U.S. Army Corps
of Engineers

Los Angeles District

LOS ANGELES REGIONAL DREDGED MATERIAL MANAGEMENT PLAN
FEASIBILITY STUDY

BASELINE CONDITIONS (F3) REPORT

U.S. Army Corps of Engineers
Los Angeles District
915 Wilshire Boulevard
Los Angeles, California 90017

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ARSSS	Anchorage Road Soil Storage Site
B/C	benefit-cost
B.P.	Before Present
Basin Plan	Water Quality Control Plan
BLS	U.S. Bureau of Labor Statistics
BMPs	Best Management Practices
BPTCP	Bay Protection and Toxic Cleanup Program
CAD	Confined aquatic disposal
CCC	California Coastal Commission
CDF	confined disposal facility
CDFG	California Department of Fish and Game
CEQA	California Environmental Quality Act
cm	centimeters
CWA	Clean Water Act
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
CZMA	Coastal Zone Management Act
DDT	Dichlorodiphenyltrichloroethane
DMMP	Dredged Material Management Plan
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ENSO	El Nino Southern Oscillation
EPA	U.S. Environmental Protection Agency
ER-L	effects range-low
ER-M	effects range-median
ERDC	Engineering Research Development Center
ESA	Endangered Species Act
FS	Feasibility Study
FWCA	Fish and Wildlife Coordination Act
FWS	U.S. Department of Interior Fish and Wildlife Service
FY	fiscal year
HAVE	hot air vapor extraction
HEP	Harbors Environmental Projects
ITM	Inland Testing Manual
IWR	Institute for Water Resources
kg/cm^2	kilograms per square centimeter
kmh	kilometers per hour
LACDPW	Los Angeles County Department of Public Works
LAEDC	Los Angeles County Economic Development Corporation

LARE	Los Angeles River Estuary
LARWQCB	Los Angeles Regional Water Quality Control Board
m^3	cubic meters
m^3/yr	cubic meters per year
MCL	Maximum Contaminant Levels
MEC	MEC Analytical Systems
µg/kg	micrograms per kilogram
mg/kg	milligrams per kilogram
mg/L	milligrams per Liter
mgC/hr/m^2	milligrams of carbon per hour per square meter
MHW	mean high water
MHHW	mean higher high water
MLW	mean low water
MLLW	mean lower low water
MOU	Memorandum of Understanding
MPRSA	Marine Protection, Research, and Sanctuaries Act
mps	meters per second
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MSL	Mean Sea Level
NAVD	North American Vertical Datum
NCDC	National Climatic Data Center
NED	National Economic Development
NEIBP	North Energy Island Borrow Pit
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPS	Non-Point Source
NTDE	National Tidal Datum Epoch
NWS	National Weather Service
P&G	Principles and Guidelines
PAH	Polycyclic Aromatic Hydrocarbon
PCBs	Polychlorinated Biphenyls
PE	Polyethylene
PET	Polyester
POLB	Port of Long Beach
POLA	Port of Los Angeles
PMP	Project Management Plan
PP	Polypropylene

PSDDA SL	Puget Sound Dredged Disposal Analysis screen levels
PST	Pacific Standard Time
REC-1	Recreational activities involving body contact with water
Region	Los Angeles Region
RHA	Rivers and Harbors Act
RSM	Regional Sediment Management
RTK	Real Time Kinematic
SAA	Streambed Alteration Agreement
SB673	Senator Karnette Bill
SCCWRP	Southern California Coastal Water Research Project
sec	seconds
SMBRC	Santa Monica Bay Restoration Commission
SMBRP	Santa Monica Bay Restoration Project
SMMP	Site Maintenance and Monitoring Program
SPLP	Synthetic Precipitation Leaching Procedure
STLC	Soluble Threshold Limit Concentrations
SUSMP	Standard Urban Storm Water Mitigation Plan
SVOA	semi-volatile organic concentrations
SWH	Shallow water habitat
SWRCB	State Water Resources Control Board
TDS	total dissolved solids
TEUs	20-foot equivalent units
TMDLs	Total Maximum Daily Loads
TOC	total organic carbon
TSR	treatment, storage, and reprocessing
USACE	U.S. Army Corps of Engineers, Los Angeles District
UTM	Upland Testing Manual
WDR	Waste Discharge Requirement
WMA	Water Management Area
WMI	Watershed Management Initiative
WET	Waste Extraction Test
WRCC	Western Regional Climate Center

1 INTRODUCTION

1.1 Study Authority

Preparation of the Los Angeles Regional Dredged Material Management Plan (DMMP) Feasibility Study (FS) is authorized under the Water Resources Development Act of 1986 and the Energy and Water Development Appropriations Act for 2000, Public Law 106-60, 29 September 1999, which reads as follows:

The Committee recommendation includes funds for the Corps of Engineers to conduct a reconnaissance study of a regional dredged material management plan for contaminated sediments in Los Angeles, California.

1.2 Local Sponsorship

Non-federal sponsors for the DMMP FS include the County of Los Angeles (County), City of Long Beach, and the Port of Los Angeles (POLA).

1.3 Study Purpose

The U.S. Army Corps of Engineers, Los Angeles District (USACE) is responsible for maintaining safe navigation of the Marina del Rey harbor entrance and the Los Angeles River Estuary (LARE) through regular maintenance dredging. Portions of the material that need to be dredged at the two locations are contaminated, hence, not suitable for open ocean disposal or beach nourishment. Dredging at these two sites is hampered by a lack of readily available disposal options for the contaminated dredged material. Counties and cities within the Los Angeles Region (Region) also face the same lack of readily available disposal options to fulfill their dredging needs for harbor and marina maintenance.

To solve this problem, the USACE initiated a Reconnaissance Study on March 17, 2000 to determine if there was a federal interest in participating in a detailed Feasibility Study to develop a Regional DMMP and multi-user disposal alternatives. As a result of the Reconnaissance Study, USACE published the Los Angeles Regional DMMP FS Project Management Plan (PMP) in August of 2001, identifying federal interest for conducting this Feasibility (F3) Study.

The purpose of a standard DMMP is to ensure that maintenance dredging activities are performed in an environmentally acceptable manner, use sound engineering techniques, are economically warranted, and sufficient confined disposal facilities are available for at least the next 20 years. A DMMP is usually developed for an individual harbor; however the main objective of this FS is to develop a Regional DMMP for all harbors within the Los Angeles Region that will define a long-term strategy for the management of dredged sediments. Emphasis will be on determining a solution to the management and disposal of contaminated sediments. It is expected that the resultant DMMP will satisfy the requirement for a DMMP for Marina del Rey, Ports of Los Angeles and Long Beach and the City of Long Beach. The primary objective of this DMMP FS is to determine the feasibility and economic justification for implementing a DMMP on a regional basis to achieve the long-term management of dredged material in the Region. The detailed objectives of the FS have been defined in the 905(b) Reconnaissance Report (USACE 2000b). As part of the FS process, the primary purpose of the present study is to define the baseline conditions in the Region within the context of dredged material management under the existing and future without project conditions, identify management problems, formulate plan alternatives to address the problems based on national and planning objectives, and provide a preliminary evaluation of the alternatives. The purpose of this last step is to select Alternative Plans to be carried forward for detailed evaluation in the Feasibility (F4) Evaluation. At that point, additional technical information for each alternative will be presented to assist in completing the detailed evaluation.

1.4 Study Scope

The scope of this report includes a survey and review of prior studies by the USACE and others to describe the physical, chemical, and biological conditions of the Study Area; an evaluation of regional dredging and disposal needs; and a characterization of physical and chemical properties of typical regional dredged materials. In addition, this study formulates alternatives for managing dredged material for the Los Angeles area, performs a preliminary evaluation of the alternatives, and recommends alternatives for further evaluation.

The DMMP FS focuses on the primary dredging sites within the Region including Marina del Rey and King Harbor in Santa Monica Bay; and Los Angeles and Long Beach Harbors, the LARE, and Alamitos Bay in San Pedro Bay. The study uses the results from the assessment of these primary dredging sites as the basis for the formulation and evaluation of management alternatives for the Region.

1.5 Study Process

The present study constitutes the F3 phase of the FS. This study was preceded by a reconnaissance study that identified federal interest and determined the need to proceed with this detailed, cost-shared FS. The final product of this DMMP FS will be a regional management plan that identifies the combination of recommended actions to be undertaken by various partners and stakeholders in order to achieve the objectives of the study. The F3 study provides a description and analysis of the existing and future without-project conditions and proposed alternatives that will form the basis for this plan.

The F3 phase includes a preliminary screening of alternatives to determine the feasibility as part of the recommended plan and consistency with National Economic Development (NED) criteria. The plan alternatives that have the greatest contribution to NED, and are agreed upon by the local sponsor, will be recommended for more detailed evaluation and selection in the subsequent F4 and F5 studies. In addition, a draft Environmental Impact Statement/ Environmental Impact Report (EIS/EIR) will be prepared to address potential environmental impacts of the proposed alternatives to satisfy the environmental review requirements of both the National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA).

The F5 report and draft EIS/EIR will be presented to the public for review. Upon addressing public comments received during the public review period, the Assistant Secretary of the Army for Civil Works (ASA/CW) will sign the Record of Decision, and the FS report will be finalized, which concludes the USACE FS process. At that point, program implementation can occur.

This Los Angeles DMMP FS is different from a typical USACE FS, which normally involves the selection of a single best alternative from a selection of several feasible alternatives, all capable of meeting the defined objective. This study is developed to formulate a strategy for the management of dredged material for the entire Region. Since each dredging project is unique and has its own objective that needs to be met, the best alternative for each dredging project may be very different. In addition, some of the management measures presented may be implementable by organizations other than the USACE.

Because of the unique nature of this study, the Baseline Condition (F3) report presented here is also slightly different from a typical USACE F3 study report. This uniqueness is reflected in the preliminary evaluation of alternatives and the recommendations for alternatives to be moved forward for further detailed evaluation in the F4 study. In addition to recommending “potentially” implementable projects for further evaluation in the F4 study, the F3 study provides the basis for the development of a regional dredged material management program. Details of the evaluation processes and recommendation for the F4 study are provided in Sections 5 and 6. Management recommendations will be formulated to support the goals and objectives of the Los Angeles Regional Contaminated Sediment Task Force, as well as the USACE and its sponsors.

1.6 Public Involvement and Coordination

Public involvement and coordination is used to ensure that the USACE planning process is responsive to the needs and concerns of the public, and to involve all interested parties in the planning decision-making process. Its objectives are: (1) to provide information about USACE activities and proposed actions to the public; (2) make public desires, needs and concerns available to the decision-makers; (3) provide for adequate interaction with the public before decisions are made; and (4) to adequately account for the views of the public in making decisions. However, these purposes and objectives must be achieved within a framework where the USACE cannot relinquish its legislated responsibilities for decision-making.

Public involvement and coordination actions are not only used to inform the public, but also to actively seek public responses in regard to needs, values, ideas for solutions, and reactions to proposed solutions. For the DMMP FS, public involvement and coordination were utilized as a two-way communications process to provide people from diverse backgrounds and interests with multiple opportunities to ask questions and offer suggestions. An initial public meeting was conducted to seek input prior to the initiation of the study, and additional meetings are planned as alternatives are evaluated. Public involvement efforts and coordination also include the consultation with other federal, state and local agencies listed in Section 1.6.1. In addition, the DMMP study team had worked closely with the Contaminated Sediments Task Force (CSTF) throughout the study process. Details about the CSTF activities are provided in Section 1.6.2.

1.6.1 *Consulting Agencies*

Coordination with state and federal consulting agencies regarding the DMMP is a critical step in completing the FS to ensure that the interests and regulations governing each entity are fulfilled with the final product. To date, coordination has occurred with the following agencies:

- U.S. Fish & Wildlife Service (FWS)
- California State Department of Fish & Game (CDFG)
- U.S. Environmental Protection Agency (EPA), Region 9
- Los Angeles Regional Water Quality Control Board (LARWQCB)
- California Coastal Commission (CCC)
- National Oceanic Atmospheric Association (NOAA), Fisheries Group

1.6.2 *Contaminated Sediments Task Force*

In response to a growing problem associated with dredging and disposal of contaminated sediments in the Region, Governor Wilson signed into law Senate Bill SB 673 authored by Senator Betty Karnette of Long Beach on October 12, 1997. This new legislation required the CCC and the LARWQCB to establish a multi-agency CSTF to address issues related to dredging and disposing of contaminated sediments. It also required the CCC and the LARWQCB to actively participate in a Task Force and assist in the preparation of a long-term management strategy for dredging and disposal of contaminated sediments in the Region. The strategy would consider aquatic and upland disposal alternatives, treatment, beneficial reuse, and other management techniques. Additionally, the strategy would include a component focused on the reduction of contaminants at their source.

SB 673 was signed into law as Chapter 897 of the Statutes of 1997. Section 13396.9 was added to the Water Code to incorporate the conditions of Senate Bill 673, the provisions of which are summarized below.

The Karnette Bill (SB 673) added a section to the Water Code that 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 the County;
- Establish and participate in a multi-agency Los Angeles Basin CSTF;

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

- Seek to enter into an agreement with the EPA and 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.

In 1999, a cooperative agreement was established through a Memorandum of Understanding (MOU) to officially form the CSTF. When SB 673 was signed into law, a Task Force already in existence to address the Marina del Rey dredging issues was dissolved and reconvened as a part of the CSTF. The original MOU was amended in 2000 to add additional members and agencies then proceeded to sign both the original agreement and the amendment incorporating the provisions of SB 673. Table 1-1 presents a list of the participants in the CSTF.

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		√	√
U.S. Fish and Wildlife Service		√	

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 consists of the head of the four regulatory agencies responsible for managing dredging activities (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 Subcommittee (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.

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, members of the Planning, Regulatory, and Operations Divisions of the USACE are actively participating 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 is also actively involved in the data interpretation process occurring at the monthly CSTF meetings and leads 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.

1.6.3 *Public Meetings*

There are a variety of meetings that must be effectively utilized in the successful achievement of public involvement/coordination objectives. The most important and visible meetings are the formal public meetings, which are scheduled by directive at the initiation of the feasibility phase study, and near the end of the study as part of the public review of the draft feasibility report and the study findings. Public comment and input are vital to finalizing the feasibility report and completing the study. These meetings include public meetings, open meetings with interest groups, workshops, and any opportunities to distribute information of the study and progress to generate public input.

Prior to initiation of this F3 Baseline Evaluation document, a public scoping meeting was held on February 26, 2003 at the Cesar Chavez Community Center in Long Beach, California. The purpose of the meeting was to gather public input on the scope of the project and to outline a schedule for future activities and public involvement. In addition to the formal public meeting, project updates are provided at the monthly meetings of the DMMP Management Subcommittee, which are also open to the public.

1.7 Prior Studies, Reports, and Existing Federal Projects

1.7.1 *Prior Studies by USACE*

The USACE has extensively studied the Los Angeles Region. A partial list of major studies sorted by geographic location within the Study Area is presented below.

1.7.1.1 Santa Monica Bay General

Santa Monica Breakwater, Los Angeles County, CA, Reconnaissance Report. U.S. Army Corps of Engineers, Los Angeles District. 1989.

Sediment Sources and Sinks in Santa Monica Bay between Point Dume and Marina del Rey. U.S. Army Corps of Engineers, Los Angeles District. 1992.

Feasibility Study for a Capped Dredged Material Disposal Site in Santa Monica Bay. U.S. Army Corps of Engineers, Los Angeles District. 1993.

1.7.1.2 Marina del Rey and Ballona Creek

Marina del Rey and Ballona Creek, California, Final Reconnaissance Report. U.S. Army Corps of Engineers, Los Angeles District. 1995.

Marina del Rey Upland Disposal Alternative for Contaminated Sediments Final Report. U.S. Army Corps of Engineers, Los Angeles District. 1997.

Marina del Rey and Ballona Creek Feasibility Study, Dredged Material Management Plan, Baseline Conditions (F3) Report. U.S. Army Corps of Engineers, Los Angeles District. 1998.

Marina del Rey Shoaling and Disposal Feasibility Study, Draft Final Report. U.S. Army Corps of Engineers, Los Angeles District. 1998.

Marina del Rey and Ballona Creek Feasibility Study Dredged Material Management Plan Alternatives Analysis and Report Final Draft Submittal Engineering Alternatives Analysis and Report. U.S. Army Corps of Engineers, Los Angeles District. Prepared by Moffatt & Nichol Engineers. 1999.

Marina del Rey and Ballona Creek Feasibility Study, Sediment Transport Analysis and Report. U.S. Army Corps of Engineers, Los Angeles District. 1999.

Sediment Sampling Results, Ballona Creek Sediment Contaminant Source Study. U.S. Army Corps of Engineers, Los Angeles District. 1999.

Marina del Rey and Ballona Creek Feasibility Study, Dredged Material Management Plan Alternative Analysis (F4) Report. U.S. Army Corps of Engineers, Los Angeles District and County of Los Angeles. 2000.

Marina del Rey and Ballona Creek Watershed, California, Economic Feasibility Report. U.S. Army Corps of Engineers, Los Angeles District. 2000.

Ballona Creek Sediment Study Phase I Report. U.S. Army Corps of Engineers, Los Angeles District. Prepared by CH2M Hill. 2001.

Marina del Rey and Ballona Creek Feasibility Study, Ballona Creek Sediment Basin Study Hydrology and Hydraulics Appendix (Draft). U.S. Army Corps of Engineers, Los Angeles District. 2001.

Lower Ballona Creek Restoration Los Angeles County, California 905(b) Reconnaissance Report. U.S. Army Corps of Engineers, Los Angeles District. 2002.

Preliminary Draft EIR/EIS for the Ballona Creek Sediment Control Management Plan. U.S. Army Corps of Engineers, Los Angeles District. Prepared by Chambers Group. 2002.

Draft EIR/EIS for the Balllona Creek Sediment Control Management Plan. U.S. Army Corps of Engineers, Los Angeles District. 2003.

Marina del Rey and Ballona Creek Feasibility Study, Sediment Control Management Plan, Final Draft Feasibility (F4) Report. U.S. Army Corps of Engineers, Los Angeles District. 2003.

1.7.1.3 King Harbor

Storm Damage Reduction Feasibility Report – Technical Report: Redondo Beach – King Harbor Area, CA. U.S. Army Corps of Engineers, Los Angeles District. 1988.

King Harbor, Redondo Beach, California, Breakwater Stability Study: Hydraulic Model Investigation. CERC-90-7. U.S. Army Engineer Waterways Experiment Station. Prepared for the U.S. Army Corps of Engineers, Los Angeles District. 1990.

Redondo Beach King Harbor, California, Development of Design Data for Harbor Improvements: Coastal Model Investigation. CERC-90-6. U.S. Army Engineer Waterways Experiment Station. Prepared for the City of Redondo Beach. 1990.

Redondo Beach King Harbor, California, Design for Wave Protection: Coastal Model Investigation. CERC-90-4. U.S. Army Engineer Waterways Experiment Station. Prepared for the U.S. Army Corps of Engineers, Los Angeles District. 1990.

1.7.1.4 San Pedro Bay General

Numerical Analysis of Harbor Resonance Response in East Channel, Los Angeles: Final Report. HL-81-3. Hydraulics Laboratory, U.S. Army Engineer Waterways Experiment Station. 1981.

Los Angeles – Long Beach Harbors Draft Feasibility Report for Channel Improvements. U.S. Army Corps of Engineers, Los Angeles District. 1984.

Los Angeles and Long Beach Harbors Model Study: Numerical Analysis of Tidal Circulation for the 2020 Master Plan. CERC-84-5. U.S. Army Corps of Engineers, Los Angeles District. 1984.

Los Angeles – Long Beach Harbor Complex 2020 Plan Harbor Resonance Analysis: Numerical Model Investigation. CERC-89-16. U.S. Army Engineer Waterways Experiment Station. Prepared for the U.S. Army Corps of Engineers, Los Angeles District. 1989.

Los Angeles and Long Beach Harbors Model Enhancement Program: Tidal Circulation Prototype Data Collection Effort, Vol. I, II and III. CERC-89-17. U.S. Army Engineer Waterways Experiment Station. 1989.

Wave Conditions for Proposed Harbor Development in Los Angeles Outer Harbor, Los Angeles, California. CERC-89-13. U.S. Army Engineer Waterways Experiment Station. Prepared for U.S. Army Corps of Engineers, Los Angeles District and Port of Los Angeles, Harbor Department. 1989.

Los Angeles and Long Beach Harbors Model Enhancement Program: Numerical Water Quality Model Study of Harbor Enhancements. EL-90-6. U.S. Army Engineer Waterways Experiment Station. Prepared for U.S. Army Corps of Engineers, Los Angeles District and Port of Los Angeles and Long Beach. 1990.

Los Angeles and Long Beach Harbors Model Enhancement Program, Numerical Modeling of Tidal Circulation and Water Quality. CERC-90-16. U.S. Army Engineer Waterways Experiment Station. 1990.

Los Angeles and Long Beach Harbors Additional Plan Testing, Numerical Modeling of Tidal Circulation and Water Quality. CERC-91-2. U.S. Army Engineer Waterways Experiment Station. Prepared for U.S. Army Corps of Engineers, Los Angeles District and Port of Los Angeles and Long Beach. 1991.

Los Angeles and Long Beach Harbors Model Enhancement Program: Measured Response of Moored Ships to Long-Period Waves. CERC-91-12. U.S. Army Engineer Waterways Experiment Station. Prepared for U.S. Army Corps of Engineers, Los Angeles District and Port of Los Angeles and Long Beach. 1991.

Wave Conditions for Proposed Harbor Development in Los Angeles Outer Harbor, Los Angeles, California, Supplemental Tests: Coastal Model Investigation. CERC-94-4. U.S. Army Engineer Waterways Experiment Station. Prepared for U.S. Army Corps of Engineers, Los Angeles District and Port of Los Angeles, Harbor Department. 1991.

Deep Draft Navigation Improvements, Los Angeles and Long Beach Harbors San Pedro Bay, California, Final Feasibility Report. U.S. Army Corps of Engineers, Los Angeles District. 1992.

Wave Conditions for Two Phases of Harbor Development in Los Angeles Outer Harbor, Los Angeles, California: Coastal Model Investigation. CERC-92-6. U.S. Army Engineer Waterways Experiment Station. Prepared for U.S. Army Corps of Engineers, Los Angeles District and Port of Los Angeles, Harbor Department. 1992.

Los Angeles and Long Beach Harbors Model Enhancement Program: Improved Physical Model Harbor Resonance Methodology. CERC-93-17. U.S. Army Engineer Waterways Experiment Station. Prepared for U.S. Army Corps of Engineers, Los Angeles District and Port of Long Beach. 1993.

Los Angeles and Long Beach Harbors Model Enhancement Program: Effects of Wind on Circulation in Los Angeles-Long Beach Harbors. CERC-94-7. U.S. Army Engineer Waterways Experiment Station. Prepared for U.S. Army Corps of Engineers, Los Angeles District and Port of Los Angeles and Long Beach. 1994.

Ship Navigation Simulation Study, Los Angeles Harbor, Los Angeles, California. HL-94-16. U.S. Army Engineer Waterways Experiment Station. Prepared for the U.S. Army Corps of Engineers, Los Angeles District. 1994.

Los Angeles Harbor Pier 400 Harbor Resonance Model Study. CERC-95-8. U.S. Army Engineer Waterways Experiment Station. Prepared for the U.S. Army Corps of Engineers, Los Angeles District. 1995.

Los Angeles and Long Beach Harbors: Physical Model Study for Harbor Resonance of the Operations, Facilities, and Infrastructure, Scheme B, 2020 Plan. CERC-95-15. U.S. Army Engineer Waterways Experiment Station. Prepared for the Port of Los Angeles and Long Beach. 1995.

Numerical Hydrodynamic Modeling in Support of Water Quality and Ship Simulation Models in Los Angeles Harbor. CERC-95-1. U.S. Army Engineer Waterways Experiment Station. Prepared for the U.S. Army Corps of Engineers, Los Angeles District. 1995.

Numerical Water Quality Model Study for the Los Angeles Harbor Pier 400 Project. EL-95-1. U.S. Army Engineer Waterways Experiment Station. Prepared for the U.S. Army Corps of Engineers, Los Angeles District. 1995.

