and selection of the alternative appropriate for a given dredging project.

The remainder of the section discusses the adoption process for the strategy within each of the lead regulatory agencies, as well as its implications to other local agencies and organizations such as the ports, cities, and counties included within the Study Area. Because the Long-Term Management Strategy is general in scope, and does not set forth enforceable policies, it is exempt from the California Environmental Quality Act (CEQA). If the strategy were to set forth enforceable policies, then an analysis of environmental impacts would be required.

10.1 California Coastal Commission

For the California Coastal Commission (CCC) to adopt a regional sediment management strategy, it must demonstrate that the strategy is consistent with California's Coastal Act and that it complies with the CEQA. Once the CSTF has developed the Long-Term Management Strategy, the document would proceed through an internal CCC staff review process. Commission staff would meet with upper management to discuss and obtain comments on the strategy prior to any public workshops or hearings. Upon completing this internal review, Commission staff would present a draft strategy for public review and comment. A public workshop would be scheduled as part of a CCC hearing to allow discussion of the strategy and receive comments from the Commissioners, the public and other interested parties. Once the public review process has been completed, staff would place the strategy on the Commission meeting agenda and submit a staff report recommending adoption of the strategy. Official adoption of the strategy by the vote of the CCC would indicate the agency's commitment to implement this plan. Typically, a minimum of four months would be required to complete the CCC's adoption process.

10.2 Los Angeles Regional Water Quality Control Board

For the Los Angeles Regional Water Quality Control Board (LARWQCB) to adopt a regional sediment management strategy, it must demonstrate that the strategy is consistent with the Clean Water Act (CWA), the Porter-Cologne Act and the CEQA. To avoid creating regulations without public input, the LARWQCB probably would choose to adopt the strategy formally in a public hearing, either as a stand-alone plan or guidance document, or through incorporation into the Basin Plan as an amendment. Staff will need to prepare an environmental checklist and staff report on the strategy. A public workshop, including at least a 30-day public review period, would then be held by staff to discuss the strategy and receive public comments. Staff will need to prepare written responses to all comments received during the public review process, place the strategy on the LARWQCB's meeting agenda, and submit a staff report recommending adoption of the strategy. In the case of a Basin Plan amendment, staff would prepare a Functional Equivalent Document, which would serve to comply with CEQA. Official adoption of the strategy by the vote of the LARWQCB would indicate the agency's commitment to implement this plan. However, if there were a Basin Plan amendment, that amendment also must be submitted to the State Water Resources Control Board (SWRCB), Office of Administrative Law (OAL) and the U.S. Environmental Protection Agency (EPA) for approval. Final adoption by the LARWQCB would not take effect until approved by all three.

Typically, a minimum of four to six months would be required to complete the LARWQCB's adoption process. An additional three to six months might be required for approval of a Basin Plan amendment by SWRCB, OAL, and EPA. Given that the LARWQCBs' Executive Officer has already reviewed and approved the Long-Term Management Strategy through participation on the CSTF's Executive Committee, this would lend weight to the staff recommendation for adoption by the LARWQCB. To facilitate the public review process, it might be possible to coordinate the LARWQCB's public workshop on the strategy with the CSTF's Annual Public Workshop.

10.3 U.S. Army Corps of Engineers, Los Angeles District

Congress has established a number of requirements that agencies must meet when issuing regulations. For the U.S. Army Corps of Engineers to adopt a regional sediment management strategy, it must demonstrate that the strategy is consistent with the CWA, the

Marine Protection, Research and Sanctuaries Act (MPRSA), Section 10 of the Rivers and Harbors Act (RHA), and the procedural requirements of the National Environmental Policy Act (NEPA).

The U.S. Army Corps of Engineers (USACE) – Dredged Material Management Plan (DMMP) Environmental Impact Statement (EIS) will ultimately provide the programmatic foundation for implementation of treatment and disposal alternatives evaluated in the DMMP pursuant to NEPA, MPRSA, RHA and CWA requirements. Once the USACE's DMMP is in place, individual projects subject to environmental review will be able to rely on the analyses put forth in the DMMP as the scientific basis for sound decision-making in concert with the strategy.

A strategy that requires fundamental modifications to dredging permitting procedures would require a change at the Congressional level. However, it should be possible to develop a Memorandum of Agreement (MOA) for the strategy to be employed by the various regulatory agencies, outlining the permitting procedures to be applied within the context of existing law and regulations. A general agreement for agencies to strive to employ the recommended strategy could be approved at the South Pacific Division level. The MOA would apply to activities conducted by the Regulatory Branch, Construction-Operations Division, and Planning Division prior to review by the District Engineer, Los Angeles District. The MOA then would be reviewed and approved by the Division Engineer, South Pacific Division. Signature of the MOA by the Division Engineer would indicate the agency's commitment to implement this plan. Given that the USACE's District and Division Engineers already have reviewed and approved the Long-Term Management Strategy through participation on the CSTF's Executive Committee, approval of the MOA should proceed quickly.