Port of Long Beach Main Channel Deepening, Final Feasibility Study. U.S. Army Corps of Engineers, Los Angeles District. 1995.

Comprehensive Condition Survey for San Pedro Breakwater, Los Angeles Harbor, Los Angeles County, CA. U.S. Army Corps of Engineers, Los Angeles District. 1996.

The Ports of Long Beach, Los Angeles, and Port Hueneme, California. Port Series No. 28. Navigation Data Center. 1996.

Long Beach Harbor Sediment Study. U.S. Army Corps of Engineers, Los Angeles District. 1998.
Los Angeles and Long Beach Harbors Model Enhancement Program: Prototype Wave Data Summary. CHL-98-21. U.S. Army Engineer Waterways Experiment Station. 1998.

MDFATE Modeling of Contaminated Sediment and Cap Placement in the Eastern Section of the North Energy Island Borrow Pit. U.S. Army Engineer Waterways Experiment Station. 1998.

Joint SEIS/SEIR for the Port of Los Angeles Channel Deepening Project Feasibility Study. U.S. Army Corps of Engineers, Los Angeles District. 2000.

Long Beach North Energy Island Borrow Pit (NEIBP) Capping Pilot Study. U.S. Army Corps of Engineers, Los Angeles District. 2001.

1.7.1.5 Los Angeles River Estuary

Technical Evaluation of Environmental Impact Potential for Proposed Ocean Disposal of Dredged Material from the Mouth of the Los Angeles River, Los Angeles County, California. U.S. Army Corps of Engineers, Los Angeles District. 1988.

Los Angeles River Estuary Navigation Channel Alternatives. Prepared for U.S. Army Corps of Engineers, Los Angeles District. Prepared by Moffatt & Nichol Engineers. 1996.

Los Angeles River Estuary Borrow Pit Sedimentation Study, Final Report. U.S. Army Corps of Engineers, Los Angeles District. 1999.

Draft Environmental Assessment Los Angeles River Estuary Pilot Study Los Angeles County Regional Dredge Material Management Plan Pilot Studies. U.S. Army Corps of Engineers, Los Angeles District. Prepared by Anchor Environmental. 2001.

Results of Physical and Chemical Testing of Sediments Proposed for Dredging in the Los Angeles River Estuary. U.S. Army Corps of Engineers, Los Angeles District. 2001.

1.7.1.6 Southern California Regional

The Source Transportation and Deposition of Beach Sediments in Southern California. Technical Memo. 22. U.S. Army Corps of Engineers, Beach Erosion Board. 1951.

Cooperative Research and Data Collection Program, Coast of Southern California. U.S. Army Corps of Engineers, Los Angeles District. 1970.

Hydrologic Data Inventory Southern California Coastal Zone Ragged Point (San Luis Obispo County) to Mexican Border. Coastal of California Storm and Tidal Wave Study. U.S. Army Corps of Engineers, Los Angeles District. 1985.

Oral History of Coastal Engineering Activities in Southern California 1930-1980. U.S. Army Corps of Engineers, Los Angeles District. 1986.

Draft Environmental Impact Statement for LA-3 Dredged Material Ocean Disposal Site Designation. U.S. Army Corps of Engineers, Los Angeles District. 1990.

Plan of Action Study for LA-3 Dredged Material Ocean Disposal Site. U.S. Army Corps of Engineers, Los Angeles District. 2000.

Los Angeles County Regional Dredged Material Management Plan Pilot Studies, Los Angeles County, California, Evaluation Report. U.S. Army Corps of Engineers, Los Angeles District. 2002.

Los Angeles County Regional Dredged Material Management Plan Pilot Studies, Los Angeles County, California, Evaluation Report, Appendix A, Evaluation of Aquatic Capping Alternative. U.S. Army Corps of Engineers, Los Angeles District. 2002.

Los Angeles County Regional Dredged Material Management Plan Pilot Studies, Los Angeles County, California, Evaluation Report, Appendix B1, Cement-Based Stabilization of Dredged Material Bench Study. U.S. Army Corps of Engineers, Los Angeles District. 2002.

Los Angeles County Regional Dredged Material Management Plan Pilot Studies, Los Angeles County, California, Evaluation Report, Appendix B2, Evaluation of Cement Stabilization Alternative. U.S. Army Corps of Engineers, Los Angeles District. 2002.

Los Angeles County Regional Dredged Material Management Plan Pilot Studies, Los Angeles County, California, Evaluation Report, Appendix C, Evaluation of Sediment Washing Alternative. U.S. Army Corps of Engineers, Los Angeles District. 2002.

Los Angeles County Regional Dredged Material Management Plan Pilot Studies, Los Angeles County, California, Evaluation Report, Appendix D, Evaluation of Sediment Blending Alternative. U.S. Army Corps of Engineers, Los Angeles District. 2002.

Zone of Siting Feasibility Study, Draft Report. U.S. Army Corps of Engineers, Los Angeles District. 2003.

1.7.2 *Prior Studies by Others*

A partial list of major studies conducted by other federal, state and city government and agencies is presented below.

1.7.2.1 Santa Monica Bay General

Santa Monica Pier Reconstruction Feasibility Project – Phase I: Feasibility Analysis. DMJM. 1984.

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1.7.3 *Existing Federal Projects*

Existing federal navigation projects in the Region include the Marina del Rey jetties, breakwater and navigation channels, King Harbor breakwaters, Los Angeles/Long Beach Harbor Federal Breakwaters and navigation channels, and the LARE navigation channel. The USACE is also participating in the on-going Port of Los Angeles Channel Deepening Project that will increase the current channel depth of 13.7 meters mean lower low (MLLW) to 16.2 meters MLLW. Other relevant projects associated with sediment issues in the Region include the California Coastal Sediments Master Plan and Regional Sediment Management (RSM) Plan. The RSM was implemented to develop methodologies and protocols to address and abate site-specific shoreline erosion problems at regional scale.

2 DESCRIPTION OF STUDY AREA

2.1 Study Area

The area of the Los Angeles Basin for which the Los Angeles District Corps of Engineers (USACE) Dredge Material Management Plan (DMMP) Feasibility Study (FS) is focused is located along the coastal waters of Los Angeles County (County). This area extends, generally, from Santa Monica Bay to the north down to San Pedro Bay to the south. Specific management areas for the DMMP FS include Marina del Rey and the mouth of Ballona Creek , King Harbor, the Port of Los Angeles (POLA) and Port of Long Beach (POLB), the mouth of the Los Angeles River Estuary (LARE), and Alamitos Bay (Figure 2-1). Each of these areas has a unique geographic setting, as described below.

2.1.1 *Santa Monica Bay*

Santa Monica Bay is an open coastal embayment situated on the western coastline of the County. The bay is bounded on the west by the Santa Monica Basin in the Pacific Ocean, north by Point Dume, south by the Palos Verdes Peninsula and Redondo Submarine Canyon, and shoreward by the Los Angeles Coastal Plain to the east and Santa Monica Mountains to the north. Marina del Rey and King Harbor are major small craft harbors located on the mid-, and southern coast of Santa Monica Bay. Ballona Creek enters Santa Monica Bay adjacent to the entrance channel of Marina del Rey. These three locations represent ongoing sources of sediment to this portion of the Study Area. The Santa Monica Bay and harbors system supports extensive commercial and recreational use including commercial and recreational boating and fishing, surfing, swimming, and beach recreational activities.

2.1.1.1 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 2-2). In the past three decades, the harbor has become one of the largest man-made recreational boat harbors in the world with over 6,000 slips available for private boaters commercial fishing vessels, and Coast Guard 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. The Marina del Rey harbor is operated and maintained by the Los Angeles County Department of Beaches and Harbors. Navigation within the approach and entrance channels is maintained by USACE.

2.1.1.2 Ballona Creek

Originally a natural, meandering waterway draining runoff from the hills north of Hollywood and the West Los Angeles Basin, Ballona Creek was channelized and lined with concrete in 1935 by the USACE as a flood control measure and now discharges parallel to the entrance channel jetties of Marina del Rey (Figure 2-2). 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.

Figure 2-1
Los Angeles Regional DMMP Feasibility Study Area

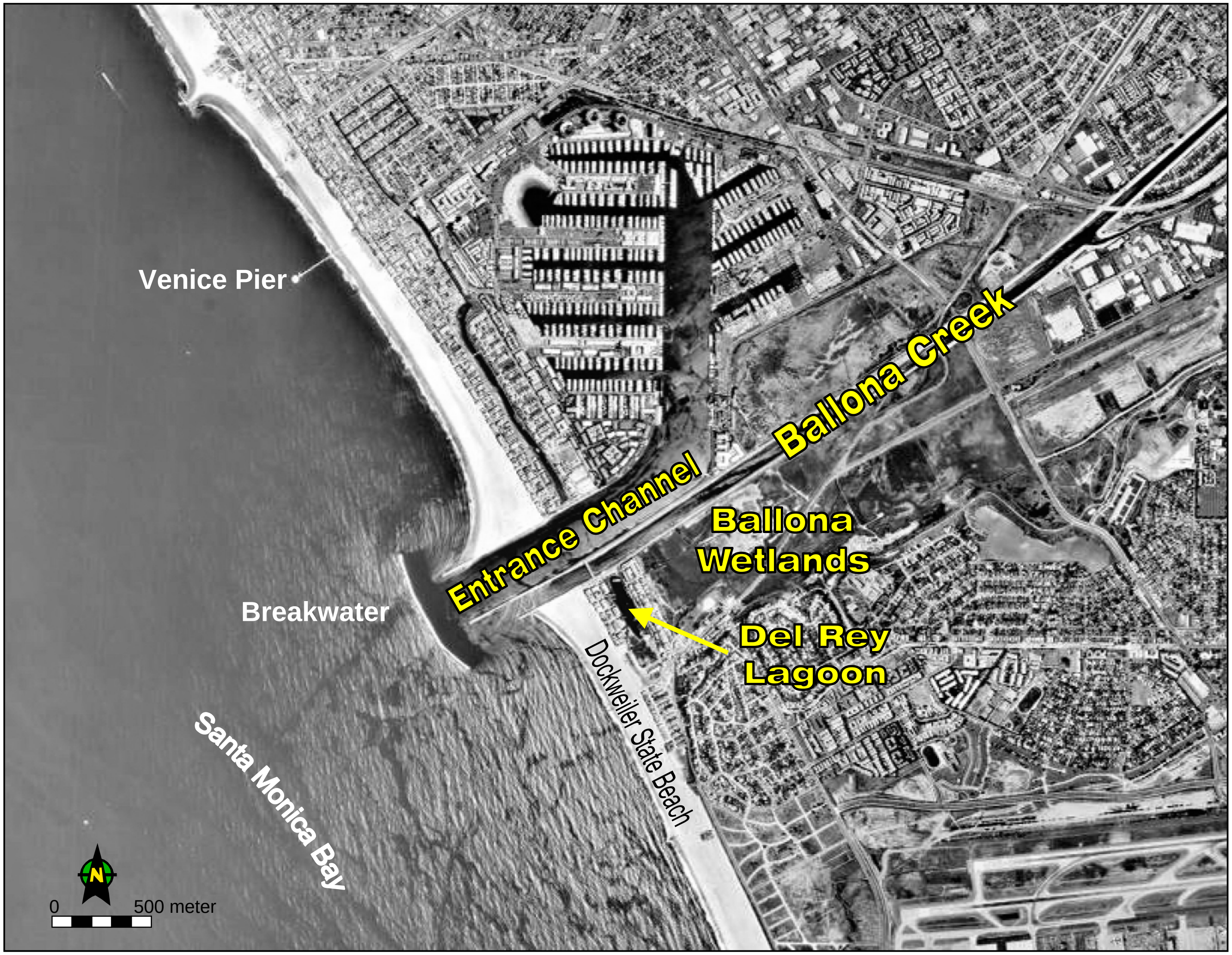

Figure 2-2
Marina del Rey and Ballona Creek

During winter storm events, significant quantities of sediment are transported down Ballona Creek, where they are trapped behind the breakwater constructed to protect the Marina del Rey harbor instead of flowing into Santa Monica Bay.

Operation and maintenance of the flood control channel are partitioned between the USACE and Los Angeles County Department of Public Works (LACDPW). USACE has jurisdiction between Washington Boulevard to La Salle Avenue and Vista del Mar to the Pacific Ocean and LACDPW has jurisdiction over the remainder of the channel. In the portion under its jurisdiction, USACE is responsible for maintenance activities required to maintain the function and structural performance of the flood control channel. Other maintenance activities involving aesthetics, water quality, and vector control are performed by LACDPW and Culver City. USACE also has the jurisdiction to review and approve proposed improvements or alterations to the Ballona Creek flood control channel to ensure there will not be any adverse effects of flood control channel functions. LACDPW may review and approve proposed improvements or alterations to the Ballona Creek flood control channel within the LACDPW jurisdiction reaches.

2.1.1.3 King Harbor

Redondo Beach − King Harbor is a small craft harbor occupying approximately 60.7 hectares of land and water at the southern end of Santa Monica Bay. King Harbor is about 27.4 kilometers southwest of the business center of the City of Los Angeles and about 11.3 kilometers south of the Los Angeles Airport (Figure 2-3). It has been an active harbor since the early 1900s when it was a commercial port. After the POLA became fully operational, Redondo Beach − King Harbor became focused on pleasure craft and fishing boats. The harbor extends approximately 1,219 meters along the coast and is roughly 610 meters wide at the widest point.

The City of Redondo Beach is responsible for maintenance of the interior harbor that includes the three boat basins and the wave protection baffles at the entrances to Basins 1 and 2, built by the federal government. As part of its Operations and Maintenance Program, USACE is responsible for maintenance of the breakwaters.

2.1.2 *San Pedro Bay*

San Pedro Bay is an open coastal embayment situated on the southern coast of the County. The bay is bounded by Point Fermin on the west, San Pedro Basin on the southwest, Newport Submarine Canyon on the south, and the coastal plain from San Pedro to Newport Beach along the coast.

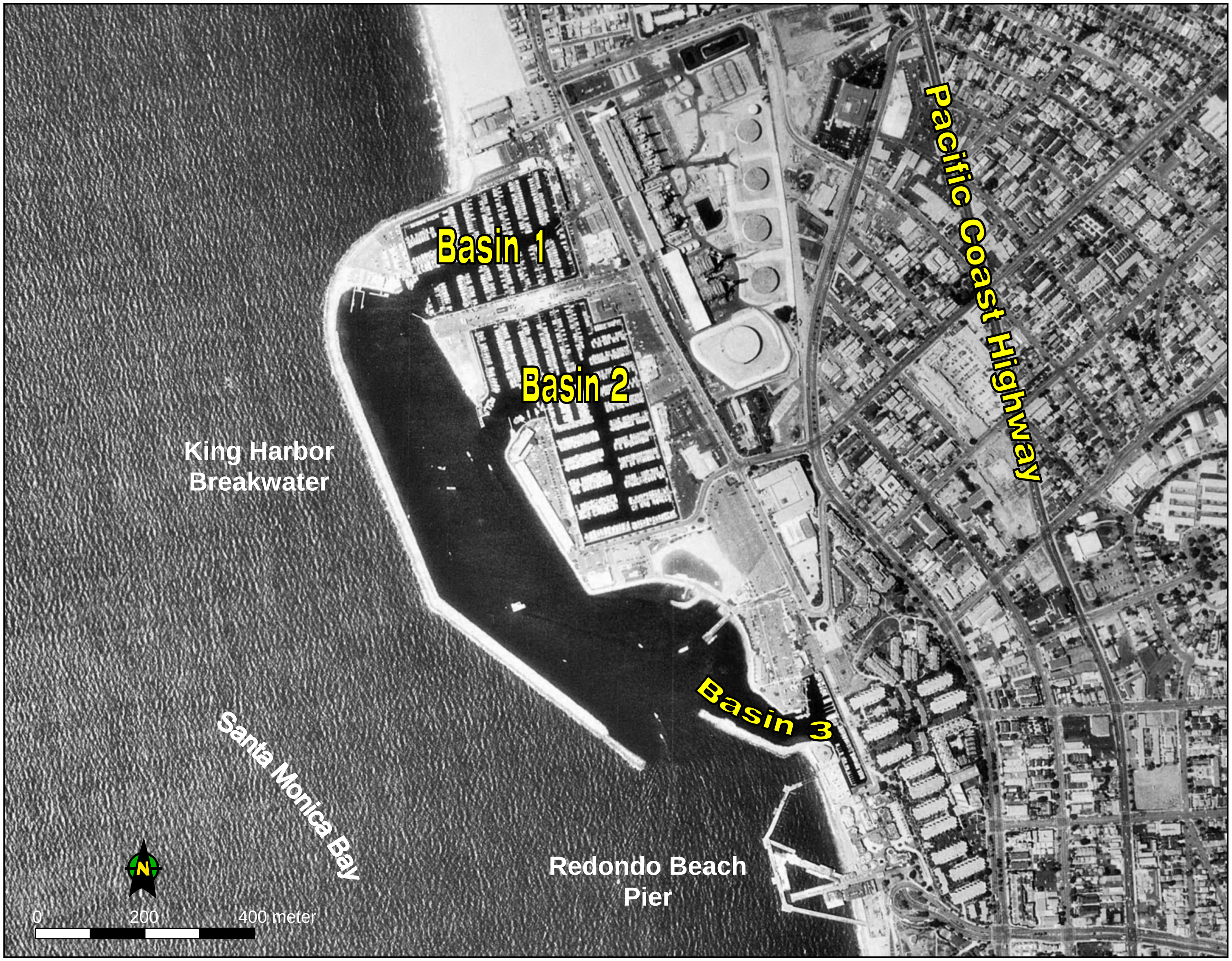

Figure 2-3
Redondo Beach - King Harbor

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. 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. An aerial view for the two Ports is shown in Figure 2-4. Port development grew rapidly and by 1912 the first section of the breakwater was constructed and the main shipping channel was dredged to a depth of 9 meters to accommodate the largest vessels of that era. Sediment input into San Pedro Bay occurs via two main upland sources: the Dominquez Channel and the Los Angeles River. 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.

The Dominquez Channel, previously known as the Dominquez Slough, drains an approximately 259 square kilometers watershed located in southern Los Angeles County. Like all of the other waterways in the Los Angeles Basin, most of the Dominguez Slough was channelized in the mid 1900s in an effort to provide flood protection to the County area.

2.1.3 *Los Angeles River Estuary*

The LARE is located at the mouth of the Los Angeles River in Long Beach (Figure 2-5). Queensway Marina, Rainbow Harbor/Marina, and Shoreline Marina are located in the LARE and operated by the City of Long Beach. These facilities serve primarily recreational boating and cruise ships to Catalina Island.

The Los Angeles River Watershed covers a land area of over 2,135 square kilometers (834 square miles) from the eastern portions of Santa Monica Mountains, and Simi Hills, and Santa Susana Mountains to the San Gabriel Mountains in the west. The watershed encompasses and is shaped by the path of the Los Angeles River, which flows from its headwaters in the mountains eastward to the northern corner of Griffith Park where the channel turns southward through the Glendale Narrows before it flows across the coastal plain and into San Pedro Bay near Long Beach. The Los Angeles River Watershed has diverse patterns of land use. The upper portion of the watershed, 920 square kilometers (approximately 360 square miles), is covered by forest or open space, while the remaining watershed, 1,215 square kilometers (approximate 474 square miles), is highly developed with commercial, industrial, or residential uses.

There are eight major tributaries to the Los Angeles River as it flows from its headwaters to the Pacific Ocean. The major tributaries of the Los Angeles River include Burbank Western Channel, Pacoima Wash, Tujunga Wash, and Verdugo Wash in the San Fernando Valley; and the Arroyo Seco, Compton Creek, and Rio Hondo south of the Glendale Narrows. The Los Angeles River Watershed has 22 water bodies within its boundaries including Devil Gates Dam, Hansen Basin, Lopez Dam, Pacoima Dam, and Sepulveda Basin. In addition, there are a number of spreading grounds in the watershed including sites at Dominguez Gap, the Headworks, Hansen Dam, Lopez Dam, and Pacoima Dam. The Rio Hondo, a tributary to the Los Angeles River is hydraulically connected to the San Gabriel River through the Whittier Narrows Reservoir during large storm events.

Figure 2-4
San Pedro Bay
Port of Los Angeles, Port of Long Beach, and Alamitos Bay

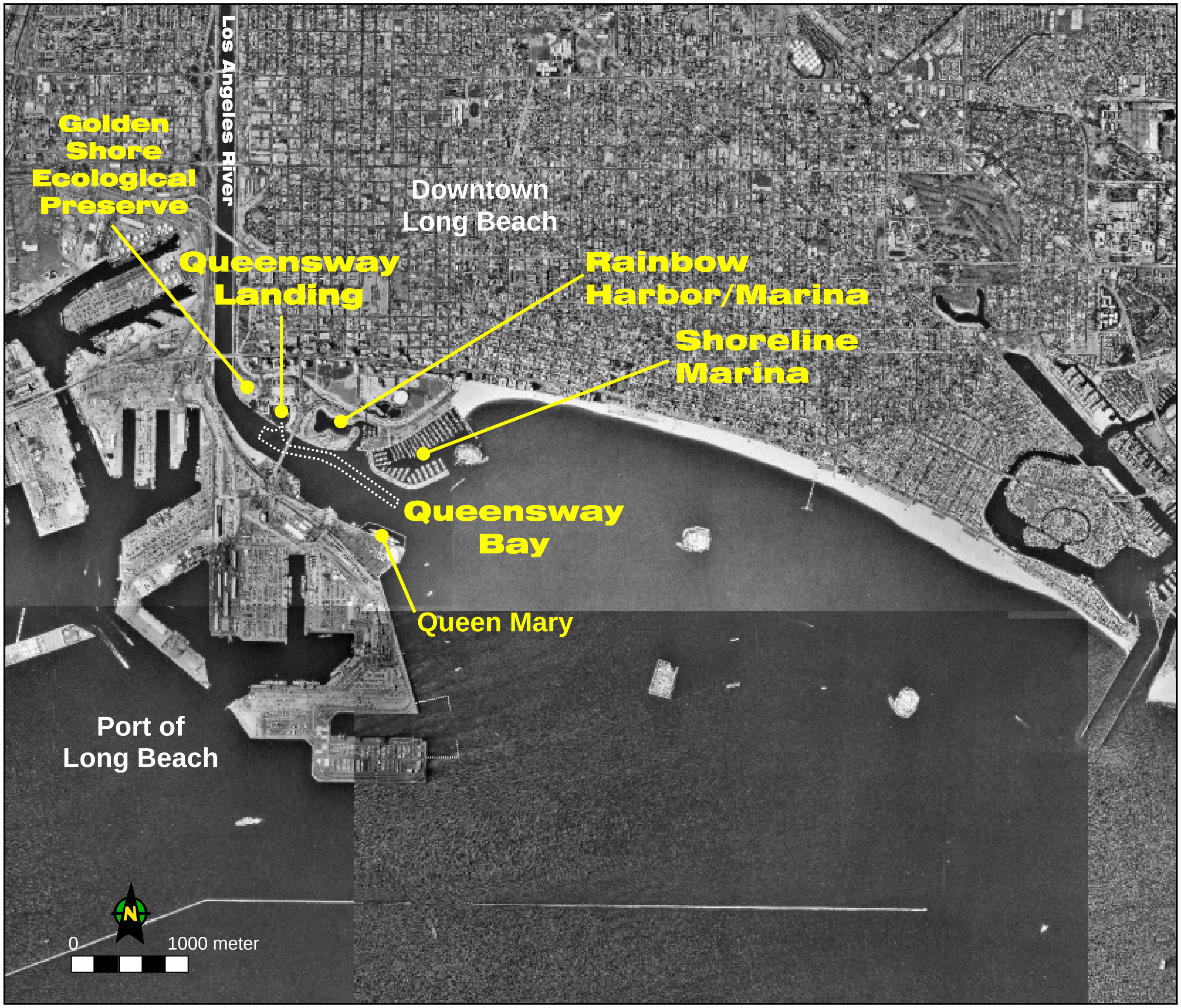

Figure 2-5
Los Angeles River Estuary

The Los Angeles River, which once flowed freely over the coastal plain, was channelized between 1914 and 1970 to control the runoff and reduce the impacts of major flood events in the Los Angeles Region (Region). Today, the Los Angeles River is lined on 77 km (47.9 miles) of its 82 km (51 miles) length. There are three stretches where the channel bottom is not lined with concrete reinforcement. They are:

- Within the Sepulveda Flood Control Basin
- Through the Glendale Narrows
- South of Willow Street in Long Beach

The Los Angeles River, along most of its course, had intermittent flow during much of the year prior to channelization. In addition, many of its tributaries did not reach the river except during storm events. The current flow in the river is effluent dominated with approximately 80 percent of its flow originating at dischargers and the remaining flow coming from storm drain runoff and groundwater reaching the surface (LACDPW 2003).

2.1.4 *Alamitos Bay*

Alamitos Bay is located just southeast of the Los Angeles/Long Beach Harbor Complex in Naples/Belmont Shores (Figure 2-4). 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 island of Naples, Marine Stadium that was built for the 1932 Olympic rowing competition, and the Los Cerritos Channel. Recreational activities include sailing, motor boating, 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.

2.2 Physical Setting

2.2.1 *Bathymetry*

The present bathymetric characteristics of the Study Area reflect the geological movement of the Pacific tectonic plate against the North American tectonic plate along the San Andreas Fault, which historically resulted in the formation of offshore islands and banks through block-faulting. A three-dimensional rendering of the bathymetric setting of the Study Area is shown in Figure 2-6.

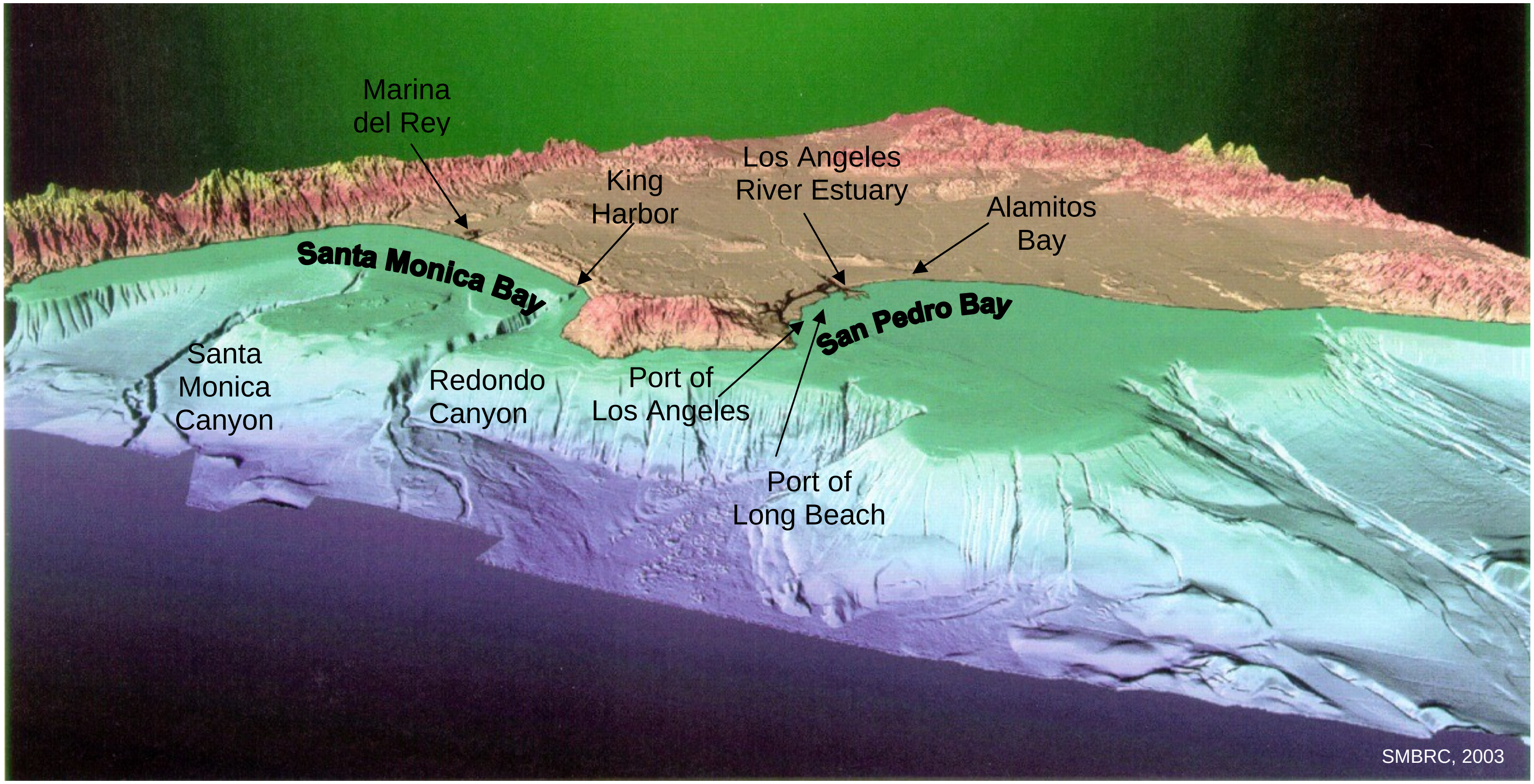

Figure 2-6
Study Area Bathymetry Setting

Santa Monica Bay is characterized by a gently sloping continental shelf that extends seaward to the shelf break at a water depth of approximately 82 meters. At the break, the seafloor becomes steep along the continental slope but then flattens again as the floor of the deep Santa Monica Basin is approached in approximately 792 meters of water (Terry et al. 1956). Two submarine canyons (Santa Monica and Redondo Canyons) cut into the shelf and bracket a distinct, flat offshore bank on the shelf. Bathymetry within Marina del Rey and at the mouth of Ballona Creek is presented in Figure 2-7. Areas of shoaling which require frequent removal occur just behind the breakwater and at the end of the southern jetty. Bathymetry for the entrance to King Harbor is presented in Figure 2-8. While the USACE does not maintain a federal channel at King Harbor, occasional dredging may be needed to maintain navigable water depths to the marina.

San Pedro Bay consists primarily of the Los Angeles/Long Beach harbor complex and a relatively flat, wide shelf offshore of the harbor complex. The harbor complex consists of the POLB in the east and POLA in the west. The bathymetry in the harbor complex features navigation channels that lead to basins and slips in the inner harbors, depressions and islands created from industrial operations, and an open water habitat constructed in the Los Angeles Outer Harbor as part of the Pier 400 expansion. The bathymetry within the harbor complex has undergone continuous modifications due to the development of the Ports, which has involved a series of dredge-and-fill operations to deepen the channels so as to accommodate deep-draft vessels and to provide fill for additional land areas for terminal development. Bathymetry data for the POLA is presented in Figure 2-9 and for the POLB in Figure 2-10.

The LARE leads the Los Angeles River into San Pedro Bay and contains a regularly maintained navigation channel connecting San Pedro Bay with Queensway Marina. The depth of the estuary ranges from approximately -7 meters mean lower low water (MLLW) at the ocean to approximately +3 meters MLLW at the terminus of tidal influence near Willow Street.

2.2.2 *Geology*

Many geologic features of the area are resulted from block-faulting − a geological process in which large blocks of the Earth's crust are thrown upwards or downwards, with offshore islands and banks representing up-thrown blocks and basins down-thrown ones. One of the primary geological features in the area is the checkerboard pattern of submarine canyons and basins across the Pacific margin. Much of the Study Area is the submerged part of the Los Angeles Coastal Plain that extends from the Santa Monica Mountains to the Santa Ana Mountains and is underlain by the Los Angeles Basin as a downthrown block. Sediment eroded from the surrounding mountains have deposited in the Los Angeles Basin and raised the surface to the current levels over the past two million years.

Figure 2-7
Marina del Rey/Ballona Creek Bathymetry Data
Source: U.S. Army Corps of Engineers, Los Angeles District
Jan 2003 Survey

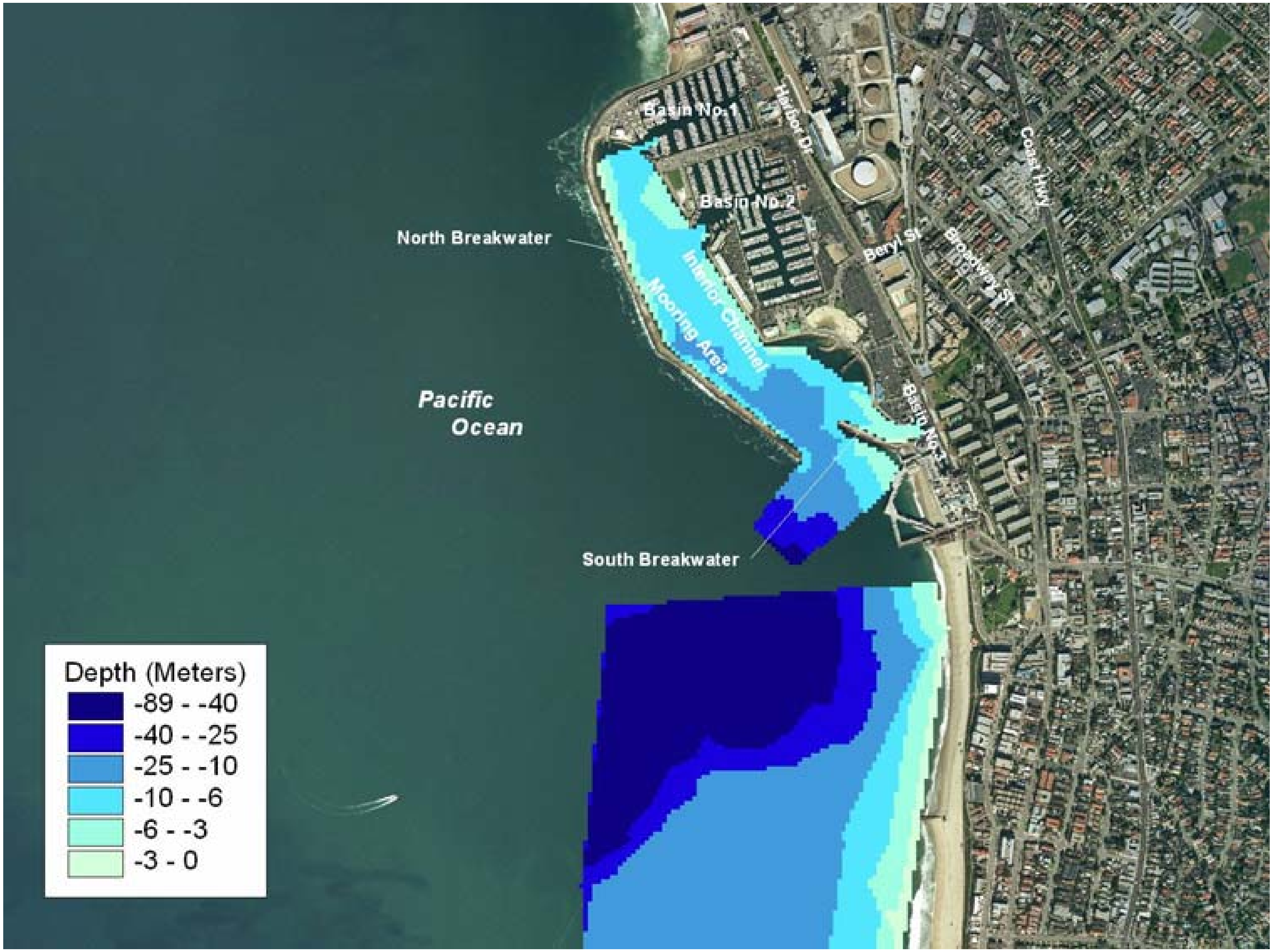

Figure 2-8
King Harbor Bathymetry Data
Source: U.S. Army Corps of Engineers, Los Angeles District
Jan 96/May 99 Survey

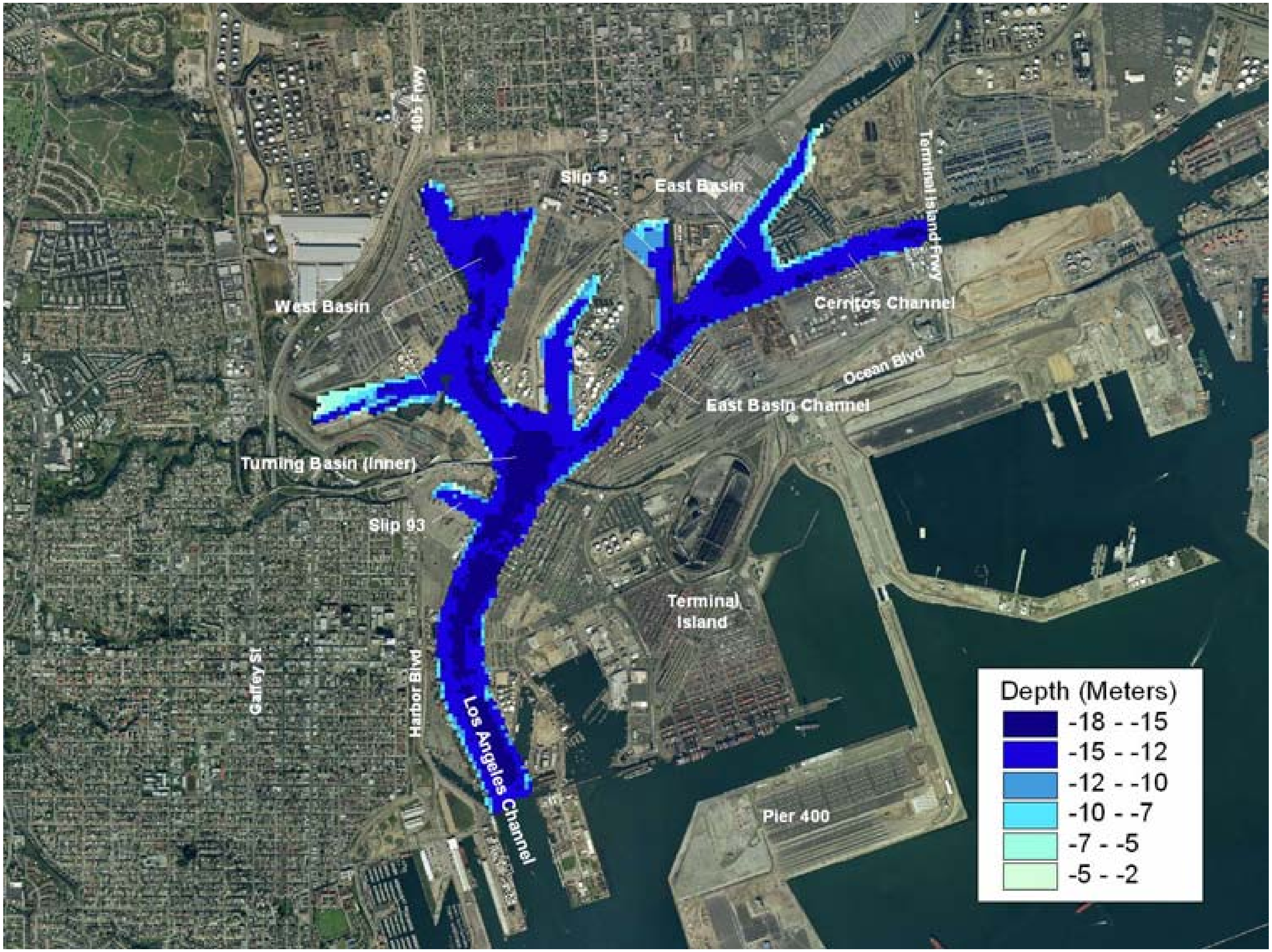

Figure 2-9
Port of Los Angeles Navigation Channel Bathymetry Data
Source: U.S. Army Corps of Engineers, Los Angeles District
Jan 2001 Survey

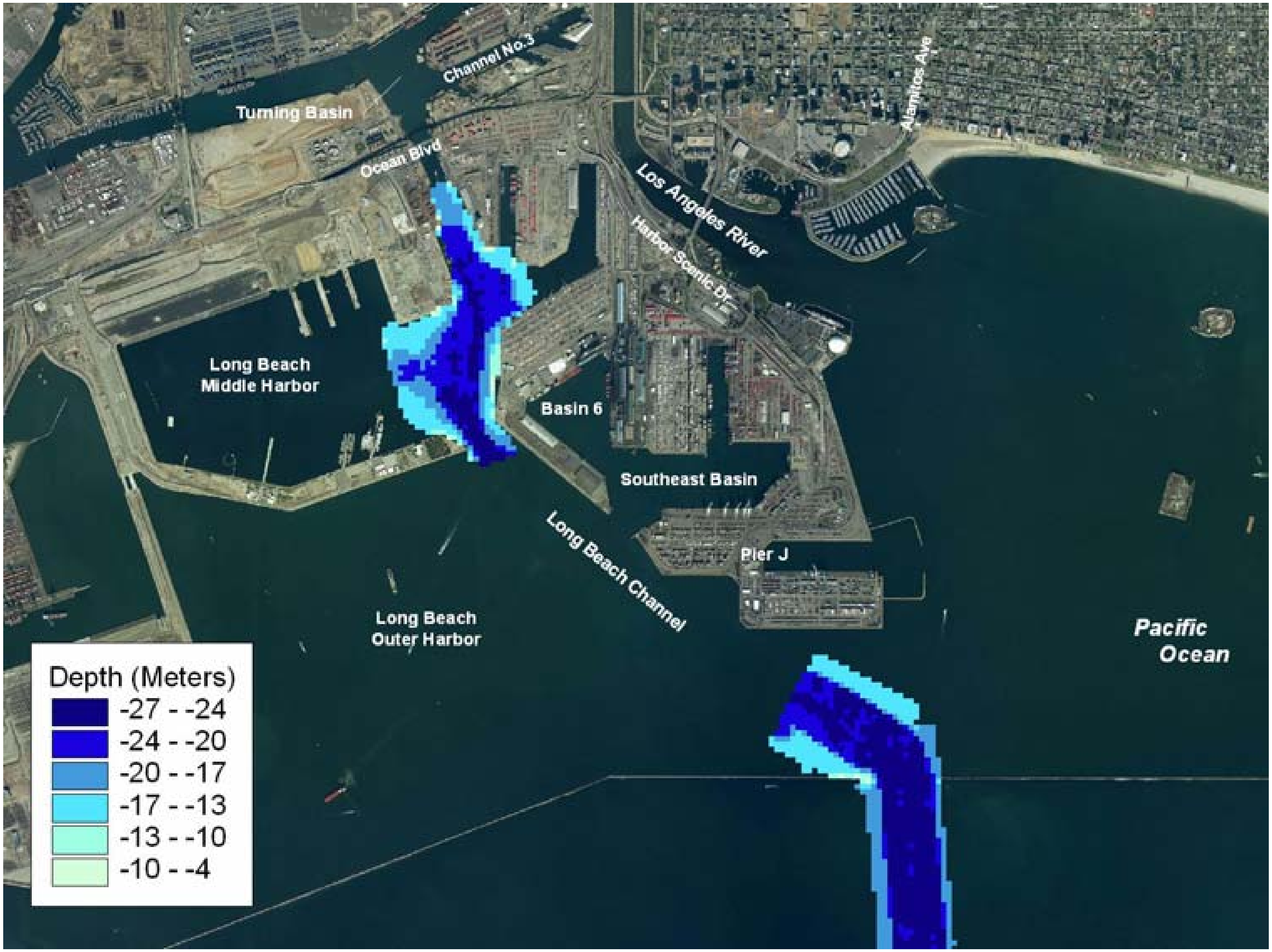

Figure 2-10
Port of Long Beach Navigation Channel Bathymetry Data
Source: U.S. Army Corps of Engineers, Los Angeles District
Oct 2002 Survey

The stability of the seafloor in the Study Area depends on its sedimentary as well as geological characteristics. The seafloor can be categorized into soft- and hard-bottom types. Even though the proximity of the sediment source can be important, the bottom types are largely a function of the movement of the overlying water mass. Much of the Study Area consists of soft-bottom seafloors with fine to coarse, unconsolidated sediments. Hard-bottoms seafloors with exposed bedrocks are present in such areas as the nearshore Region along the Carillo and Malibu coasts from the Ventura-Los Angeles County line to Pulga Canyon and from Malaga Cove to Point Fermin on the Palos Verdes Shelf. The submarine canyons in the Study Area often act as sediment sinks that collect sediment loads from littoral drift, which in turn contribute to the morphology of the slopes of the deep canyons and the neighboring seafloors.

2.2.3 *Climate*

The Study Area has a subtropical climate with mild temperatures throughout the year. The climate is influenced by the large-scale weather patterns in the Pacific Ocean and by the mountain ranges surrounding the coastal plain. Pacific storm paths extend to the Region during late fall, winter, and early spring. The Region is covered by marine air most of the year, with occasional interruption by air from inland, particularly during fall and winter. The overall low cloudiness, together with the prevalent westerly sea breeze produces generally mild temperatures throughout the year. The 30-year average daily minimum and maximum temperatures are approximately 8.9°C in January and 28.9°C in July, respectively. High temperatures nearly always occur with low humidity conditions. Haze and fog accompanied by moist marine layers and light winds frequent the Region. Foggy nights or mornings are rare during the summer, but account for approximately 25 percent of the nights and mornings during the winter.

Precipitation in the Study Area occurs primarily during the winter. Measurable precipitation occurs in approximately 25 percent of the days during the period of late October through early April. In contrast, precipitation during the months of July and August is essentially nonexistent in three years out of four. Relatively infrequent thunderstorms occur over the coastal ranges in the summer when moist air moves in from the south and southeast. Rainfall amount generally increases from the lower-altitude coastal plain to the inland mountains. Annual precipitation on the coast as measured at the Los Angeles International Airport is approximately 30.5 centimeters (cm) on average, with a range of 7.6 cm in the driest year to 74.7 cm in the wettest year.

2.2.4 *Oceanography*

Oceanographic conditions of the Region are briefly described below and a detailed description is given in Chapter 5 of the Technical Appendix.

Tides within the Study Area are of mixed, semidiurnal type consisting of two unequal high tides and two unequal low tides within a tidal period of 24 hours and 50 minutes. Tides in San Pedro

Bay have a tidal range of approximately 1.7 meters and a mean sea level of approximately 0.9 meters MLLW based on the water elevations recorded at NOAA Station 9410660 in Los Angeles Outer Harbor for the National Tidal Datum Epoch (NTDE) of 1983 to 2001 (NOAA 2003). The tidal range and datums at different locations within the Study Area vary slightly from those recorded in San Pedro Bay as a result of interactions with land forms.

Wave conditions in the Study Area result from waves generated by extratropical storms, tropical storms, and southern hemisphere extratropical storms. Prefrontal winds and local winds also generate waves of shorter periods within the Region. Extratropical storm swell generated by historical severe storm events ranges approximately 4.3 to 10.4 meters high in the deepwater with periods of 12 to 22 sec and approach directions of 250 to 289° (USACE 1996b). Occasional occurrences of southeasterly swell of the same category approaching from the Mexican coast were also recorded (Strange et al. 1993). The corresponding swell in San Pedro Bay was estimated to be approximately 2.7 to 5.5 meters high with periods of 12 to 19 sec and approach directions of 179 to 227° (Strange et al. 1993).

Tropical storm waves generated by tropical cyclones approach the Study Area from southeast off the Mexican coast during northern hemisphere summers. These storms occur approximately 15 to 20 times a year and affect the Study Area when taking a southeasterly track. Tropical storm swell generated by historical severe storms ranges from 1.8 to 3.4 meters in height in deepwater with periods of 9 to 15 sec and approach directions of 153 to 195° (USACE 1996b). The corresponding swell in San Pedro Bay was estimated to be approximately 1.8 to 4.0 meters high with periods of 9 to 15 sec and approach directions of 176 to 192° (Strange et al. 1993). Waves generated by prefrontal winds are typically 0.9 to 1.8 meters with periods of 6 to 8 sec.