The USACE's Regulatory program currently utilizes Regional General Permits (RGP) specific to dredging activities in particular ports and municipalities. RGPs allow the regulated entity and the resource agencies to conduct an "umbrella" review of a dredging program, enabling streamlined review of individual projects subject to the umbrella review. RGPs go through the same steps as an individual permit application (i.e., public comment period, NEPA/CWA compliance documentation) prior to their authorization. Examples of existing RGPs include:

- RGP 28 allows the Port of Long Beach (POLB) to dredge up to 40,000 cubic yards (cy) per a year, and no more than 200,000 cy in a five-year period. Sampling and analysis plans and disposal option analysis required on a case-by-case basis. RGP028 will expire August 4, 2008.
- RGP 29 allows the POLA to dredge up to 100,000 cy per year. No more than 200,000 cy in a two-year period, and no more than 500,000 in a five-year period. Sampling and analysis plans and disposal option analysis required on a case-by-case basis. RGP029 expires March 24, 2008.
- RGP 30 authorizes the City of Long Beach to maintenance dredge a maximum of 68,760 cubic meters (m^3) (90,000 cy) per year using a hydraulic suction dredge. The dredged sand would be used to nourish eroded beaches adjacent to dredging areas where the material meets suitability requirements on a case-by-case basis. Other dredged spoils would be pumped to delineated pending sites. RGP030 was issued February 4, 1999 and will expire March 3, 2004.
- For dredging project not subject to existing RGPs, Individual Permits (IPs) are required. The USACE Regulatory program would be able to incorporate the strategy recommendations and options analyzed in the DMMP EIS in case-by-case analysis pursuant to existing RGPs, as well as in new IP applications.

10.4 U.S. Environmental Protection Agency

For the EPA to adopt a regional sediment management strategy, it must demonstrate that the strategy is consistent with the CWA, the MPRSA, the RHA, and NEPA. It should be possible to develop a MOA for the strategy to be employed by the various regulatory agencies, outlining the permitting procedures to be applied within the context of existing regulations. The EPA could work jointly with the USACE to develop an Environmental Assessment (EA) or EIS for this process. In signing the MOA, the Regional Administrator would indicate the agency's commitment to implement this plan.

The EPA could coordinate activities to work simultaneously with the USACE, thus completing tasks on the same schedule outlined above. If the USACE were to choose to develop a RGP, EPA would review and comment during development of the RGP. If there would be a need to designate a regional confined aquatic disposal (CAD) site as part of the strategy, EPA might be the agency responsible for completing the designation process, which could require a total of four to five years.

10.5 Local Agencies

The adoption and implementation of the Long-Term Management Strategy would affect several local agencies, such as the Port of Los Angeles (POLA), POLB, the City of Long Beach and the County of Los Angeles. The strategy could be more effective if it also were adopted at the local level by the appropriate agencies.

The CCC already has certified a Port Master Plan (PMP) for the POLA and one for the POLB. These plans identify land and water uses within the port boundaries and delegate coastal development permit responsibility to the Ports. Each port could choose to amend its plan, seeking to incorporate the provisions of the Long-Term Management Strategy. These amendments could be approved by the CCC at the same time that it considers approval of the strategy itself, or the amendments could be considered at a separate meeting following adoption of the strategy. Although the ports may amend their certified PMPs, no amendment may take effect until the CCC certifies the amendment. Alternatively, the Ports may choose to adopt the recommendations of the CSTF without amending their PMPs. In this case, each Port could ask its Board of Harbor Commissioners to adopt a resolution supporting implementation of the provisions of the Long-Term Management Strategy.

The CCC already has certified a Local Coastal Program (LCP) for the City of Long Beach and County of Los Angeles. This program consists of a land-use plan and implementing ordinances. The City or the County might choose to amend its LCP to include the provisions of the Long-Term Management Strategy. Once the local councils have approved the amended LCPs, they would be submitted to the CCC for certification.

Under the Coastal Act, local agencies would be required to adopt amendments to the PMPs and LCP if those agencies agreed under the strategy to impose requirements or establish policies to be implemented in the coastal zone. To the extent that the strategy might not include polices or requirements to be implemented by the ports or city, then the agencies would not need to amend the PMPs or LCP. Instead, the agencies could develop resolutions that would be adopted by the agencies' respective boards. These resolutions could serve as a mechanism to demonstrate support for the strategy.

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