Currents in the Study Area are composed predominantly of large-scale circulation and tidal currents. Other processes such as wave-generated longshore currents and rip-currents are limited to the vicinity of the narrow surf zone along the coastal edges of the Study Area. The large-scale current system within the Southern California Bight consists of the California Current, Southern California Countercurrent, Southern California Eddy, and California Undercurrent. Current speeds vary with location, but are typically 0.09 to 0.2 meters per second (mps) in the Study Area (Hickey 1992). Tidal currents in mid-depths within the Study Area are approximately 0.07 to 0.12 mps in median speed and 0.15 to 0.21 mps in the highest 10-percentile speed. Near-bottom current speeds are similar to the mid-depth speeds on average (SCCWRP 1993).

Coastal sedimentation within the Study Area consists of littoral drift in the nearshore and sedimentation on and near the shelves. Littoral drift is generally dominated by longshore transport driven primarily by waves and wave-induced currents. Sedimentation on the continental shelves is driven by a combination of surface gravity waves, internal waves, and subtidal currents. Nearshore sedimentation, together with sediment sources and sinks along the coast as well as human activities such as beach filling and borrowing, defines the budget of sediment for the Study Area shoreline. The net longshore drift in Santa Monica Bay is downcoast (southward) at a rate of approximately 146,030 to 191,140 cubic meters per year (m^3/yr) off Santa Monica Beach (USACE 1985; DMJM 1984; USACE 1989; Ingle 1966), 151,300 m^3/yr off Dockweiler Beach, and 167,400 m^3/yr off Manhattan and Hermosa Beaches (Landrum and Brown 1996).

2.3 Existing Coastal Structures

Existing structures along the Study shoreline include Malibu Pier, Santa Monica Breakwater, Santa Monica Pier, Marina del Rey and Ballona Creek jetties, breakwater and harbor complex, Venice Breakwater, Venice Pier, Chevron Groin, Manhattan Beach Pier, Hermosa Beach Pier, King Harbor breakwater and harbor complex, Redondo Beach Pier, Federal Breakwaters, Los Angeles/Long Beach Harbor complex, Belmont Pier and Alamitos Bay jetties.

Every structure along the shoreline will, to a certain degree, impact wave, current and littoral transport along the coast. Some pier structures may only have minor impact, while some offshore breakwaters play an important role in defining the wave, current and sediment movements at certain locations along the shoreline. A brief description of some of the major structures along the shoreline of the Study Area is provided below. Locations of these structures are shown in Figure 2-11.

2.3.1 *Malibu Pier*

The Malibu Pier is located at the northern edge of Santa Monica Bay and extends to 237.7 meters. The Frederick Rindge family originally built the Pier in the early 1900s. The Pier was subsequently purchased in 1943 by William Huber who replaced the pier in 1946 and eventually sold it to the California State Parks in 1980.

2.3.2 *Santa Monica Pier and Breakwater*

The Santa Monica Pier is composed of two piers constructed side-by-side with restaurants, shops, a harbor office, boat servicing facilities, and amusement park attractions. The Newcomb Pier was constructed in 1916 as an all-timber pier. The Municipal Pier was later constructed in 1921. The City of Santa Monica constructed the Santa Monica Breakwater in 1934 to provide protection to the Santa Monica Pier and create a protected harbor area for mooring commercial and recreational boats. The Santa Monica Pier and Breakwater have sustained significant storm damage, especially from the 1982 to 1983 storm season (USACE 1995). The pier has since been rebuilt, but not the breakwater.

2.3.3 *Venice Pier*

The 390-meter Venice Pier, built in 1963, was severely damaged by the 1980s. It was closed and scheduled for demolition in 1986 but was later restored and reopened in 1997.

Figure 2-11
Existing Structures

2.3.4 *Marina del Rey Breakwater, Jetties, and Harbor Complex*

The Marina del Rey Harbor provides over 6,000 wet-berthed slips for private pleasure boats, 3,000 dry boat storage, and eight lanes of launch ramps for trailer boats and additional boat launching facilities. Approximately 12 commercial (fishing and party/cruise) and 12 emergency vessels also dock in the harbor. The Marina del Rey Harbor Complex entrance is composed of four major structures, the north, middle, and south jetties and a detached breakwater. The middle and south jetties were constructed for the Ballona Creek Flood Control project in 1938. These jetties were extended approximately 165 meters in 1947. The harbor development initiated further extension of the middle jetty and construction of the north jetty. The north and middle jetties define the harbor entrance and were extended inland in 1959 with the revetments completed in 1962. The harbor was completed in August 1962. The Marina del Rey detached Breakwater is a 710-meter rubble mound structure that provides wave protection to the harbor and entrance jetties. Construction of the breakwater began in 1963 and was completed in 1965 (USACE 1993a). Figure 2-2 shows an aerial view of the Marina del Rey harbor entrance. A major portion of the sediment discharged from Ballona Creek is trapped behind the detached breakwater and subsequently blocks the harbor entrance. The area is dredged regularly by the USACE to maintain safe navigation conditions for the harbor entrance.

2.3.5 *Manhattan Beach Pier*

The Manhattan Beach Pier was constructed by the City of Manhattan Beach during the years 1917 to 1920. The roundhouse building was added a year later. Although the roundhouse was reconstructed in 1992, the pier itself survives as southern California's oldest remaining example of early reinforced concrete pier construction.

2.3.6 *Redondo Beach Pier and King Harbor*

The “horseshoe-shaped” Redondo Beach Pier was built in 1915 and rebuilt in 1929 after storm damage. The Redondo Beach/King Harbor Breakwater was originally constructed as a 450-meter long stone breakwater in 1939. The original breakwater did not provide adequate wave protection for small crafts and induced erosion of the down coast beach. In 1958, the breakwater was raised to +4.3 meters, MLLW, extended 741 meters, and a 183-meter south breakwater was constructed. The harbor was opened for berthing by 1965 and a 2.4-meter high seawall constructed at the north breakwater to provide additional wave protection. The seawall did not provide adequate protection, thus a portion of the north breakwater was raised to a crest elevation +6.7 meters, MLLW in 1964. Wave protection baffles were constructed at the basin entrances in 1977 and are maintained by the City of Redondo Beach. Multiple repairs have occurred to fix storm-induced damage to the north breakwater (USACE 1988a).

2.3.7 *Los Angeles/Long Beach Harbor Complex*

The POLA and POLB occupy the entire western half of San Pedro Bay to form the nation’s largest harbor complex. As shown in Figure 2-4, the Ports are protected from incoming waves by the Federal Breakwaters which consist of three individual rock structures. The Federal Breakwaters alter the patterns of water exchange between the harbor and the rest of San Pedro Bay and create unique tidal circulation patterns within the harbor complex.

2.3.8 *Belmont Pier*

The Grand Ave Pier was a wooden pier built in 1915. The wooden pier was later demolished and replaced with the existing 494-meter concrete Belmont Pier in 1966.

2.3.9 *Alamitos Bay Jetties*

Two jetties adjacent to the San Gabriel River mouth define the Alamitos Bay entrance. These stone jetties were built prior to the construction of the Alamitos Bay Marina.

3 EXISTING (BASELINE) CONDITIONS

The existing, or baseline, condition for the Los Angeles Regional Dredge Material Management Plan (DMMP) Feasibility Study (FS) includes the actual conditions within the Study Area as they occur in the absence of a dredge material management plan, and as of the date of report preparation. Factors evaluated include location(s) of dredge materials within the Study Area based on recent dredging events; physical, chemical, biological, and toxicological characteristics of “typical” dredge material for each portion of the Study Area; and potential sources of contamination to the dredge materials within the Study Area.

3.1 Dredging History and Disposal Practice

This section provides a brief summary of historical dredging and disposal practice in the Los Angeles Region (Region). A detailed documentation on the past dredging and disposal activities in the Study Area is provided in the Technical Appendix.

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 3-1 summarizes the historical dredging volumes from major dredging sites in the Region.

Table 3-1 Dredging Volumes Summary

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 [1]	-	-
Alamitos Bay	1994-2002	111,000	14,000	-	-
	Regional Total	**6,672,000**	**305,000**	**71,733,000**	**4,050,000**

1. Rate based on records between 1990 and 2001.

The dredging history in the Region based on available records indicates that a total of approximately 6.7 million cubic meters (m^3) of maintenance dredge material has been generated from harbor and channel projects over the past three decades at an annual rate of approximately 305,000 cubic meters per year (m^3/yr). Over that same period of time, approximately 72 million m^3 of dredge material has been generated from capital improvement projects in the Ports at an annual rate of about 4 million m^3/yr. The data indicate that the regional total dredging volume and rate associated with capital improvement projects are over 10 times those of maintenance projects, which suggests that capital improvement projects in the Ports have been the dominant dredge material generator in the Region.

Disposal practices in the Region include harbor infill, open ocean disposal, nearshore open water disposal, beach fill, shallow water habitat fill, and stockpiling. Table 3-2 presents disposal quantities, by method, for dredge materials from the major sources in the Region. Harbor infill includes records for Port fill activities and confined disposals. Open ocean disposal refers to disposal at U.S. Army Corps of Engineers/U.S. Environmental Protection Agency (Corps/EPA) sites such as LA-2 or LA-3. Nearshore open water refers to disposal records for nearshore and borrow pit (e.g., North Energy Island Borrow Pit). Beach fill includes beach placement and nourishment. Shallow water habitat (SWH) indicates disposal at locations to create SWH. Stock piling refers to the disposal of dredge material at the Anchorage Road Soil Storage Site (ARSSS) for the Port of Los Angeles (POLA) and Western Anchorage for the Port of Long Beach (POLB). The mixed disposal method refers to the combination of harbor infill and shallow water habitat 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 3-2 Disposal Method Volumes Summary

Disposal Method	Marina del Rey (m^3)	Port of Los Angeles (m^3)	Port of Long Beach (m^3)	Los Angeles River Estuary (m^3)	Alamitos Bay (m^3)	Regional Total (m^3)	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 [1]	-	12,435,000	-	-	-	12,435,000	16%
Unspecified	-	17,000	-	111,000	-	128,000	0%

1. Disposal recorded as either harbor infill or shallow water habitat (not differentiated).

Disposal data indicates that approximately 60 percent (46.6 million m^3) of the total historical volume of dredge 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 designated ocean disposal sites including LA-2 and LA-3, and 7 percent at nearshore disposal sites such as the Energy Island Borrow Pits. Beach fill and shallow water habitat 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. Less than 1 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.

Historical dredge records did not provide sufficient information on the volumetric breakdown between statutorily contaminated and uncontaminated (clean) dredge material on a project-by-project basis. Assuming only clean material would be allowed for ocean disposal or beach fill, at least 10.2 million m^3 (13 percent) of the dredged material listed in Table 3-2 could be considered as clean sediment. The remaining 68.2 million m^3 (87 percent); however, may not necessarily all be contaminated. This is because sediment that was deemed unsuitable for ocean disposal or for beach placement might actually consist of a mix of clean and contaminated material. Also, Port Capital Improvement projects frequently rely on the most suitable materials for construction (e.g. sands), regardless of contaminant level. There were no attempts in past projects to physically separate the clean sediments from the contaminated sediments so that they can be disposed of accordingly, so the true historical ratio of clean vs. contaminated is difficult to estimate. Based on historical sediment testing results, USACE estimates that about 20 to 25 percent of the dredged material at both Marina del Rey and Los Angeles River Estuary (LARE) were actually contaminated.

3.2 Regional Dredged Material Characteristics

As mentioned previously, the Study Area comprises two predominant sub-areas − Santa Monica Bay, which includes Marina del Rey and the mouth of Ballona Creek, and San Pedro Bay, which includes the LARE, Alamitos Bay and the POLA and POLB. The watersheds within the Study Area are shown in Figure 3-1. Each area contains different sediment sources and depositional systems, which affect the need for dredging frequency, physical characteristics, contaminant concentrations, and available management options. This section summarizes “typical” dredge material characteristics for each portion of the Study Area as they exist today.

Much of the information presented in this section relative to sediment sources, physical properties and chemical concentrations are extracted from the regional sediment database created by the Los Angeles Contaminated Sediments Task Force (CSTF). This database contains all of the known dredge material suitability characterization data collected within the Study Area over the past 20 years.

A caveat to the data contained in the database, and summarized in this report, is that most was collected primarily for determining dredge material suitability for open ocean (in-water) disposal. As a result, dredging projects conducted solely for use as fill in capital improvement projects may not have been subjected to the same rigorous chemical and biological testing. In addition, dredging projects specifically for beach nourishment were determined to be clean for contact water recreation (REC-1) beneficial use and hence will not be included in the database. As a result, the data contained in the database and the summaries presented in this report, may potentially be skewed towards areas more susceptible to containing fine-grained and contaminated sediments. Where possible, notes are added to clarify specific areas typically not fully characterized prior to disposal.

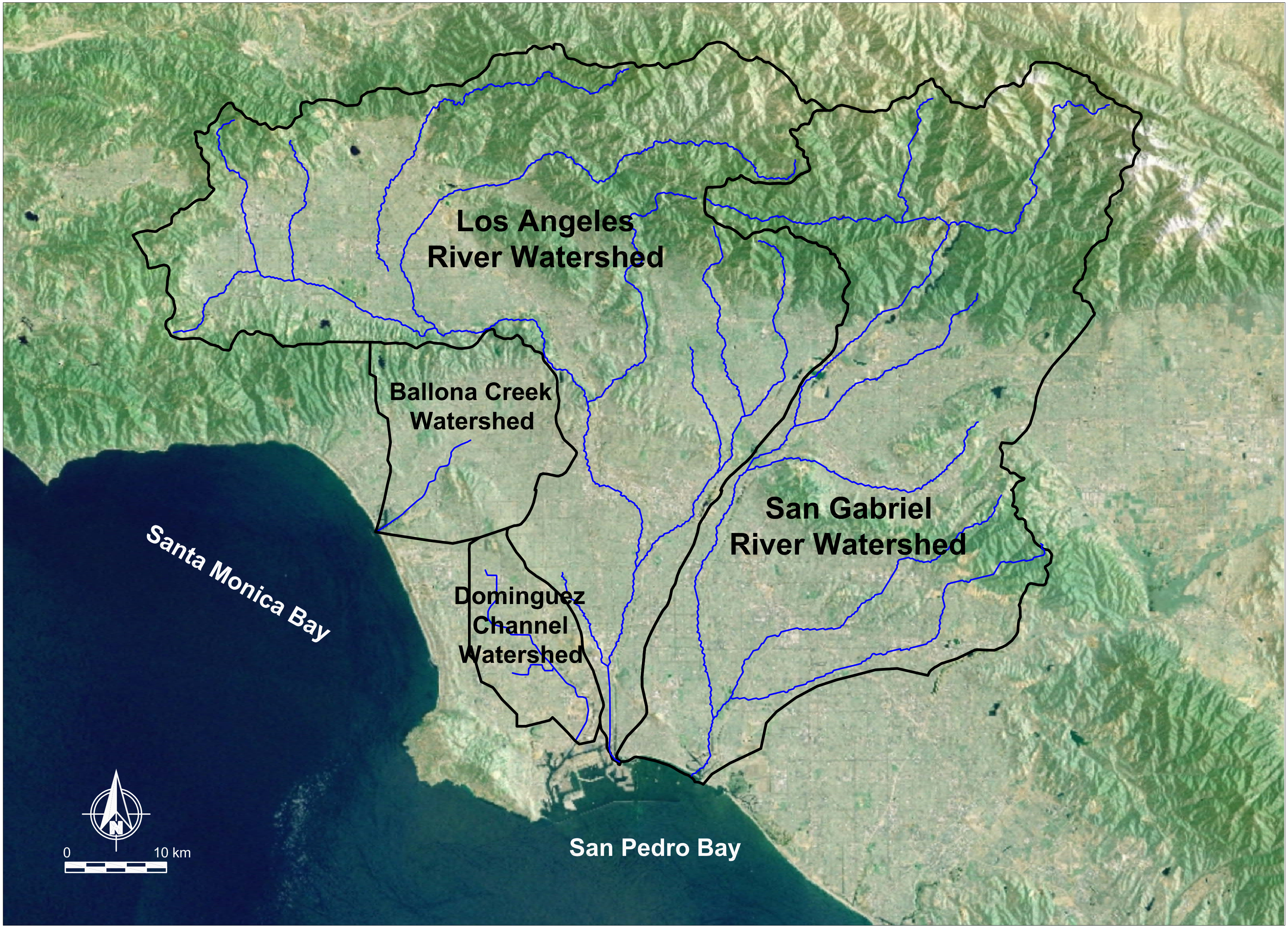

Figure 3-1

Major Watersheds in the Study Area

3.2.1 *Santa Monica Bay*

Within Santa Monica Bay, sediment management activities covered by the Los Angeles DMMP FS are limited to Marina del Rey, the mouth of Ballona Creek, and the jetty located at the mouth of King Harbor. Sediment characterization data (other than bathymetry and grain size) is readily available for Marina del Rey and Ballona Creek, but only one record exists for King Harbor. As such, the majority of the data presented in this section will be limited to the former two locations.

3.2.1.1 Sediment Source(s)

Sediment input to Marina del Rey is limited to discharge from Ballona Creek and littoral transport from wind and waves along adjacent beaches. Previous studies (SCCWRP 1996) suggest that Malibu Creek is also a sediment source to the bay as a whole, but that its runoff is not contaminated, like that from Ballona Creek. This is likely a result of the different drainage patterns for the two different watersheds. Malibu Creek drains mostly undeveloped areas of Malibu Canyon while Ballona Creek drains highly developed areas of West Los Angeles.

3.2.1.2 Physical Characteristics

Typical physical characteristics of Marina del Rey/Ballona Creek dredge material are detailed in Section 4 of the Technical Appendix for this report. Sand content typically ranges from 51.2 percent to 97.9 percent with an average of 79.3 percent; Silts range from less than 1 percent to almost 67 percent, with an average of 25.5 percent; and clays range from less than 1 percent to 59.5 percent with an average of 17 percent. Gravel is rarely encountered in Marina del Rey dredged material, averaging only 2.5 percent. Because of the high sand content typically found in Marina del Rey/Ballona Creek dredge material, this material has historically been suitable for beach nourishment, when not contaminated.

3.2.1.3 Chemical & Toxicological Characteristics

Chemical and toxicological properties of typical dredge material from Marina del Rey/Ballona Creek are detailed in Section 4 of the Technical Appendix for this report. In summary, inorganic concentrations frequently exceed conservative toxicity reference values for sediments (ER-L's [effects range-low] and ER-M's [effects range-median]). Semi-volatile organic concentrations (SVOA), while frequently detected, rarely exceeded the screening values. Dichlorodiphenyltrichloroethane (DDT) and Polychlorinated Biphenyls (PCBs) were also frequently detected, but at concentrations that may pose ecological effects concerns. Chemical results for King Harbor show all metals and organics below sensitive threshold concentrations.

3.2.1.4 Source of Contamination

Contaminant sources to Santa Monica Bay are limited to marine vessel activities and storm water runoff from Ballona Creek. Marina del Rey currently houses the largest concentration of private marine vessels in the United States. Contaminant sources related to marine vessels include engine emissions, bilge pump and sewage releases, and incidental fuel and oil spills.

The greatest source of contaminants to the area, however, is storm water runoff from Ballona Creek (SCCWRP 2003).

3.2.1.5 Biological Community

The biological community supported by sediments in Santa Monica Bay is detailed in Section 6 of the Technical Appendix to this report. A wide range of invertebrates and vertebrates are common to the area, including many recreationally important species such as California spiny lobster, clams, grunion, white sea bass, and California halibut. These and many more species could be potentially at risk due to dredging and disposal operations in the area.

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3.2.2 *San Pedro Bay – Port of Los Angeles*

The POLA is one of three primary management areas covered by the DMMP within San Pedro Bay. Lease hold areas for the POLA are shown in Figure 2-4. The following sections summarize the physical and chemical characteristics of dredge material from this area.

3.2.2.1 Sediment Source(s)

The source of sediment to the POLA harbor complex is predominantly external and mostly associated with inflow within the shipping channel arriving through the Angel's Gate opening in the Federal Breakwater, and runoff from the Dominguez Channel which discharges to the Consolidated Slip. At low tides, fully loaded ships may also contribute to the inflow of sediment by pushing bow wakes of fine grained materials into the back channels of the port complex. These fine grained materials are then typically deposited along the wharfs and structures that line portions of the channels, and in the depositional areas at the head of the terminal slips.

3.2.2.2 Physical Characteristics

Typical physical characteristics for dredge material from the POLA are detailed in Section 4 of the Technical Appendix for this report. Sand contents range from 2 percent to 99 percent, with an average of 55 percent; silt contents range from 0 percent to 80 percent, with an average of almost 28 percent; and clay contents range from 0 percent to 47 percent with an average 2 percent. Detailed evaluation of the individual studies suggests the more sandy material is located in the outer harbor area nearest the federal channel. Sediments from the inner harbor and wharf faces is typically higher in silts and thus, less suitable for nourishment or construction alternatives.

3.2.2.3 Chemical and Toxicological Characteristics

Chemical and toxicological properties of typical dredge material from the POLA are also detailed in Section 4 of the Technical Appendix for this report and summarized in this section. Overall, chemical concentrations were highly variable, ranging from concentrations that were barely detectable to values typically considered as moderately contaminated. Inorganic, semi-volatile, and pesticide/PCB concentrations frequently exceed conservative toxicity reference values for sediments (ER-L's and ER-M's) at some locations which may pose ecological effects concerns. Some of these areas (e.g., Consolidated Slip) are currently targeted for future remediation.

3.2.2.4 Source of Contamination

Sources of contamination to POLA sediments include the Dominguez Channel, which drains a heavily industrialized area of San Pedro adjacent to the Port, and has historically been contaminated with metals and DDT. As a result, the sediments located at the point of discharge into the back channels of the port (the Consolidated Slip) are heavily contaminated and may contribute to greater spatial contamination through resuspension during storm flow. Additional sources of contamination to the area include marine vessel activities and storm water runoff (e.g., West Basin storm drain).

3.2.2.5 Biological Community

The biological community supported by sediments within the POLA harbor complex was detailed in study conducted by MEC Analytical Systems (MEC) in 2000. That study is summarized in Section 6 of the Technical Appendix for this report. Within the harbor complex several recreationally important species can be found including the California spiny lobster, white sea bass, and California halibut.

3.2.3 *San Pedro Bay – Port of Long Beach*

Another major management area covered by the DMMP in San Pedro Bay is the POLB, which is located adjacent to the POLA. Combined the two Ports form the third largest port complex in the world. The following sections summarize the physical and chemical characteristics of dredge material from this area.

3.2.3.1 Sediment Source(s)

The predominant sources of sediment to the POLB are associated with inflow from the shipping channel arriving through the Queen's Gate opening in the Federal Breakwater, and runoff from the LARE which discharges to the south of the harbor complex. As with the POLA, it is possible that fully loaded ships arriving at low tides may also contribute to the inflow of sediment by pushing bow wakes of fine grained materials into the back channels of the port complex. These fine grained materials are then typically deposited along the wharfs and structures that line portions of the channels, and in the depositional areas at the head of the terminal slips.

3.2.3.2 Physical Characteristics

Typical physical characteristics for dredge material from the POLB are detailed in Section 4 of the Technical Appendix for this report. Sand contents range from 4 percent to 99 percent, with an average of 44 percent; silt contents range from 1 percent to 77 percent, with an average of 37 percent; and clay contents range from 0 percent to 43 percent with an average 16 percent.

As with the POLA, POLB sediments are highly variable with courser grained materials typically present in the outer harbor and fine-grained materials in the back channels and berth areas.

3.2.3.3 Chemical & Toxicological Characteristics

Chemical and toxicological properties of typical dredge material from the POLB are similar to that observed for the POLA. The properties are detailed in Section 4 of the Technical Appendix for this report and summarized in this section. Overall, chemical concentrations were highly variable, ranging from concentrations that were barely detectable to values typically considered as moderately contaminated. Inorganic, semi-volatile, and pesticide/PCB concentrations frequently exceed conservative toxicity reference values for sediments (ER-L's and ER-M's) at some locations, which may pose ecological effects concerns. Some of these areas (e.g., former Navy Mole area) are currently identified for future remediation.

3.2.3.4 Source of Contamination

Sources of contamination to POLB sediments include the Los Angeles River, which drains a large residential and industrial use area south of Los Angeles, general marine vessel activities and storm water runoff. The Los Angeles River, which has historically been contaminated with metals and Polycyclic Aromatic Hydrocarbons (PAHs), has been shown in satellite imagery to spread sediments throughout the southern portion of San Pedro Bay.

3.2.3.5 Biological Community

Similar to the POLA, the biological community supported by sediments within the POLB harbor complex was detailed in study conducted by MEC (2000). That study is summarized in Section 6 of the Technical Appendix for this report. Within the harbor complex several recreationally important species can be found including the California spiny lobster, white sea bass, and California halibut.

3.2.4 *San Pedro Bay – Los Angeles River Estuary*

The third major management area within San Pedro Bay is the LARE. The LARE is located at the mouth of the Los Angeles River in the City of Long Beach. Maintenance dredging occurs at the site approximately every one to three years, depending on the severity of sedimentation resulted from storm-related runoff. The following sections summarize the physical and chemical characteristics of dredge material from this area.

3.2.4.1 Sediment Source(s)

The primary source of sediment to the LARE is urban runoff within the Los Angeles River watershed that is shown in Figure 3-1. There are eight major tributaries to the Los Angeles River as it flows from its headwaters to the Pacific Ocean. The major tributaries of the Los Angeles River include Burbank Western Channel, Pacoima Wash, Tujunga Wash, and Verdugo

Wash in the San Fernando Valley; and the Arroyo Seco, Compton Creek, and Rio Hondo south of the Glendale Narrows.

3.2.4.2 Physical Characteristics

Typical physical characteristics for dredge material from the LARE are detailed in Section 4 of the Technical Appendix for this report. Sand contents range from 19 percent to 97 percent, with an average of 61 percent; silt contents range from 1 percent to 45 percent, with an average of 24 percent; and clay contents range from 2 percent to 36 percent with an average 13 percent.

3.2.4.3 Chemical and Toxicological Characteristics

Chemical and toxicological properties of typical dredge material from the LARE are similar to that observed for the two Ports with regards to metals, semi-volatiles, and PAHs. Pesticides and PCBs, on the other hand, are rarely detected in LARE sediments, but are more commonly observed at the ports. The properties are detailed in Section 4 of the Technical Appendix for this report and summarized in this section. Overall, chemical concentrations were highly variable, ranging from concentrations that were barely detectable to values typically considered as moderately contaminated. Inorganic, semi-volatile and PAH concentrations frequently exceed conservative toxicity reference values for sediments (ER-L's and ER-M's) which may pose ecological effects concerns.

3.2.4.4 Source of Contamination

The source of contamination to dredge material within the LARE is primary contributed from urban runoff occurring within its tributaries. Because of the very large surface area, much of which is paved, metals and PAHs are frequently a concern. Storm water runoff carries metals from vehicle exhaust; and oil and grease compounds from all types of motor vehicles into the collector drains, which in turn end up in the various flood control channels draining into the Los Angeles River. The chemicals become attached to sediment particles as they travel down the channels to the mouth of the LARE. At the mouth of the LARE, water velocities dissipate causing the heavier sediment particles settle out, clogging the navigational channel to the Queensway Marina.

3.2.4.5 Biological Community

The biological community of the LARE, which is detailed in Section 6 of the Technical Appendix to this report, is similar to the rest of the San Pedro Bay in that similar habitats are present as are similar organisms. Within the LARE several recreationally important species can be found including juvenile white sea bass and California halibut.

3.2.5 *Alamitos Bay*

Alamitos Bay is located just outside the southern boundary of San Pedro Bay. Because of its close proximity, it shares many of the same habitats as San Pedro Bay. Physically, the material is similar to that found in San Pedro Bay. Chemically, however, it is very different with much lower chemical concentrations.

Dredging in Alamitos Bay occurs annually near the mouth of the harbor where the City of Long Beach typically removes approximately 14,000 m^3 and disposes the material on the adjacent beaches. The following sections briefly describe the baseline physical and chemical features of the dredge material.

3.2.5.1 Sediment Source(s)

Because there are no major creeks or rivers that flow into Alamitos Bay, sediment sources are limited to storm water drainage canals and tidal flow into the bay. The San Gabriel River discharges into the Pacific Ocean adjacent to the mouth of the bay and may result in some sediment transport into the bay. Sedimentation along the navigation channel that requires regular maintenance dredging, however, is mainly due sediment transport by waves into the channels.

3.2.5.2 Physical Characteristics

Sediment physical data available for Alamitos Bay is limited to only a few samples collected during the Bay Protection and Toxic Cleanup Program / National Oceanic and Atmospheric Administration (BPTCP/NOAA) study and observations made during annual dredging by the City of Long Beach. Based on this very limited dataset, it appears the dredge material contains lower silt contents than the other management areas. A more detailed summary of the available data can be found in Section 4 of the Technical Appendix to this report.

3.2.5.3 Chemical and Toxicological Characteristics

Chemical and toxicological properties of typical dredge material from Alamitos Bay is different from the other management areas in that chemical concentrations are much lower, and hence the expected potential for sediment toxicity is also much lower. The chemical properties for the available Alamitos Bay material are detailed in Section 4 of the Technical Appendix for this report. There may be other areas of Alamitos Bay, however, with higher chemical concentrations (e.g., Colorado Lagoon) that have not yet been fully characterized. Availability of this data might alter the information summarized in this section.

3.2.5.4 Source of Contamination

As mentioned in the previous section, very little sediment data is available for Alamitos Bay and that which is available does not indicate the presence of sediment contamination.

3.2.5.5 Biological Community

The biological community of Alamitos Bay, which is detailed in Section 6 of the Technical Appendix to this report, is similar to that found in San Pedro Bay because similar habitats are present as are similar organisms. Within the bay, several recreationally important species can be found including juvenile white sea bass and California halibut.

3.3 Biological Resources in the Study Area

The following summarizes the existing without-project biological resources found within the Study Area. For a more detailed baseline conditions description of the biological resources that exist within the Study Area, refer to Section 6 of the Technical Appendix for this report.

3.3.1 *Habitats*

The DMMP FS Study Area is located along the coastal waters of Los Angeles County (County) extending from Santa Monica Bay south to Alamitos Bay. This nearshore environment supports a wide variety of key biological habitats. Aquatic habitats include pelagic (shallow and deep waters), benthic (soft bottom and hard substrate), and kelp beds. Terrestrial habitats include wetlands intertidal mudflats, salt marshes and sandy beaches. Wetland habitats along the shoreline within the Study Area are limited due to a long history of development in the area. Sporadic areas of pickleweed (*Salicornia virginica*) and saltgrass (*Distichlis spicata*) patches have been documented along minimally developed harbor shorelines (MBC 1999).

3.3.2 *Biological Communities*

Despite the rapid growth and development of the coastal zone of the County, the area supports a very diverse biological community. The waters support a huge recreational and commercial fishery for both migratory and resident species.

Plankton communities within the Study Area represent those that are commonly found along the southern California coast. Phytoplankton communities are dominated by diatom blooms in the spring and dinoflagellate blooms in the fall. Zooplankton communities are dominated throughout the year by copepods and show clear seasonal patterns of abundance (Dawson and Pieper 1993). Maximum zooplankton biomass occurs between April and June and the minimum is between December and February.

The Study Area is a transient or permanent habitat for numerous juvenile, adult and larval fish species (Horn and Allen 1981; MEC 2002). Fish communities are generally dominated by northern anchovy (*Engraulis mordax*), white croaker (*Genyonemous lineatus*) queenfish (Seriphus politus), topsmelt (*Atherinopsaffinis*), and Pacific sardine (*Sardinoops sagax*) (Brewer 1983; MEC 2002). Abundance varied with season and habitat with significantly higher abundances during the summer in the shallow water habitats than in other seasons and deeper open water habitats (MEC 2002). Larval fish abundance is dominated by a variety of goby species, northern anchovy, California clingfish (*Gobiesox rhessondon*), queenfish and white croaker.

Benthic communities found in soft bottom habitats in the Study Area are dominated by the non-indigenous polychaete (*Pseudopolydora paucibranchiata*), the amphipod (*Amphideutopus oculatus*), the ostracod (*Euphilomedes carcharodonta*), clam (*Theora lubrica*), and the polychaete worms (*Cossura* sp. A*, Euchone limnicola, Mediomastus* spp., and *Monticellina siblina*) (MEC 2002).

Benthic organisms residing on hard substrates such as piers, jetties and breakwaters, within the Study Area typically 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*).

Kelp and macroalgae found along the nearshore coast of the Study Area 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) Giant Kelp (*Macrocystis* sp.) is found along the inner side of breakwaters and along rock dikes in the outer bay (MEC 2002).

California sea lions (*Zalophus californianus*) are the most abundant pinniped in the southern coastal waters of the Study Area (NOAA 2000b). Transient marine mammals most commonly observed along the outer areas of the Study Area include the short-beaked common dolphin (*Delphinus delphis*), bottle nose dolphins (*Tursiops truncates*), Risso's dolphins (*Grampus griseus*), and Pacific white-sided dolphins (*Lagenorhynchus obliquidens*). In the fall and spring, a transient population of blue whales (*Balaenoptera musculus*), humpback whales (*Megaptera novaeangliae*) and California Grey Whales (*Eschrichtius robustus*) are found foraging off the coastal waters as they migrate up and down the coast.

Over 100 bird species have been reported to occur within the Study Area (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 include terns, grebes, California brown pelican (an endangered species), and cormorants.

3.3.3 *Sensitive and Recreationally Important Species*

Sensitive and/or recreationally important fish species found within the Study Area include California halibut, California white sea bass, and the northern anchovy. Special interest fish species include the California grunion.

Eelgrass is an important component of estuarine ecosystems and is considered a "Special Aquatic Site" under the Clear Water Act. It provides food and habitat for many birds, fish, and invertebrates and is found sporadically within the Study Area.

The California least tern (*Sterna antillarum browni*), the California brown pelican (*Pelecanus occidentalis californicus*), and the western snowy plover (*Charadrius alexandrinus nivosus*) are the primary bird species found in the Study area that are protected by the Endangered Species Act (ESA) of 1973.

Several species of birds protected by the Migratory Bird Treaty Act, including the elegant tern (*Sterna elegans*), caspian tern (*Sterna caspia*), royal tern (*Sterna maxima*), black skimmer (*Rynchops niger*), black oystercatcher (*Haematopus bachmani*), and great blue heron (*Ardea herodias*), have been observed nesting in San Pedro Harbor (MEC 2002). Individuals of these species not only use the Harbor for breeding but forage on fish in the harbor (MEC 1988).

3.4 Water Quality

Some areas within the urbanized portions of the Study Area that are typically dredged have been shown to be degraded. Several of the management areas of focus for this study are included on the State of California 2002 CWA 303(d) list of impaired waters. A summary of applicable 303(d) listings is presented in Table 3-3.

Table 3-3 Summary of 303(d) Listings for the Dredge Management Areas in Los Angeles County

Management Area	Metals	Pesticides	PCBS	PAHs	Fecal Coliform
Ballona Creek	√	√	√		√
Ballona Creek Estuary	√	√	√	√	√
Cabrillo Beach		√	√		√
Dominguez Channel	√	√	√	√	√
Long Beach Harbor Main Channel		√	√	√	
Los Angeles Fish Harbor		√	√	√	
Consolidated Slip	√	√	√	√	
Los Angeles Inner Harbor		√	√	√	
Los Angeles Harbor Main Channel	√	√	√	√	
Los Angeles Harbor SW Slip		√	√		
Los Angeles River Estuary	√	√	√		
Los Angeles River [1]	√				√
Los Cerritos Channel	√	√			√
Marina del Rey Harbor	√	√	√		√

1. Also contains 303(d) listings for nutrients and organics.

3.5 Commercial and Recreational Resources

3.5.1 *Santa Monica Bay*

3.5.1.1 Marina del Rey

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 harbor area hosts a number of parks include 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. Other facilities around the harbor serving recreational purposes include the UCLA Boathouse, Pardee Scout Sea Base, and Los Angeles County South Bay Bicycle Trail.

The Marina del Rey harbor consists of 1.64 square kilometers of water and is the largest man-made small-craft harbor in the world. The harbor provides over 6,000 wet-berthed slips, 3,000 dry boat storages, eight lanes of launch ramps for trailer boats, 240 boat launch facilities, 640-meter 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. Commercial and recreational activities include charter boat fishing, sport fishing, dining cruises, wind surfing, jet skiing, and sail boarding. Two entrance jetties and an offshore breakwater form the harbor entrance. The harbor jetties are regularly used for sightseeing, bicycling, fishing, and walking.

Different boat types use the harbor at different time. Fishing boats generally leave early in the morning and return in the early afternoon as winds pick up, a time 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. Winter weekdays are typically periods of lowest usage.

3.5.1.2 King Harbor

King Harbor offers a small boat launch, sport fishing pier, restaurants, commercial and retail shops, a hotel, and apartments. Parks include Seaside Lagoon, a saltwater, sand bottom pool, Czuleger Park (Plaza Park), Veterans Park and Community Center, and Redondo State Beach. Other recreational activities include fishing from the pier, boats for sport fishing and whale watching, ocean racer, charters, sailing classes, bike rentals, wave runner rentals, and roller skating/rollerblading.

King Harbor is a recreational harbor serving primarily pleasure craft and fishing boats. Over 1,450 slips are available and can accommodate vessels ranging from 4.3 meters to 25.3 meters. Harbor amenities include tenant lounges, hot shower and laundry rooms, mailboxes, landlockers, dingy racks and secured parking. Other boating services include two yacht clubs, a marine hardware store and repair yard, fuel dock and free pump out station.

The King Harbor is separated into three basins, two large and one small, with a large entry channel. The harbor services vessels, which range from small craft to boats 27.4 meters in length. The harbor entrance is 183 meters wide, which is adequate navigation need for the commercial and residential vessels using the harbor basins.

3.5.2 *San Pedro Bay*

3.5.2.1 Ports of Los Angeles and Long Beach

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, 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, Cabrillo Marine Aquarium, Cabrillo Beach, and Cabrillo Beach Pier.

San Pedro Bay within the Long Beach Harbor supports boating activities from Downtown Long Beach Harbor Marina and Alamitos Bay Marina, as well as other water related recreational activities such as jet skiing and wind surfing. Belmont and Alamitos Piers also serve as the main locales for sport fishing. Bluff Park and Beach south of Ocean Boulevard offer activities such as strolling, beach sports, and picnicking. Passenger and charter services based in the LARE utilize San Pedro Bay en route to and from Santa Catalina Island.

San Pedro Bay contains the Los Angles/Long Beach Harbor complex, and supports extensive industrial, commercial, and recreational use including shipping, commercial and recreational boating and fishing, surfing, swimming, and beach recreational activities. Combined, the POLA and POLB would be the third busiest container port in the world, after Hong Kong and Singapore. The two ports host a wide variety of vessels, although container and dry and liquid bulk cargo ships predominantly use the harbors. Additional types of vessels that use the harbors include cruise ships, commercial fishing boats, power and sail boats, and small personal recreational watercrafts. Marinas in the Long Beach Harbor and Queensway Bay contain over 8,000 boat slips. Recreational use is predominant in the Outer Long Beach Harbor.

Navigation lanes and precaution areas were established by the U.S. Coast Guard to promote safe traffic in and out of the Los Angeles and Long Beach 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. 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. Boat traffic peaks on summer weekends and is the least during winter weekdays. In addition, there are a number of traffic routes for ferries between the Los Angeles and Long Beach Harbors, Newport Harbor, and Dana Point Harbor, and Isthmus Cove and Avalon Point on Santa Catalina Island.

3.5.2.2 Los Angeles River Estuary

The LARE hosts several major charter boat operators that provide passenger and charter service to Santa Catalina Island from bases 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. Most recently, Carnival Cruise Lines has begun operating a dock facility for its cruise ships on property adjacent to the Queen Mary in the space formerly housing the Spruce Goose wooden airplane owned by Howard Hughes.

Recreational boating in the area is primarily supported by the Long Beach Shoreline Marina and Rainbow Harbor/Marina located in downtown Long Beach. Rainbow Harbor/Marina is located next to the Long Beach Aquarium and is composed of 103 commercial and recreational boat slips and 61-meter day mooring dock. There are 12 46-meter docks for commercial vessels. Opened in 1982, Shoreline (Downtown) Marina has 1,844 recreational boat slips located adjacent to Shoreline Village with retail shops and restaurants. Areas along the downtown side of the estuary shoreline contain the Aquarium of the Pacific, and offer recreational vehicle parking and 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.

Primary vessel types using the navigable waters in the estuary include passenger and charter ships, recreational boats, and dinner and harbor cruise ships.

3.5.2.3 Alamitos Bay

Facilities in Alamitos Bay 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 has 1,991 slips and can accommodate vessels between 5.5 to 37.8 meters. Alamitos Bay Marina is host to the Congressional Cup, the Trans Pac Race to Hawaii, and North Sails Week. Recreational activities include sailing, canoeing, kayaking, board sailing, wind surfing, water skiing, and rowing.

The City of Long Beach is responsible for maintaining recreational navigation for Alamitos Bay Marina.

3.6 Land Use

Land use in the County is in general substantially urbanized as a result of population growth through recent history. Urban development has been especially significant in the Ballona Creek watershed where vacant/open lands constitute only 11 percent of the watershed area, in contrast to approximately 79 percent vacant/open land in the Malibu Creek watershed. Table 3-4 shows the distributions of land use in the five primary watersheds within the County (LACDPW 2000).

Table 3-4 Land Use by Watershed

Land Use	Land Use Percentage (%)				
	Ballona Creek [1]	Los Angeles River [2]	San Gabriel River [3]	Coyote Creek [4]	Malibu Creek [5]
High Density Single Family Residential	40	28.8	15.2	38.3	5.7
Multi-Family Residential	12.3	3.5	1.4	6.1	1.3
Mixed Residential	6.7	1.8	0.1	0.2	0
Commercial	9.9	3.6	1.5	5.6	0.5
Light Industrial	3.5	5.1	2.3	8.4	0.3
Transportation	1.5	2.4	1	1.8	0.5
Education	2.7	1.9	1.6	4.3	0.5
Vacant	11.1	40.4	66.7	14.3	79.3
Other	12.3	12.5	10.2	21	11.9

1. Above Sawtelle Boulevard.
2. Above Willow Street.
3. Above San Gabriel Parkway in Pico Rivera.
4. Above Spring Street.
5. Above Malibu Canyon Road.

3.7 Cultural Resources

Within the Study Area, while no known submerged prehistoric archeological sites have been reported in Los Angeles/Long Beach Harbors, there are several sites in the general area of Ballona Lagoon that indicate inhabitance dating from 7,000 to 200 B.P. (Before Present) (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. The construction and periodic dredging of the POLB and POLA would similarly destroy any such resources (USACE 1998f).

3.8 Economic Analyses

3.8.1 *Los Angeles County*

The County has a diversified multi-centered metropolis economy with strong manufacturing, services and trade sectors, international business and finance, communication (television and movies), transportation, and electronics. Christopher Thornberg, Senior Economist at University of California, Los Angeles Anderson Forecast, in an April 2003 presentation to the Citizens' Economy Efficiency Commission, described Los Angeles as an externally driven economy (Thornberg 2003). He says that much of the Region's industries serve customers in other parts of the U.S. and the world. As such, the Region is particularly exposed to changes in external demand, which influences demand for exports and tourism services.

The County is the most prolific both in California and in the country with respect to manufacturing output; producing more than 10 percent of the nation's output in such items as aircraft, aircraft equipment, aluminum, dental equipment, games and toys, gas transmissions and distribution equipment, guided missiles, space vehicles and propulsion units, and women's apparel (City of Los Angeles 2003). In terms of employment, the County is the second largest major manufacturing center in the U.S., with an estimated 605,000 employed as of 2001 (LAEDC 2003).

Between the years 1998 and 2002, the rate of unemployment in the County was slightly but persistently higher than the rates for both California and the nation. At the time of writing, the latest numbers from the U.S. Bureau of Labor Statistics (BLS) show the trend continuing. The seasonally unadjusted unemployment rate as of December 2003 was 6.1 percent for the Los Angeles-Long Beach metropolitan area. The state and nation had unemployment rates of 6.1 percent and 5.4 percent, respectively.

Over the last 50 years worldwide maritime trade has steadily expanded at a rate of 2 to 3 percent annually. In a report by Martin Stopford of Clarkson Research (a large, UK-based shipping services provider), Stopford discusses some of the most important issues with respect to future seaborne trade growth, focusing on the likelihood and implications of an increasingly large shipping fleet (Stopford 2002). According to the report, most analysts assume that annual trade growth over the next 20 years will continue to be between 2 and 3 percent. Such a growth rate implies an increase in trade of approximately 64 percent over the period. Container trade, which over the past 20 years has had a growth rate of around 8 percent, is expected to continue to grow strongly over the next 20 years at around 6 percent annually, implying a trebling in its trade over the period (Stopford notes that such high estimates of sustained growth seem to implicitly assume overall improvements to capacity infrastructure). Such a high rate of growth in container trade has particular significance for the POLB, for which container trade accounts for two-thirds of its tonnage. The expectation of overall steady trade growth seems to underline the importance of general infrastructure improvements.

The Los Angeles County Economic Development Corporation (LAEDC) forecasted in July 2003 that overall growth in international trade–and in particular imports–will continue to expand through 2004, and that additional benefits may derive from a possible weaker U.S. dollar, which would generally increase demand for domestic goods. As two of the principal Ports in the nation, developments in international trade are important to the POLA and POLB.

3.8.2 *Recreational and Commercial Value of County Harbors*

As the world's largest man-made pleasure boat harbor, with the capacity for some 6,000 boats, Marina del Rey provides a wide variety of outdoor recreation opportunities. It offers activities ranging from walking, biking and beach activities to fishing and boating. This harbor offers a unique combination of amenities, making it a renowned California State attraction, not only in the U.S., but also around the globe. Three sources of recreational resource value at the Harbor include: park and beach activity; wet-berthed boating; and other classifications of boating including dry-berthed and launched.

Marina Del Rey is also an irreplaceable resource for the sport fishing outfits that are currently located there. Respondents to a survey that was included as part of the 2000 USACE FS indicated that relocating to alternative harbors would not be practical due to two main factors: (1) there are no vacancies in other harbors for additional sport fishing charter boats since the slips dedicated to commercial fishing boats are occupied by commercial gill netters, lobstermen and other sport fishing charter boats and (2) the sport fishing charter boat business is dependent on being easily accessible to the public and Marina del Rey offers that to the entire Los Angeles Basin.

The POLA is the world's eighth largest container port with respect to 20-foot equivalent units (TEUs). In 2001 and 2002, the POLA handled 5.18 and 6.11 million TEUs, respectively. In the year 2000 the POLA was the nation's number one port with respect to net income, amounting to nearly $84 million. The POLB followed closely with just over $83 million, according to the Institute for Water Resources (IWR) (IWR 2003).

Besides commercial trade, the POLA is a very important center for commercial cruise and sport fishing outfits. In total, twelve cruise lines call the POLA. The POLA owns the largest passenger facility on the West Coast–the World Cruise Center. According to the POLA, in recent years more than one million passengers annually have traveled via the Cruise Center. The Cruise Center is leased to a consortium of five cruise lines, including Carnival, Cunard, Norwegian, Princess, and Royal Caribbean. The majority of cruises are bound for popular Mexican coastal cities. The POLA also serves as an intermediate stop for additional cruises to and from various parts of the world. The POLA has two passenger terminals that can accommodate up to three full-size cruise vessels simultaneously.

The POLB is the United States' second busiest port, and the world's twelfth busiest container cargo port. If combined, the POLB and POLA would be the world's third-busiest port complex, after Hong Kong and Singapore. In 2002, the POLB handled nearly 65 million metric tons of cargo, equivalent in value to $89 billion. This volume of cargo is almost exactly the average annual tonnage handled between the years 1998 and 2002. Revenues from 2002, while 10 percent higher than in 1998, were down 10 percent from the five-year period's high of $98.2 billion. According to the POLB, container throughput has increased by 175 percent since 1990.

Leading imports by tonnage at the POLB are: petroleum, salt, electric machinery, machinery, furniture, vehicles, chemicals, steel products, and toys. The leading exports by value are: machinery, electric machinery, vehicles, toys, clothing, furniture, shoes, and plastics and medical equipment. According to IWR, non-tow vessel traffic at the POLB in 2001 amounted to just over 16,500 trips including inbound and outbound vessels. Foreign commerce accounted for around 2,000 of the inbound non-tow trips, and domestic commerce comprised just over 6,100. Importantly though, vessel trips for foreign commerce represented the vast majority of large vessels – 87 percent of vessels with drafts greater than 6 meters.

At the mouth of the Los Angeles River are located both Rainbow Harbor and Long Beach Shoreline Marina. The Long Beach Shoreline Marina opened in 1982 and has 1844 slips for recreational boaters. It is located in the heart of downtown Long Beach and is home to, among others, the Shoreline Yacht Club. Rainbow Harbor is located next to the Aquarium of the Pacific. The Harbor is home to both commercial and recreational vessels, and has 103 slips available. As of October 2003, there were zero slips available at either of the harbors within the LARE.

Rainbow Harbor, located at the LARE, offers a wide range of commercial boating services, including sport fishing, day cruises, harbor tours, and service to Catalina Island. According to the Catalina Island Visitors Bureau, there are two operators providing passenger service to the Island from the estuary's docks. Both the Catalina Express and the Catalina Explorer operate from docks located within the LARE.

3.9 Regulatory Approval Processes

Dredging and disposal of dredged material in the Study Area are regulated by federal and state agencies including the USACE, EPA, U.S. Fish and Wildlife Service (USFWS), National Oceanic and Atmospheric Administration National Marine Fisheries Service (NMFS), California Coastal Commission (CCC), Los Angeles Regional Water Quality Control Board (LARWQCB), and California Department of Fish and Game (CDFG).

The USACE regulates all dredging, dredge material transport, and disposal activities in the waters of the U.S. under Section 10 of the Rivers and Harbors Act of 1899 (RHA), Section 404 of the Clean Water Act of (CWA) 1972, and Section 103 of the Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA). The regulatory responsibilities of the USACE include review of permit applications and issuing permits for dredging, transport and discharge of dredged or fill material in the waters of the U.S. pursuant to Section 10 of the RHA, Section 404 of the CWA and Section 103 of MPRSA. The USACE analyzes individual discharges of fill material in accordance with the Section 404 (b) (1) Guidelines of the CWA, as incorporated in the Inland Testing Manual (ITM), which require avoidance of "unacceptable adverse effects" on the aquatic environment, selection of the least environmentally damaging practicable alternative, as well as over 30 resource-specific federal environmental statutes and Executive Orders that represent public interest.

Federal resource agencies including the EPA, FWS, and NMFS review dredging and disposal activities and provide the USACE with comments regarding compliance with federal statutes, nature of the impacts, as well as appropriate and practicable measures to mitigate the impacts within the authorities and expertise of the agencies. The authorities of the agencies are provided under the CWA, the National Environmental Policy Act (NEPA), the Fish and Wildlife Coordination Act (FWCA), the ESA and the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA). The EPA reviews the dredging and disposal activities, identifies its views regarding their compliance with the Section 404 (b) (1) Guidelines, and has the authority under Section 404 (c) of the CWA to restrict or prohibit any dredged of fill material that can cause unacceptable adverse effects on the water environment and beneficial uses. The FWS reviews and provides comments regarding the effects of the dredging and disposal activities on fish and wildlife resources and their habitats. The NMFS reviews and provides comments regarding the effects of the activities on sensitive populations of marine and anadromous fishes as well as the aquatic and riparian habitats that support these fishes.

When material is disposed (not discharge with the effect of fill) in waters of the U.S. (i.e., open ocean disposal at LA-2), the proposed disposal are analyzed according to the Ocean Disposal Manual, or Green Book, in order to meet the requirements of Section 103 of MPRSA. The CWA and MPRSA authority can overlap, but in all cases where Section 103 of the MPRSA applies, EPA can veto or modify proposed 103 permits issued by USACE.

State resource agencies including the CCC, LARWQCB, and CDFG participate in the regulatory processes for dredging and disposal activities. As the state's coastal zone management agency, the CCC has the responsibility of ensuring compliance of dredging and disposal activities with the Coastal Zone Management Act of 1972 (CZMA). The statute provides the CCC the authority to review federal permitting, licensing, and funding actions as well as federally conducted activities in the coastal zone to determine their consistency with the state's coastal policies. The California Coastal Act of 1976 requires any development in the Coastal Zone (500 yards inland in developed areas to 5 miles inland in undeveloped areas) to obtain a Coastal Development Permit from the CCC. If the activities occur within the Ports' Tidelands Trust boundaries, the Ports' certify compliance with their CCC approved Master Plans. The LARWQCB regulates activities that might impact surface and ground water resources in the Region. As part of the California Environmental Protection Agency and delegated by the EPA with responsibilities to implement and enforce portions of the CWA, the LARWQCB conducts water quality planning and control programs including municipal and industrial waste discharge permitting and storm water discharge permitting under the National Pollutant Discharge Elimination System (NPDES). The LARWQCB regulates water quality issues related to dredging activities under Section 401 of the CWA and no project can proceed until the state grants a water quality certification. In addition to dredging activities, the LARWQCB regulates discharges associated with dredging under the authority of the Porter-Cologne Water Quality Control Act and issues waste discharge requirements (WDRs) pursuant to that act.

3.10 Dredging and Disposal Best Management Practices

Current dredging and disposal Best Management Practices (BMPs) include occasional use of silt curtains for areas with high concentrations of contaminants or areas adjacent to sensitive biological resources. Water quality monitoring is conducted prior to, during and after most dredging projects, but that data is not used to select and implement BMPs during construction.

However, one BMP that is commonly employed in the Region is the use of environmental windows to limit dredging and disposal activities to periods when sensitive biological species are nesting in or migrating through the Study Area. Examples include limiting nearshore sediment disposal during grunion breeding periods, and limiting general construction activities during least tern nesting season.

4 FUTURE WITHOUT-PROJECT CONDITIONS

The Future Without-Project Conditions portion of the Feasibility Study (FS) documents the estimated conditions likely to be present within the Study Area over the next 20 years in the absence of the proposed project. In this case, the proposed project is the creation of a Los Angeles Regional Dredged Material Management Plan (DMMP). Therefore, the future without-project conditions would assume that dredging and disposal projects conducted within Los Angeles County (County) would continue to be conducted on a case-by-case basis, and would not follow specific steps specified in an organized federal guidance document.

With or without the development of a regional DMMP, other regional programs will likely be implemented over the next 20 years related to watershed management, sediment source control and chemical discharges that could affect the future need for dredging and disposal within the Region. This section accounts for each of those programs within the Study Area.

4.1 Dredging Needs and Disposal Practice

Future dredging needs in the Los Angeles Region (Region) will remain largely driven by the needs of the U.S. Army Corps of Engineers, Los Angeles District (USACE) and the Ports to maintain safe navigation and economic development in a manner consistent with the past. Similar needs also exist with local governments such as the City of Long Beach to maintain recreational marinas. The projected future dredging and disposal need is estimated based on historical dredging and disposal records summarized in the last section and discussions with agencies responsible for conducting dredging operations.

Short-term (five to six years) projections obtained from USACE, Port of Los Angeles (POLA), Port of Long Beach (POLB), and the City of Long Beach for maintenance and capital improvements needs reflect relatively accurate dredging and disposal needs. Long-term projections to 20 years in the future are based on ranges between the short-term projections and historical records and hence are less accurate. The accuracy is also reduced to the potential of sediment source reductions attributed to source control measures being implemented in watershed.

The 20-year projected rate for Marina del Rey of 1 to 2 million cubic meters (m^3) of sediment with 250,000 to 500,000 m^3 being contaminated was based on USACE continuing regular maintenance dredging programs at a rate of approximately 50,000 to 100,000 cubic meters per year (m^3/yr) with about one-fourth of the dredge volume expected to be contaminated. No capital improvement projects are expected for Marina del Rey.

Since there is only one maintenance dredging event on record for King Harbor, dredging need for King Harbor is expected to be minimal, if any, over the next 20 years.

The POLA is expecting to dredge a total of 261,200 m^3 of contaminated sediment for their maintenance need over the next six years, which is about 44,000 m^3/yr for the next five years. This rate is about half of the historical maintenance rate of 85,000 m^3 estimated in Section 4.1. Hence, the future maintenance dredging need for the POLA is estimated to have a range of between 44,000 and 85,000 m^3/yr (i.e., a total of about 880,000 to1.5 million m^3 of contaminated sediment from maintenance dredging over the next 20 years).

In the next five years, the POLA is expecting to generate a total of 2.58 million m^3 of sediment for their capital improvement projects, out of which 1.38 million m^3 (53 percent) are considered contaminated. Combining the short-term projections with the historical rate established in Section 4.1, it is estimated that over the next 20 years, the POLA will generate 429,000 to 3.4 million m^3/yr of sediment through their capital improvement projects (i.e., a total of 8.6 to 68 million m^3).

Similarly, the best estimates for the dredging and disposal needs for the POLB over the next 20 years will be based on their more accurate short-term estimates and the historical need presented in Section 4.1. The POLB has estimated that the need to dredge a total of 153,000 m^3 of contaminated sediment for the maintenance need between 2004 and 2008. Over the next 20 years, the maintenance dredging projection is between the short-term projection of 31,000 m^3/yr and the historical rate of 71,000 m^3/yr. Over the next 20 years, it can be estimated that 620,000 to 1.2 million m^3 of contaminated sediment could be generated from maintenance dredging. Capital improvements are expected to generate 1.2 million m^3/yr with 73 percent being contaminated over the next five years. Beyond the five-year projection, capital improvement projects can produce 644,000 to 1.2 million m^3/yr. The future 20-year total can range between 2.22 to 25.2 million m^3 of sediment with 1.8 to 18.7 million m^3 of contaminated sediment.

USACE and the City of Long Beach estimate the Los Angeles River Estuary (LARE) maintenance dredging need at 86,000 m^3/yr. It is estimated that 25 percent of the total will be contaminated. This rate can reasonably reflect the short-term dredging and disposal need for the LARE. Assuming the short-term rate continues over the next 20 years, approximately 1.7 million m^3 of sediment with 430,000 m^3 of contaminated sediment could be generated from LARE. However, because it may not be possible to separate clean from contaminated, the total contaminated amount could be equal to the total amount projected.

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/yr. 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 about one-fourth of the total volume (39,000 m^3) contaminated. Over the next 20 years, the maintenance dredging and beach disposal can be expected to continue at the historical rate. Therefore, a combined total of 433,000 m^3 of sediment with 39,000 m^3 of contaminated sediment could be generated from Alamitos Bay.

Table 4-1 summarizes the 20-year projections of both maintenance dredging and capital improvements for each location. The Region can expect to generate 14.8 to 80.8 million m^3 of sediment with 8.0 to 49.4 million m^3 (54 to 61 percent) being contaminated. This wide range in estimated volume is attributed to the long-term extrapolation of dredging rates and uncertainty associated with capital improvement projects within the POLA and POLB, as these are the dominant dredge sediment generator in the Region.

Table 4-1 20-Year Projection for Sediment Generation in the Los Angeles Region

Location	Projected 20-Year Total Volume (million m^3)	Projected 20-Year Total Contaminated Volume (million m^3)
Marina del Rey	1 – 2	0.25 – 0.50
King Harbor	0	0
Port of Los Angeles	9.46 – 51.5	5.5 – 28.5
Port of Long Beach	2.22 – 25.2	1.8 – 18.7
Los Angeles River Estuary	1.7	0.43 – 1.7
Alamitos Bay	0.43	0.04
Regional Total	**14.8 – 80.8**	**8.0 – 49.4**

4.2 Regional Dredged Material Characteristics

Changes in regional dredge material characteristics for the future, without-project condition over the next 20 years will be highly dependent on implementation and effectiveness of several regional management plans, including:

- Implementation of the Regional Sediment Management (RSM) Plan for the California Coast currently in development at the USACE;
- Implementation of watershed management plans for Ballona Creek, Dominguez Channel, Los Angeles River and the San Gabriel River;
- Effectiveness in removing historical sources of contaminated sediments within the Study Area; and
- Implementation of Total Maximum Daily Loading (TMDL) initiatives for the County.

This section summarizes the expected without-project changes that may occur within the Study Area and describes, in more detail, the scope and potential impact of these regional management plans. Regional management plans specific to each of the dredging areas are presented in subsequent sections; management plans universal to the entire Study Area include: Watershed Management Initiative; Water Quality Control Plan (Basin Plan); TMDL Program; Non-Point Source (NPS) Program; Standard Urban Storm Water Mitigation Plan (SUSMP); and Contaminated Sediments Task Force (CSTF). Each is briefly described below:

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 Water Management Areas (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.

Water Quality Control 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 LARWQCB. 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.

Total Maximum Daily Load Program

The TMDL program for the Region is being developed and implemented jointly by the LARWQCB, State Water Resources Control Board (SWRCB), and U.S. Environmental Protection Agency (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 4-2 presents the schedule of TMDL activities for Ballona Creek, Marina del Rey, the Los Angeles River, and Dominquez Channel (LARWQCB 2002).

Table 4-2 Draft TMDL Development Schedule

Watershed	Nutrients	Bacteria	Metals	Organics
Ballona Creek/Marina del Rey	Not listed	2003	2003	2003
Los Angeles River	2003	2004	2004	2004
Los Angeles Harbor/Estuary	Not listed	2007	2007	2007
Dominguez Channel	2010	2010	2007	2007

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.

Standard Urban Storm Water Mitigation Plan

The SUSMP for the Los Angeles County Region was developed and implemented by the County to fulfill the requirements under the National Pollutant Discharge Elimination System (NPDES) permit issued to the County and 85 incorporated cities by the LARWQCB. Approved by the LARWQCB in 2000, the plan is a guidance document that designates best management practices (BMPs) 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 are required to submit an Urban Storm Water Mitigation Plan that includes the BMPs required by the city in which the development is located.

Contaminated Sediments Task Force

The CSTF was established under the authority of the Karnette Bill (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, California Department of Fish and Game (CDFG), 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 Los

Angeles Region. 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 Subcommittees 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.

4.2.1 *Santa Monica Bay – Marina del Rey*

Within Santa Monica Bay, the greatest factor affecting future, without-project conditions is the extensive WMIs planned for the Ballona Creek Watershed. These programs include TMDL development; the Ballona Creek Watershed Management Plan; Ballona Creek and Marina del Rey Sediment Control Management Plan; and the Clean Marina and In-Water Hull Cleaner Certification Programs. In addition, a Bay Restoration Plan for Santa Monica Bay as a whole will also be implemented to address bay-wide water quality and sediment issues. Each of these programs/initiatives is briefly described below.

<u>Bay Restoration Plan</u>
The Bay Restoration Plan for Santa Monica Bay and its watersheds including the Ballona Creek Watershed was approved by Governor Wilson in 1994 and by the EPA Administrator Browner in 1995. The Bay Restoration Plan is administered by the Santa Monica Bay Restoration Commission (SMBRC), an independent state agency formerly known as the Santa Monica Bay Restoration Project (SMBRP) within the LARWQCB. 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.

<u>Ballona Creek Watershed Management Plan</u>
The Ballona Creek Watershed Management Plan is being developed by the County, SMBRC, Ballona Creek Renaissance, and the City of Los Angeles under the oversight of the LARWQCB. The primary objective of the plan is to address urban runoff pollution, pathogen, 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.

<u>Ballona Creek and Marina del Rey Sediment Control Management Plan</u>
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. An FS has been recently completed that evaluates management alternatives including 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.

<u>Ballona Creek and Marina del Rey Trash and Debris Control Management Plan</u>
The Ballona Creek and Marina del Rey Trash and Debris Control Management Plan is scheduled to begin in 2004. This feasibility study will be undertaken by Los Angeles County Department of Beaches and Harbors and Public Works.

<u>Clean Marina and In-Water Hull Cleaner Certification Programs</u>
The Clean Marina and In-Water Hull Cleaner Certification Programs are a boating pollution control program 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.

4.2.1.1 Source of Material

Future sources of dredge material to Marina del Rey/Ballona Creek are not expected to change dramatically. Implementation of sediment source control plans in the Ballona Creek watershed may result in a small reduction in sediment loading to the estuary, but it is not expected to be significant. Other, new sources of sediment loading to this area are also not projected. As such, future, without-project conditions are expected to be similar to current conditions.

4.2.1.2 Physical Characteristics

Because the source of dredge material to the Marina del Rey/ Ballona Creek area is not expected to change significantly in the next 20 years, the physical characteristics of this material is also not expected to change significantly. Sediment grain size ranges presented in Section 4 will likely continue to be present in future years.

4.2.1.3 Chemical and Toxicological Characteristics

Implementation of upland watershed management plans and the Ballona Creek TMDLs may result in a net reduction of contaminant loading to the Marina del Rey/Ballona Creek management area. This, in turn, may result is less contaminated sediment accumulation at the mouth of the Ballona Creek Estuary, and a lower probability for toxicological impacts from sediment contaminants.

4.2.1.4 Source of Contamination

As described in Section 5.2.1, several measures are in progress to reduce contaminant loading to the Marina del Rey/ Ballona Creek area. Success of these programs could result in improved water quality and lower concentrations of contaminants in the sediments.

4.2.1.5 Biological Community

Significant changes in the biological community within the Marina del Rey/Ballona Creek dredge management areas are not expected in the next 20 years because neither the habitats present in the area, nor the sources and physical characteristics of the sediments are expected to change significantly within that time period.

4.2.2 *San Pedro Bay – Port of Los Angeles*

Future, without-project conditions for dredging and disposal activities within San Pedro Bay are evaluated separately for the POLA and POLB. This section details potential future conditions for the POLA.

Perhaps the two biggest factors affecting future conditions within the POLA include the development of a watershed management plan for the Dominguez Channel and remediation of the Consolidated Slip. Both areas are considered sinks of historically contaminated sediments and, once remediated, will greatly improve the overall quality of dredge material within this portion of the Study Area. Other activities include ongoing port capital improvement projects and deepening of the main navigation channel into the Port.

<u>Dominguez Channel Watershed Management Plan</u>
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.

Dominguez Channel and Consolidated Slip Sediment Remediation

The Consolidated Slip is located at the mouth of the Dominguez Channel at the point that it enters San Pedro Bay in the POLA. The sediments in the channel and the Consolidated Slip are considered to be some of the most contaminated in the County. Elevated concentrations heavy metals, Polycyclic Aromatic Hydrocarbons (PAHs), Polychlorinated Biphenyls (PCBs), and Dichlorodiphenyltrichloroethane (DDT) are present in the sediments as a result of historical storm water runoff and discharge from the former Montrose Chemical plant in Torrance (DDT source).

The POLA, EPA and the LARWQCB are currently conducting investigations to map the nature and extent of sediment contamination in the Consolidated Slip, and to develop remediation alternatives for sediment removal and/or treatment. Concurrently, studies are underway to remediate the Dominguez Channel upstream of the Consolidated Slip. Thus far, storm drain sediments have been removed and confirmatory sampling is underway to determine if additional remediation is necessary.

Port of Los Angeles Capital Improvements

The POLA is currently in the process of designing and implementing several large capital improvement projects along its waterfront areas. One such project is the San Pedro Waterfront Promenade Project which will enhance and re-develop the San Pedro shoreline area from the Vincent Thomas Bridge all the way out to the Cabrillo Fishing Pier. Groundbreaking for this project is expected in the spring of 2004. Other capital improvement projects are expected at berths 145 to 147, 173 to 176, 206 to 209, and 226 to 236 in 2005; berths 122 to 129 in 2007; berths 214 to 218 in 2008; and berth 139 in 2009.

The on-going POLA Channel Deepening Project will increase the current depth of the federal navigation channel of 13.7 to 16.2 meters, mean lower low water (MLLW) to accommodate larger container vessels. The project began in September 2002 and will continue into 2005 and entail dredging approximately 6,116,500 m^3 (8 million cy) from the channel and berths. Disposal locations include: 1,146,800 m^3 (1.5 million cy) at the Southwest Slip West, 688,100 m^3 (0.9 million cy) at the Southwest Slip East, 76,500 m^3 (0.1 million cy) at the Eelgrass Shallow Water Habitat, 1,223,300 m^3 (1.6 million cy) at the Pier 300 expansion, 2,217,200 m^3 at the Pier 400 Submerged Material Storage Site, and 764,600 m^3 (1 million cy) at the Cabrillo Shallow Water Habitat (CSWH) (USACE 2002).

4.2.2.1 Source of Material

The sources and volume of sediment transported to the POLA portion of San Pedro Bay is not expected to change significantly over the next 20 years because the majority of the material is brought in from external sources to the bay or through the Federal Breakwater. With continued deepening of the federal navigation channel there may actually be an increase in the potential for it to act as a sink and transport mechanism for new material into the container terminal areas.

Changes in sediment source loading from the Dominguez Channel watershed are not expected to result in significant changes over the next 20 years. Perhaps the most significant change will be the eventual remediation of contaminated sediments from the Consolidated Slip. This step would significantly reduce the amount of *in-situ* contaminated sediment available for re-mobilization to the rest of the POLA Study Area.

4.2.2.2 Physical Characteristics

Because the source of sediments transported to the POLA portion of San Pedro Bay is not expected to change significantly in the next 20 years, the physical characteristics of this material is also not expected to change significantly. Sediment grain size ranges presented in Section 4 will likely continue to be present in future years. Capital improvement projects are expected to continue but at a slower rate as today, generating roughly the same type of material, and routine maintenance of the wharf structures will occur on an as-needed basis, like they do today.

4.2.2.3 Chemical and Toxicological Characteristics

As legacy contamination areas like Consolidated Slip are cleaned up, and new sources of contamination are minimized through the implementation of watershed management plans and TMDLs on the Dominguez Channel, the overall volumes of contaminated sediments are expected to drop over the next 20 years. With this drop in overall chemical concentrations should be a drop in the incidence of adverse toxicological responses associated with those contaminants.

4.2.2.4 Source of Contamination

As mentioned in the two previous sections, measures are in place to reduce chemical contamination to San Pedro Bay by implementing TMDLs for chemicals present in the Dominguez Channel watershed, and by remediating legacy sediment contamination in areas like the Consolidated Slip. Over time, as these measures are implemented, a shift in the overall source of contamination might occur from more point source type areas to more non-point, watershed related sources.

4.2.2.5 Biological Community

Significant changes in the biological community within the POLA dredge management areas are not expected in the next 20 years because neither of the habitats present in the area, nor the sources and physical characteristics of the sediments are expected to change significantly within that time period. As overall contaminant levels in the area continue to decline, the biological community should continue to thrive.

4.2.3 *San Pedro Bay – Port of Long Beach*

As described in Section 5.2.2, future, without-project conditions for dredging and disposal activities within San Pedro Bay are evaluated separately for the POLA and POLB. This section details potential future conditions for the POLB.

The single biggest influence on future conditions within the POLB is the development of management plans for the Los Angeles River, which flows into San Pedro Bay just south of the port's lease hold area. Watershed-specific initiatives include the Sub-Watershed Management Plans, the Upper Los Angeles River Watershed Urban Runoff Pollution Removal Projects, and the TMDL projects described in Section 5.2.

<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 LARWQCB 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 LARWQCB with the participation of the USACE, County, tributary cities, and other stakeholders.

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

The Upper Los Angeles River Watershed Urban Runoff Pollution Removal Projects 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.

<u>Port of Long Beach Capital Improvements</u>

Capital improvement projects expected at the POLB include Pier J, Pier T and the Back Channel Navigational Improvements in 2004; Pier S in 2005; a LNG terminal on the former Navy Mole, a liquid bulk terminal and Pier E in 2006; and Pier F in 2008.

4.2.3.1 Source of Material

Like with the POLA, the dominant source of sediments transported to the POLB is not expected to change significantly in the next 20 years. The predominant source of sediment is still expected to be associated with inflow within the federal navigation channel arriving through the Queen's Gate opening in the Federal Breakwater. A smaller source of material to the area expected to continue in the future is runoff from the LARE which discharges to the south of the harbor complex.

4.2.3.2 Physical Characteristics

Because the source of sediments transported to the POLB portion of San Pedro Bay is not expected to change significantly in the next 20 years, the physical characteristics of this material is also not expected to change significantly. Sediment grain size ranges presented in Section 4 will likely continue to be present in future years. Capital improvement projects are expected to continue but at a higher rate as today, generating more but roughly the same type of material, and routine maintenance of the wharf structures will occur on an as-needed basis, like they do today.

4.2.3.3 Chemical and Toxicological Characteristics

As legacy contamination areas like the former Navy mole area are cleaned up, and new sources of contamination are minimized through the implementation of watershed management plans and TMDLs on the LARE, the overall volume of contaminated sediments is expected to drop over the next 20 years. With this drop in overall chemical concentrations should be a drop in the incidence of adverse toxicological responses associated with those contaminants.

4.2.3.4 Source of Contamination

The sources of contamination to dredge material in the POLB portion of San Pedro Bay are not expected to change significantly in the next 20 years. Contaminant runoff into the Los Angeles River will likely continue and these contaminants will likely end up attached to fine grained particles accumulated within the port berth areas. It is anticipated, however, that during that time some of the historical contamination areas may be cleaned up and thus no longer able to remobilize into the system.

4.2.3.5 Biological Community

Significant changes in the biological community within the POLB dredge management areas are not expected in the next 20 years because neither the habitats present in the area, nor the sources and physical characteristics of the sediments are expected to change significantly within that time period. As overall contaminant levels in the area continue to decline, the biological community should continue to thrive.

4.2.4 *San Pedro Bay – Los Angeles River Estuary*

Future, without-project conditions for the LARE are almost exclusively dependent on the implementation of the WMIs described in Section 5.2.3 for the Los Angeles River. Other factors are present that could affect the need for dredging in the future (e.g., continued vessel operations at the Queensway Marina), but they will not have any effect on the characteristics of the dredge material itself.

4.2.4.1 Source of Material

Like with the two Ports, the dominant source of sediments transported to the LARE is not expected to change significantly in the next 20 years. The predominant source of sediment is still expected to be associated with storm water runoff during flood events.

Several management initiatives are in progress such as the Sub-Watershed Management Plans for the Compton Creek, Arroyo Seco, and Rio Hondo Watersheds; and the Upper Los Angeles River Watershed Urban Runoff Pollution Removal Projects which may yield a reduction in overall sediment source loading to the Los Angeles River and ultimately the LARE.

4.2.4.2 Physical Characteristics

Because the source of sediments transported to the Los Angeles River is not expected to change significantly in the next 20 years, the physical characteristics of this material is also not expected to change significantly. Sediment grain size ranges presented in Section 4 will likely continue to be present in future years.

4.2.4.3 Chemical and Toxicological Characteristics

In the future, as TMDLs and a watershed management plan are implemented for the Los Angeles River, there should be an overall net reduction in contaminants reaching the LARE. This overall net reduction in contaminants should equate to a lower probability for adverse toxicological impacts associated with dredge material from the LARE.

4.2.4.4 Source of Contamination

Despite the implementation of TMDLs and a watershed management plan, some contaminant runoff will still find its way into the Los Angeles River, and these contaminants will likely end up attached to fine grained particles accumulated in the LARE. The overall source of contamination will not change significantly in the next 20 years and will still be associated with storm water runoff. The difference may be, however, that future contamination may only be associated with high flow events and management plans may be in place to treat 100 percent of the low flow discharge.

4.2.4.5 Biological Community

Significant changes in the biological community within the LARE dredge management area are not expected in the next 20 years because neither the habitats present in the area, nor the sources and physical characteristics of the sediments are expected to change significantly within that time period. As overall contaminant levels in the Los Angeles River decline as a result of upstream management plans, the biological community should become more stable.

4.2.5 *San Pedro Bay – Alamitos Bay*

Future without project conditions for Alamitos Bay are not expected to differ greatly from current conditions because the area surrounding the bay is not heavily industrialized and there are no major new development projects planned that would significantly affect sediment and/or chemical loading to the bay.

4.2.5.1 Source of Material

The dominant source of sediments transported to Alamitos Bay is not expected to change significantly in the next 20 years. The predominant source of sediment is still expected to be associated with inflow within the navigation channel arriving through the entrance jetty. A smaller source of material to the area expected to continue in the future is runoff from the San Gabriel River which discharges to the south of the harbor entrance.

4.2.5.2 Physical Characteristics

Because the source of sediments transported to Alamitos Bay is not expected to change significantly in the next 20 years, the physical characteristics of this material is also not expected to change significantly. Sediment grain size ranges presented in Section 4 will likely continue to be present in future years.

4.2.5.3 Chemical and Toxicological Characteristics

The sediments routinely dredged from Alamitos Bay are rarely contaminated today and this characteristic is not likely to change in the future.

4.2.5.4 Source of Contamination

Source of contamination to the Alamitos Bay is not likely to change in the future.

4.2.5.5 Biological Community

Significant changes in the biological community within Alamitos Bay are not expected in the next 20 years because neither the habitats present in the area, nor the sources and physical characteristics of the sediments are expected to change significantly within that time period.

4.3 Biological Resources in the Area

Biological resources in the Study Area are not expected to change significantly over the next 20 years as overall habitat quality; and water and sediment quality are not expected to degrade during that period. Potential increases in recreational and commercial fishing within the Study Area would likely be offset by additional conservation and breeding programs. With state and federal protection, the marine mammals inhabiting and migrating through the study will likely continue to thrive, as will the sensitive avian species. To offset recent construction of large terminal projects, the POLA has constructed wildlife mitigation areas (i.e., Pier 400 least tern nesting area and CSWH area). The future success of these areas may actually result in net increases in biological productivity to the Region.

4.4 Water Quality

Successful implementation of the regional TMDL programs described in Section 4.2 over the next 20 years should result in a net reduction in sediment and contaminant loading to the Study Area and an improvement in water quality. However, there is not enough information to provide quantifiable prediction on water quality improvement for the Study Area.

4.5 Recreational Resources

4.5.1 *Santa Monica Bay*

4.5.1.1 Marina del Rey

If USACE (through the local sponsors) cannot identify suitable disposal options for the contaminated dredged material in the future, continued shoaling of contaminated sediments in the harbor entrance channel under the future without-project conditions would eventually hinder the scheduling of maintenance dredging in an efficient manner. Beach-based use of Mother's Beach may also be impacted, should water quality within the harbor deteriorate beyond acceptable levels due to the reduction of tidal flushing as a result of entrance shoaling.

USACE has recently completed an FS to evaluate alternatives for reducing contaminated sediment shoaling at the mouth of Ballona Creek which blocks the southern portion of the Marina del Rey harbor entrance. If the selected alternative is implemented, the frequency of dredging needed to maintain the south entrance navigation channel would be reduced, thus providing greater flexibility in conducting dredging operations.

4.5.1.2 King Harbor

Historically, King Harbor did not need to be dredged frequently to keep the harbor entrance open. Hence, future commercial and recreational activities are not expected to have any significant changes.

4.5.2 *San Pedro Bay*

4.5.2.1 Port of Los Angeles and Port of Long Beach

In the next 20 years, both Ports will continue to maintain or deepen existing navigation channels to meet the needs of the increase in container ships and oil tankers that would require deeper drafts. Historically, the Ports have fulfilled dredging and disposal needs by dredging events with fill projects to balance the need of disposal and fill. However, it is expected that in the next 20 years, the Ports may begin to run out of available fill sites for contaminated dredge materials and will need to locate additional disposal areas. It is not expected that commercial and recreational activities will be significantly impacted within this period. In the long-term (beyond 20 years), the Ports may reach a stage when future capital improvement projects may not provide enough capacity to handle the dredged volumes required for maintenance dredging, and commercial activities will then be impacted.

4.5.2.2 Los Angeles River Estuary

Continued shoaling of contaminated sediments in the navigation channel under the future without-project conditions would eventually make dredging of the federal navigation channel difficult. However, continued shoaling may eventually result in the closure of Queensway Marina (also known as Catalina Landing) located adjacent to the LARE navigation channel. Operated by the City of Long Beach, the Queensway Marina serves passenger and charter services to Catalina Island.

The Long Beach Marinas (Long Beach Shoreline Marina, Rainbow Harbor Marina, and Alamitos Bay Marina) are planning to rebuild and replace the docks in the marinas. Slip sizes will be increased, thereby decreasing the total number of slips in the marinas. The Long Beach Shoreline and Rainbow Harbor marinas are scheduled to begin construction early 2004 with the loss of about 74 total slips.

4.5.2.3 Alamitos Bay

The City of Long Beach is expected to continue its dredging activities to maintain the inlet to Alamitos Bay and fulfill its navigation needs. Alamitos Bay Marina is scheduled to begin replacement of its docks in 2005. A total of approximately 300 slips will be lost, primarily slip sizes 9.1 meters or less.

4.6 Land Use

Since the Los Angeles Basin is already highly developed, the land use distribution presented in Section 4.7 is not expected to change significantly over the next 20 years.

4.7 Cultural Resources

No significant changes are expected to the cultural resources within the Study Area over the next 20 years.

4.8 Economic Analyses

For the POLA, POLB, and for Marina Del Rey, the continuation of maintenance dredging into the future is assumed. It is assumed that dredging at all sites will be maintained at such a level that there will not be any adverse impacts to either commercial or recreational activities. Under the future without project conditions, the costs can be said to be comprised of both the actual dredge and disposal costs as well as the study and regulatory costs that are associated with the completion and approval of the environmental reports that are requisite for dredge and disposal activity to go forward. These study and regulatory costs are the result of conducting and approving, for example, Environmental Impact Statements or Environmental Assessments of a particular dredge and disposal event. Of course, of these two components, the costs of the actual dredging and disposal of the sediment comprise the vast majority of total without project costs. Thus, the following discussion will focus on this cost element, and no attempt will be made at this point to quantify the future without project environmental study costs over the twenty-year study period.

Additionally, this study does not develop or include single estimates of the expected future without project dredging and disposal costs for the various locations. Instead, the analysis uses as a basis the cost estimates developed in a previous feasibility study as well as recent dredging and disposal event cost information as available, and simply provides a range of costs given various scenarios and assuming particular unit costs. It is expected that as the study moves forward a single most likely scenario for dredge material disposal will be developed.

Detailed cost information on dredging and disposal cost at the POLB and POLA were not available from the Ports themselves. USACE Coastal Engineering Section provided estimates of unit costs for these two locations as well as the estimates for Marina Del Rey and the LARE. From event to event there are, of course, large variations in the total cost of disposal of the dredged material, which depends on the choice or availability of disposal site and disposal method. The 2003 Marina Del Rey and Ballona Creek Feasibility Study (USACE 2003b) notes that historical dredging records indicate that ocean or beach disposal costs for clean material range from approximately $4/$m^3$ to as high as $31/$m^3$ in 2004 dollars, plus mobilization and demobilization costs. The report also estimates that the cost for dredging and disposal of contaminated material could be as much as $150/$m^3$ for any material that needed to be shipped to an upland disposal site such as the ECDC facility in Utah.

In general, the extent to which the contaminated dredge material from the study areas would have to be disposed of at an upland location, however, depends on the availability of sites of opportunity, such as local port projects that could accept the contaminated material as landfill. While upland disposal of contaminated dredge material does not appear to be imminently necessary, according to USACE Coastal Engineers, it may very well be that the ability to dispose of material in the medium and long-term future at local sites of opportunity will be diminished to an extent that makes some level of upland disposal necessary (for example, when further port expansion becomes infeasible given the location of the existing breakwater). The remainder of this section is concerned with describing the range of likely maintenance dredging and disposal costs for four study areas.

For Marina Del Rey, as detailed in Section 3.1 of this report, the total maintenance dredging volume between the years 1969 and 1999 was just less than 1.5 million m^3. It follows that the average annual maintenance dredging volume over this period was around 49,000 m^3 (approximately 95,000 per event). Maintenance dredging was conducted on average every four years over this thirty-year period, but every two years over the past decade. As indicated in Section 4.1 of this report, USACE expects the annual dredge volume at this site over the next twenty years to be between 50,000 and 100,000 m^3.

Employing unit cost estimates and dredge volumes developed in the 2003 FS (USACE 2003b), Table 4-3 shows that as the percentage of contaminated material disposed at an upland location ranges from zero to one-hundred, the annual dredge and disposal cost, holding all else constant and excluding mobilization, demobilization, and administrative and design costs, ranges from approximately $0.8 million to $4.8 million. Table 4-3 combines the range of expected dredge volumes with the possible percentages of upland disposal of contaminated sediment, resulting in a wide range of costs for the different scenarios. For example, under the least cost scenario, only 50,000 m^3 are dredged per year (100,000 per event), and all of the contaminated material is disposed of at a local site of opportunity – in this case the North Energy Island Borrow Pit (NEIBP).

Table 4-3 Estimated Future Maintenance Dredging Cost for Marina del Rey

Percent of Contaminated Sediment Disposed Upland	0	20	40	60	80	100
Marina Del Rey (25% contaminated) [1] Maintenance Costs If:						
Total Volume = 50,000 m^3	$775,000	$1,100,000	$1,425,000	$1,750,000	$2,075,000	$2,400,000
Total Volume = 100,000 m^3	$1,550,000	$2,200,000	$2,850,000	$3,500,000	$4,150,000	$4,800,000
Average Cost Per Year	**$1,162,500**	**$1,650,000**	**$2,137,500**	**$2,625,000**	**$3,112,500**	**$3,600,000**

1. Based on $14/$m^3$ dredge and ocean or beach disposal of clean material, and $20/$m^3$ of contaminated material to the NEIBP. Estimate taken from USACE 2003b, Operation and Maintenance, Table 5, and Attachment C, page 1, respectively.

Continuing, the difference between the low and high end of the range of likely costs shown in the table below is attributable to varying assumptions about the disposal method for the contaminated material. The low end of the specified cost range assumes disposal of the contaminated material at a contained ocean disposal site. At the highest end of this cost range, it is assumed that all contaminated material is disposed of at the ECDC landfill in Utah. Ocean or beach disposal is assumed for the clean material, at a cost of $14/$m^3$ (USACE 2003b).

According to the 2003 FS, the cost to dredge and dispose of the contaminated material at the upland location would be approximately $150/$m^3$, not including an additional approximate fifty percent for other costs such as supervision and administration, design, contingency, etc. The cost estimate that includes the upland disposal of all contaminated sediments effectively serves as an upper bound of the cost of dredging and disposal at the harbor, given that it is likely that at least some portion of the contaminated material would be able to be disposed in a less costly manner. The volume of contaminated material that can be disposed of in less costly manners depends, of course, on the available sites of opportunity. Importantly though, as the 2003 FS states, at this point the availability of sites of opportunity cannot be guaranteed into the future.

For the POLA, as detailed in Section 3.1 of this report, the total maintenance dredging volume between the years 1978 and 2002 was around 2 million m^3. It follows that the average annual maintenance dredging volume over this period was around 85,000 m^3. Over that period another approximately 58 million m^3 has been dredged as part of capital improvement projects at the POLA. As stated in Section 4.1 of this report, taking into account the POLA's expectations for the annual maintenance dredge volume over the next five years, USACE estimates the POLA's annual volume of contaminated dredge material to be between 44,000 and 85,000 m^3 over the next twenty years.

Actual average unit dredge and disposal data was not available from the POLA, but USACE Coastal Engineers indicate that a reasonable estimate of the unit cost, using data and prices from similar USACE dredge and disposal circumstances, is around \$11/m^3. In general, the total actual cost of dredging and disposal is highly variable because it depends on several factors including the level of contamination of the material, the dredge method, and the distance of the disposal site from the dredge location. Given, however, that POLA officials have indicated they will likely be able to accommodate all of their dredge material on-site, the total unit cost can be expected to be relatively stable over the next 20 years and less uncertain as compared to the dredging and disposal costs for Marina Del Rey and the LARE.

Importantly however, the ability of the POLA (as with the POLB) to accommodate the placement of contaminated material as part of land expansion or capital improvement projects is at least somewhat dependent on the future growth in trade at the POLA, which is, of course, tied to economic growth and international trade patterns. As with the other sites in the Study Area, dredge and disposal costs would increase significantly in the event that the contaminated material from maintenance dredging had to be disposed at an upland site, as opposed to being contained at the POLA. As an example, and as stated previously with regards to maintenance activity at Marina Del Rey, the 2003 FS estimates that the unit cost for dredging and disposal of contaminated material, with disposal at an upland facility, could be as much as \$150/m^3, not including administrative and other general costs.

Employing unit cost estimates for upland disposal developed in the 2003 FS (USACE 2003b), Table 4-4 shows that as the percentage of contaminated material disposed at an upland location ranges from zero to one-hundred, the annual dredge and disposal cost, holding all else constant and excluding mobilization, demobilization, administrative, design, and contingency costs, ranges from approximately \$.5 million to \$12.7 million. Table 4-4 combines the range of expected dredge volumes with the possible percentages of upland disposal of contaminated sediment, resulting in a wide range of costs for the different scenarios. For example, under the least cost scenario, only 44,000 m^3 are dredged per year (88,000 per event), and all of the contaminated material is disposed of at a local site of opportunity – for example, either at a Port landfill or the NEIBP. The highest cost scenario assumes all the dredge material is shipped to the ECDC landfill, at a cost of \$150/m^3.

Table 4-4 Estimated Future Maintenance Dredging Cost for Port of Los Angeles

Percent of Contaminated Sediment Disposed Upland	**0**	**20**	**40**	**60**	**80**	**100**
POLA (100% contaminated) [1] Maintenance Costs If:						
Total Volume = 44,000 m^3	\$484,000	\$1,707,200	\$2,930,400	\$4,153,600	\$5,376,800	\$6,600,000
Total Volume = 85,000 m^3	\$934,100	\$3,294,900	\$5,655,700	\$8,016,400	\$10,377,200	\$12,738,000
Average Cost Per Year	**\$709,000**	**\$2,501,000**	**\$4,293,000**	**\$6,085,000**	**\$7,877,000**	**\$9,669,000**

1. Based on \$11/m^3 disposal of contaminated material to a local site of opportunity. Source: USACE Coastal Engineering.

For the POLB, as detailed in Section 3.1 of this report, the total volume of maintenance dredge material between the years 1976 and 2003 was just less than 2 million m^3. It follows that the average annual maintenance dredging volume over this period was just over 71,000 m^3. Over that period another approximately 13 million m^3 has been dredged as part of capital improvement projects at the POLB. As stated in Section 4.1 of this report, taking into account the POLB's expectations for the annual dredge volume over the next four years, USACE estimates the POLA's annual volume of contaminated dredge material to be between 31,000 and 71,000 m^3 over the next twenty years.

As with the POLA, actual average unit dredge and disposal data was not available from the POLB, but USACE Coastal Engineers indicate that a reasonable estimate of the unit cost, using data and prices from similar USACE dredge and disposal circumstances, is around \$11/m^3. In general, the total actual cost of dredging and disposal is highly variable because it depends on several factors including the level of contamination of the material, the dredge method, and the distance of the disposal site from the dredge location. Given, however, that POLA officials have indicated they will likely be able to accommodate all of their dredge material on-site, the total unit cost can be expected to be relatively stable over the next 20 years and less uncertain as compared to the dredging and disposal costs for Marina Del Rey and the LARE.

As with the other sites in the Study Area, dredge and disposal costs would increase significantly in the event that the contaminated material from maintenance dredging had to be disposed at an upland site, as opposed to being contained at the POLB. The 2003 FS also estimates that the unit cost for dredging and upland disposal of contaminated material could be as high as \$150/m^3.

Employing unit cost estimates for upland disposal developed in the 2003 FS (USACE 2003b), Table 4-5 shows that as the percentage of contaminated material disposed at an upland location ranges from zero to one-hundred, the annual dredge and disposal cost, holding all else constant and excluding mobilization, demobilization, administrative, design, and contingency costs, ranges from approximately $.3 million to $10.7 million. Table 4-5 combines the range of expected dredge volumes with the possible percentages of upland disposal of contaminated sediment, resulting in a wide range of costs for the different scenarios. For example, under the least cost scenario, only 31,000 m^3 are dredged per year (62,000 per event), and all of the contaminated material is disposed of at a local site of opportunity – for example, either at a Port landfill or the NEIBP. The highest cost scenario assumes all the dredge material is shipped to the ECDC landfill, at a cost of $150/$m^3$.

Table 4-5 Estimated Future Maintenance Dredging Cost for Port of Long Beach

Percent of Contaminated Sediment Disposed Upland	0	20	40	60	80	100
POLB (100% contaminated) [1] Maintenance Costs If:						
Total Volume = 31,000 m^3	$341,000	$1,202,800	$2,064,600	$2,926,400	$3,788,200	$4,650,000
Total Volume = 71,000 m^3	$780,900	$2,754,400	$4,727,900	$6,701,500	$8,675,000	$10,648,500
Average Cost Per Year	**$560,900**	**$1,978,600**	**$3,396,300**	**$4,813,900**	**$6,231,600**	**$7,649,300**

1. Based on $11/$m^3$ disposal of contaminated material to a local site of opportunity. Source: USACE Coastal Engineering.

For the LARE, as detailed in Section 3.1 of this report, the total volume of material from maintenance dredging between the years 1979 and 2001 was just over 1.2 million m^3. It follows that the average annual maintenance dredging volume between 1990 and 2001 was around 86,000 m^3. Maintenance dredging was undertaken approximately every two years over the past decade. USACE and the City of Long Beach expect the annual maintenance dredging volume at this site over the next twenty years to be around 86,000 m^3.

As in the case of Marina Del Rey, it is important to note that the total cost of dredging and disposal of the LARE is highly variable because it depends, among other things, on the volume and level of contamination of the material and the location of the various disposal sites. Using historical dredging records for Marina Del Rey as cited in the 2003 FS indicates that ocean or beach disposal costs for clean material range from approximately $4/$m^3$ to as high as $31/$m^3$ in 2004 dollars. The 2003 report also estimates that the unit cost for dredging and disposal of contaminated material could be upwards of $150/$m^3$ for material that needed to be shipped to an upland disposal site. Whether the contaminated material would have to be disposed of at an upland location, however, depends on the availability of sites of opportunity, such as local port projects that could accept the contaminated material as landfill. USACE Operations estimates that, on average, 30 percent of the material dredged from the LARE classifies as contaminated.

While upland disposal of contaminated dredge material does not appear to be imminently necessary, according to USACE Coastal Engineers, it may very well be that the ability to dispose of material in the medium and long-term future at local sites of opportunity will be diminished to an extent that makes some level of upland disposal necessary (for example, when further port expansion becomes infeasible given the location of the existing breakwater). In the event that all of the contaminated sediments must be disposed of at an upland landfill (the ECDC Landfill in Utah is assumed), the annual real total dredge and disposal cost per event could be nearly $3 million (assuming ocean disposal of all clean material at $19/m^3 and upland disposal of contaminated material, which is assumed to constitute 30 percent of the dredge volume, at $150/m^3 plus administrative and other general costs). This estimate effectively serves as an upper bound of the cost of dredging and disposal at the harbor, given that it is likely that at least some portion of the contaminated material would be able to be disposed in a less costly manner, depending on the available sites of opportunity and the degree of material contamination.

Employing unit cost estimates for upland disposal developed in the 2003 FS (USACE 2003b), Table 4-6 shows that as the percentage of contaminated material disposed at an upland location ranges from zero to one-hundred, the annual dredge and disposal cost, holding all else constant and excluding mobilization, demobilization, administrative, design, and contingency costs, ranges from approximately $1 million to $4.6 million. Table 4-6 combines the expected dredge volume with the possible percentages of upland disposal of contaminated sediment, resulting in a range of costs for the different scenarios. For example, under the least cost scenario, all of the 86,000 m^3 are disposed of at a local site of opportunity; none of the contaminated sediment is shipped upland for disposal. The highest cost scenario assumes all the contaminated sediment (assumed to constitute 30 percent of the total volume of sediment dredged) is shipped to the ECDC landfill, at a cost of $150/m^3. Finally, it should be noted that Section 4.1 of this report states that in may not be possible to separate the clean material from the contaminated, in which case the percent contaminated would be 100 percent, instead of the 30 percent that is assumed here.

Table 4-6 Estimated Future Maintenance Dredging Cost for Los Angeles River Estuary

Percent of Contaminated Sediment Disposed Upland	0	20	40	60	80	100
LARE (30% contaminated) [1] Maintenance Costs If:						
Total Volume = 86,000 m^3	$1,032,000	$1,744,100	$2,456,200	$3,168,200	$3,880,300	$4,592,400

1. Based on $12/m^3 dredge and disposal of all material to a local site of opportunity. Source: USACE Coastal Engineering.

4.9 Regulatory Approval Process

Regulatory approval processes will remain unchanged unless Congress or the State Legislature (where applicable) acts to modify the statues themselves. Additional technical information may result in modifications to the Inland Testing Manual (ITM) and Green Book to update the scientific approach embodies within those documents.

The CSTF has created a streamlined Master Dredging Permit application to enable dredging applicants within the Region to generate only one application suitable for all regulatory agencies review. The Master Dredging Permit does not alter the statutory review process itself. Additionally, the CSTF Advisory Committee guidelines and procedures enable all interested parties in the Los Angeles Region to review and provide comments on potentially large-scale or controversial dredging projects.

The DMMP would afford the USACE a standing programmatic level analysis of potential options for handling dredged material, both clean and contaminated. The Corps Regulatory Program or Planning Division could rely on the DMMP in the future for the overall National Environmental Policy Act (NEPA), CWA and 103 analyses of particular options, and thereby use the DMMP to streamline and improve case-specific applications for particular scenarios.

4.10 Dredging and Disposal Best Management Practices

The selection of dredging and disposal BMPs will likely become more advanced in the coming years as the CSTF completes preparation of its Long-Term Management Strategy for contaminated sediments in the Region. As part of that process guidelines for selecting appropriate BMPs were developed and are summarized in this section for reference.

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 4-1 and Table 4-7. Using the flow chart in Figure 4-1, 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 4-7 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 providing these tools is to provide the user sufficient information for proactively identifying potential environmental concerns and recommending BMPs to minimize the impacts.

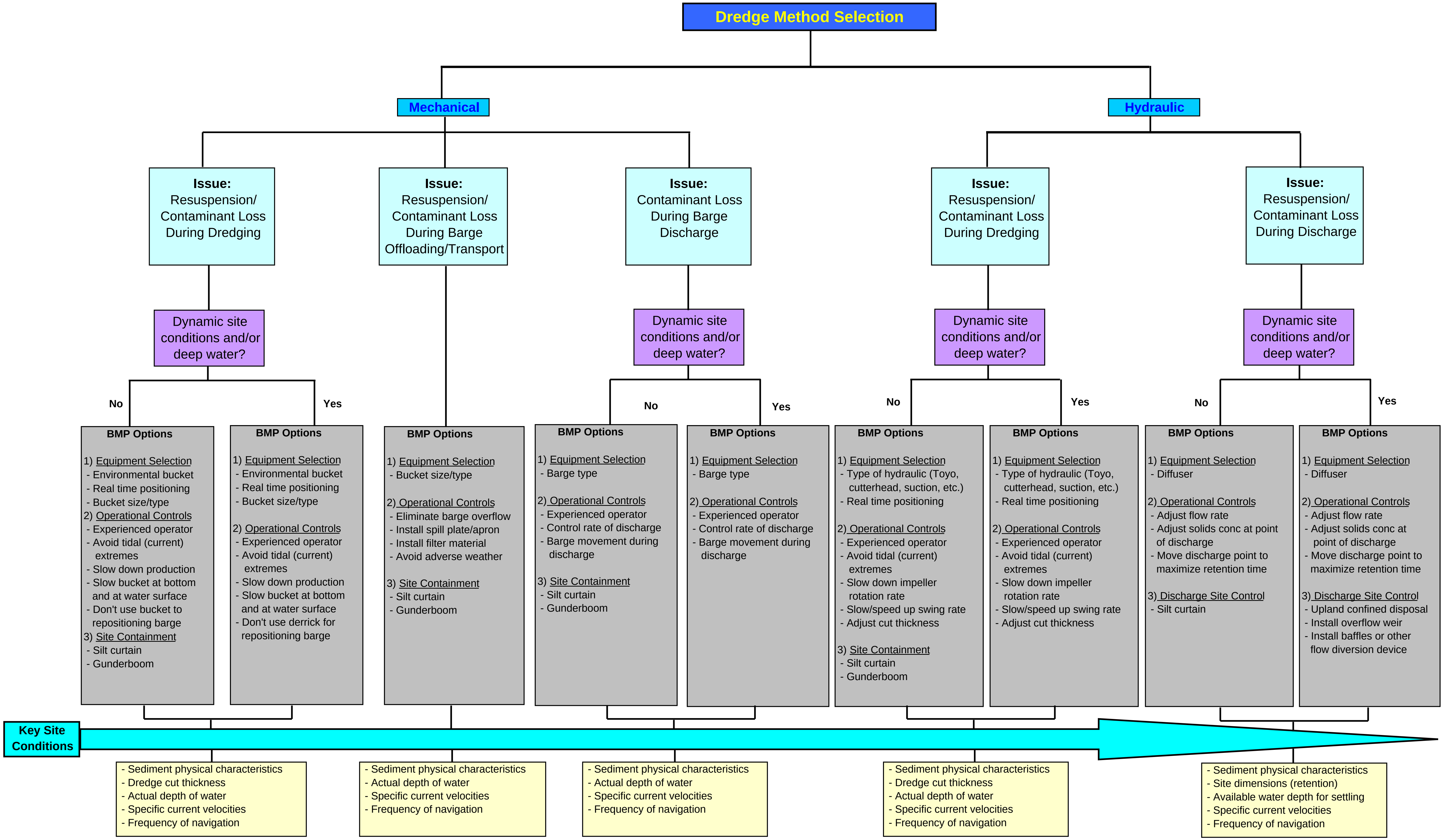


Figure 4-1
Guide for BMP Selection for Contaminated Sediments

Table 4-7 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)
Slow down production rate (e.g., slow bucket	None	May reduce sediment loading to water column	Slower production rate means increased project duration and	Typically used as a contingency measure when	Project schedule is tight and slowing production is not an option (e.g.,

Table 4-7 BMP Toolbox for Dredging Contaminated Sediments

BMP Option	Technical Limitations/ Site Constraints	Potential Advantages	Potential Disadvantages	Effective Applications	Ineffective Applications
near bottom when lowering and near surface when raising)		May reduce sediment resuspended from bucket impact on bottom and drainage at the water surface	increased project cost	water quality criteria can not be achieved during standard dredging	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 4-7 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
Hydraulic Dredging, Equipment Selection					
Select appropriate	Dependent upon site	Maximize production, minimize	Specifying hydraulic equipment	Any hydraulic dredging	None

Table 4-7 BMP Toolbox for Dredging Contaminated Sediments

BMP Option	Technical Limitations/ Site Constraints	Potential Advantages	Potential Disadvantages	Effective Applications	Ineffective Applications
type of hydraulic dredge (suction, cutterhead, dustpan, toyo, etc.)	conditions and sediment physical characteristics Requires dredging experience	potential sediment loss	to be used may limit available contractors	project	
Use 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 4-7 BMP Toolbox for Dredging Contaminated Sediments

BMP Option	Technical Limitations/ Site Constraints	Potential Advantages	Potential Disadvantages	Effective Applications	Ineffective Applications
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	
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.	
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	
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	
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	
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	

5 FORMULATION OF ALTERNATIVES

5.1 Statement of Problem

The U.S. Army Corps of Engineers, Los Angeles District (USACE) is charged with the mandated responsibility of maintaining safe navigation in the harbors and marinas throughout the U.S., including the Los Angeles Region to provide safe and efficient waterborne transportation systems (channels, harbors, waterways) for movement of commerce, national security needs and recreation. In the Los Angeles Region, the Marina del Rey and Los Angeles River Estuary navigation channels routinely shoal in from sediment loads carried down Ballona Creek and the LA river, respectively, where the USACE is responsible for its removal. Historically, these two areas have been dredged on a periodic basis (three and two years, respectively) in order to maintain safe navigational depths. However, since the mid 1980s, sediments from Marina del Rey and the LA River have been shown to be contaminated, making material disposal problematic and costly. This, in turn, has resulted in difficulties maintaining the USACE optimal dredging schedule.

Similar problems exist with dredge material disposal from harbor maintenance dredging projects at the Port of Los Angeles (POLA) and the Port of Long Beach (POLB) where sediments at a substantial number of inner harbor locations have also been found to be contaminated. The lack of regional suitable disposal methods for clean and contaminated dredged material inhibits dredging operations required for maintaining safe navigation, harbor/marina accessibility, and Port operations, which in turn adversely affects commerce and economic development in the Region. The Dredged Material Management Plan (DMMP) is developed to provide a long term management strategy to add certainty to dredging and disposal activities from navigation channels and Port facilities within the Region in an environmentally acceptable and economically practicable manner.

5.2 National Objective

The USACE planning process is grounded in the economic and environmental Principles and Guidelines (P&G), which were promulgated in 1983 via the Water Resources Council. The P&G are comprised of two parts: The Economic and Environmental Principles for Water and Related Land Resources Implementation Studies, and Environmental Guidelines for Water and Related Land Resources Implementation Studies. Together, both provide the framework for USACE water resource planning studies. Within this framework, the USACE seeks to balance economic development and environmental needs as it addresses water resource problems (USACE 2000e).

The P&G state that the federal objective of water and related land resources planning is to contribute to National Economic Development (NED), while preserving environmental resources consistent with established laws and policies. Contributions to NED include area increases in the net value of the national output of goods and services, expressed in monetary units, and are the direct net benefits that accrue in the planning area and the rest of the Nation. Plans are formulated to take advantage of opportunities in ways that contribute to the NED objective.

5.3 Study Planning Objectives

The primary planning objective for the DMMP FS is to develop a plan to aid in facilitating removal and disposal of clean and contaminated sediments from the navigation channels and port facilities in the Region in an environmentally acceptable and economically practicable manner. Specific planning objectives include the following:

- Review established dredged material disposal sediment threshold levels to determine applicability for regional use;
- 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 Corps' Operations and Maintenance program;
- Identify environmental restoration and/or enhancement opportunities that are directly related to 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) best management practices 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 EIS/EIR to implement regional disposal management alternatives; and
- Recommend a regional dredged material management plan that is consistent with the Los Angeles Region's Contaminated Sediments Task Force Implementation Strategy.

To ensure preservation of environmental resources, all NED alternatives will undergo both National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA) review processes to identify and disclose information on the potentially significant environmental effects of the alternatives and recommended plan.

5.4 Planning Opportunities & Constraints

According to USACE (2000e), planning opportunities should be framed in terms of the federal objective and the specific study planning objectives. Furthermore, planning opportunities should be defined in a manner that does not preclude the consideration of all potential alternatives to solve a problem. For the DMMP Feasibility Study (FS), Planning Opportunities include the following:

- Opportunity to coordinate dredging activities and disposal opportunities with other state and federal agencies (e.g., U.S. Environmental Protection Agency, State Water Resources Control Board, California Coastal Commission), regional sediment management groups (e.g., CSTF), and local project sponsors (e.g., ports of Los Angeles and Long Beach, City of Long Beach, County of Los Angeles)
    - Biannual meetings of the CSTF management and implementation committees;
    - Meetings of the California Regional Sediment Management team; and
    - Annual workshops between CSTF members and regional watershed management authorities.
- Opportunity to evaluate identified dredge material management alternatives in coordination with the preparation of the Contaminated Sediments Task Force (CSTF) Strategy document for managing contaminated sediments;
    - Ability to incorporate information developed for the CSTF related to identifying potential dredge material management alternatives for the Region;
    - Use of data collected during a series of Pilot Studies to evaluate the effectiveness and environmental impacts associated with aquatic disposal and capping, cement stabilization, sediment washing, and sediment blending as potential dredge material management alternatives for the Region;
    - Use of techniques developed for selecting appropriate disposal alternatives; and
    - Use of data developed related to dredging BMPs and field monitoring.

Based on the assessment of the exiting conditions and historical dredging and disposal practices in the LA Region, and the coordination of the ongoing efforts of the CSTF Strategic Planning, a list of potential solutions to help the development of a DMMP for the region is identified. Potential solutions to alleviate difficulties with dredging and disposal of contaminated sediments for the LA Region are identified for this DMMP (F3) Planning Study. These potential solutions will be described in detail in Section 5.6 and will be preliminary evaluated according the evaluation criteria discussed in Section 5.5.

Planning constraints are restrictions that limit the planning process. Alternative plans are formulated to achieve the planning objectives and avoid violating the planning constraints. Although specific to each study, typical planning constraints include engineering, economical, financial, environmental, public views and policies. These constraints can be grouped into two categories: resources and legal and policy constraints. Resource constraints include those associated with limits on knowledge, expertise, experience, ability, data, information, money and time. Legal and policy constraints refer to those defined by law, USACE policies and guidance documents. Specific study constraints for the DMMP FS including the following:

- Data gaps exist for some of the dredge material treatment alternatives related to field implementation under local, “real world” scenarios;
- Funding for the DMMP FS is limited, requiring the use of data generated for studies conducted in other regions as surrogates for technical research within the Study Area;
- Long-term monitoring for one of the dredge material disposal alternatives (confined aquatic disposal [CAD] site disposal) has not yet be completed, requiring an assumption on suitability based on data collected to date;
- Near shore property suitable for treating and or storing dredge materials within the Study Area is very limited, which limits equal evaluation of all alternatives related to implementability of the option; and
- Uncertainty in planning for large port fill projects creates uncertainty in determining need for and size of future disposal areas or treatment facilities.

5.5 Evaluation Criteria

U.S. Army Corps of Engineers, Los Angeles District (USACE) Planning Guidance Notebook (USACE 2000e) policy states that each alternative plan shall be formulated in consideration of four evaluation criteria, as outlined in the Principles and Guidelines (P&G). They are: completeness, efficiency, effectiveness, and acceptability.

According to USACE (2000e), completeness is the extent to which the alternative plans provide and account for all necessary investments or other actions to ensure the realization of the planning objectives, including actions by other federal and non-federal entities. Effectiveness is the extent to which the alternative plans contribute to achieving the planning objectives. Efficiency is the extent to which the alternative plan is the most cost effective means of achieving the objectives. Acceptability is the extent to which the alternative plans are acceptable in terms of applicable laws, regulations, and public policies. Lastly, appropriate mitigation of adverse effects is an integral component of each alternative plan.

To provide more specificity to the evaluation criteria requirements stated in the P&G, additional, engineering-related criteria were also developed. “Engineering” and “economics” criteria were added to fulfill the requirements for “completeness”, “efficiency” and “effectiveness” categories; and “environmental” and “public views” were added to fulfill the “acceptability” category. Each is described in more detail in Sections 5.5.1 and 5.5.2.

As a reminder, the DMMP FS is different from a typical USACE FS, which normally involves the selection of one best alternative out of several feasible alternatives to solve a single defined objective. Rather, the DMMP FS is developed to formulate a strategy for the management of dredged material for the entire Los Angeles Region (Region). Since each dredging project is unique and has its own set of objectives that need to be met, the best alternative for each dredging project can be very different.

5.5.1 *Completeness, Effectiveness, and Efficiency*

5.5.1.1 Engineering

The recommended alternatives presented should be complete and sound, and in sufficient detail so that environmental and economic investigation on a feasibility level can be completed. Additionally, the recommended alternatives should be technically feasible and implementable.

5.5.1.2 Economics

Any potential project that is in the federal interest must display feasibility by satisfying the benefit-cost (B/C) criteria. Generally, this ratio must be greater than one to allow federal participation for continued study and on any project proposal.

5.5.2 *Acceptability*

5.5.2.1 Environmental

Applicable environmental requirements must be met for a feasibility level study. Environmental acceptability must be ascertained; and adverse impacts should be avoided if possible, or minimized, if avoidance is not possible. Lastly, a specific alternative has to be evaluated such that it would not pose short-term and/or long-term environmental impacts.

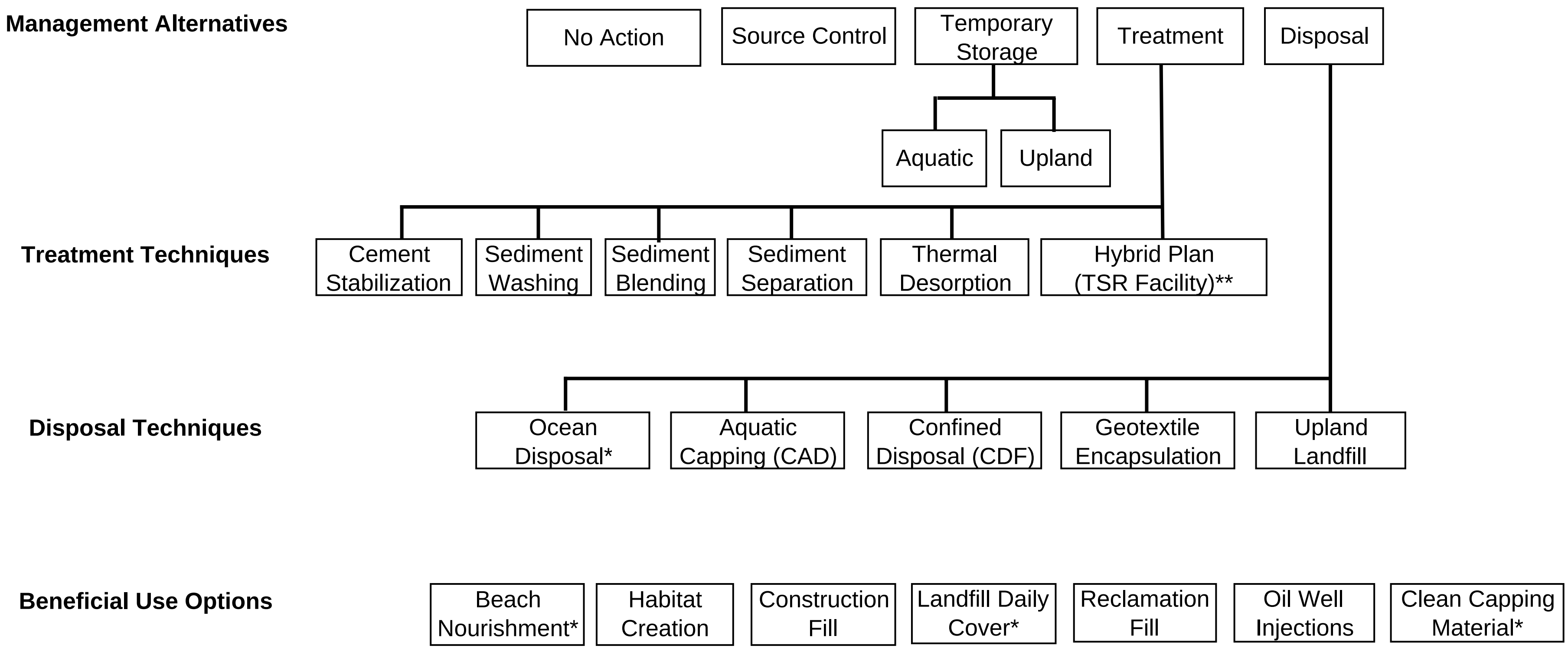
5.5.2.2 Public Views

The alternative options and plans should be acceptable to the local residents, agencies, organizations, and non-federal sponsors, as well as interested state and federal agencies.

5.6 Preliminary Alternatives Considered

The purpose of this F3 Baseline Evaluation Report is to preliminarily review all relevant and feasible management alternatives for meeting the National and Planning Objectives while taking into consideration the Planning Opportunities and Constraints provided in Section 5.4. The preliminary alternatives considered include no action, source control, temporary storage, treatment, and disposal. Combinations of these alternatives may also be feasible for meeting the National and Planning Objectives. For example, combining source control with the development of a regional treatment and temporary storage facility may provide a more cost effective alternative than if any one of the alternatives were selected individually.

Within these over-reaching alternatives, several implementable technologies and/or projects are considered which represent the current options available within the region. A summary of each alternative is provided; a more detailed presentation will be included in the Feasibility (F4) Evaluation for those alternatives that are selected for further evaluation. Figure 5-1 presents the range of alternatives and implementable technologies/projects considered in this study.



* Only for use with clean sediment

** TSR Facility refers to Treatment, Storage & Reprocessing. May include one or many of the treamtent alternatives to produce beneficial use products from unsuitable dredge material.

Figure 5-1

Los Angeles Regional DMMP Feasibility Study Preliminary Alternatives

5.6.1 *No Action*

The No Action alternative permits the existing conditions of the problems associated with contaminated sediments as presented under Statement of Problem to persist without implementing a long-term management strategy (i.e., the LA Regional DMMP). The No Action alternative is required under the National Environmental Policy Act (NEPA), and is used as a baseline alternative for the evaluation and comparison of all alternatives developed. For this study, the No Action alternative assumes that dredging at the Port of Los Angeles (POLA) and Port of Long Beach (POLB) will continue since historically they have been able to manage their disposal needs by linking dredging activities with capital improvement projects to provide for material disposal. Under the No Action scenario, there will be no readily available, low-cost, disposal options for the Corps maintenance dredging at Marina del Rey and Los Angeles River Estuary (LARE), and for the City of Long Beach to dredge its marinas.

5.6.2 *Source Control*

Sediments deposited in 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 LARE is a result primarily from 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 watersheds in the Los Angeles Region (Region) include erosion from construction sites, land development, foothills, canyons, and burned areas. For the Region, over 100 debris 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 2001). 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. By implementing monitoring and containment of contaminated sediment-producing sources within the watersheds, the option reduces the volume of contaminated sediment discharged to the coast, although it also tends to deprive 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 as a way to alleviate the problems with sedimentation in the Marina del Rey entrance channel. One of the alternatives under consideration is the construction of in-stream sediment traps to collect the 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. Source control was determined to be an implementable alternative for meeting the National and Planning Objectives, and is recommended for further evaluation.

5.6.3 *Temporary Storage*

Occasionally, clean and contaminated dredged 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 either in aquatic or upland facilities may be a viable option, pending appropriate environmental review.

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 unconfined, open-water placement of dredged material in the near-shore environment, aquatic stockpiling would be subject to the same regulatory constraints and requirements as for all discharges of dredged material in the near-shore, which calls for meeting the requirements of the Inland Testing Manual (ITM).

Emphasis in the suitability analysis would be placed on both short-term impacts due to double handling in the form of placement and re-dredging within a relatively short period of time, and long-term bioavailability in case materials are not immediately utilized. These constraints would likely limit this option to include only clean to mildly contaminated sediments that are otherwise suitable for unconfined discharge according to the testing requirements, unless some form of isolation were included (e.g., a cap) during the storage process. Regulatory agencies would work to generate a Site Maintenance and Monitoring Program (SMMP) to monitor long-term bathymetry and bioavailability of stockpiled materials. Additional requirements would prevent the creation of navigational hazards as a result of the alteration of existing nearshore bathymetry, among other aspects.

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 Anchorage Road dredge material holding basin in the POLA, which has been receiving dredged materials from various berthing basins in Los Angeles Harbor. Placement of dredged materials at upland facilities would be subject to the constraints of the Upland Testing Manual (UTM), and other regulatory constraints and requirements that are in place for these facilities, such as the regulation of return water from upland dewatering sites, which is considered a regulated discharge under the Clean Water Act (CWA). New stockpiling sites could include confined disposal facilities, and new holding basins 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 have to be integrated into storage planning to ensure efficient use and uninterrupted service of existing and new facilities.

Both aquatic and upland temporary storage were determined to implementable alternatives for meeting the National and Planning Objectives, and are recommended for further evaluation.

5.6.4 *Treatment*

For this study, treatment refers to any method used to decontaminate, bind, or enhance previously unsuitable dredge material to make it more suitable for beneficial reuse elsewhere. In the case of uncontaminated, fine-grained sediments, treatment may include adding binding agents or sand to render the material suitable for use in structural fill applications. In the case of contaminated sediments, treatment will include a first step to remove or isolate the contaminants to prevent them from leaching out of the sediment. A second step may include enhancing the physical qualities of the material to make it more suitable for construction applications. For some treatment alternatives (e.g., cement stabilization) both of these steps may occur at the same time.

Treatment technologies evaluated for this F3 Feasibility Study (FS) include cement stabilization, sediment washing, sediment blending, sediment separation, thermal desorption, and hybrid or treatment, storage, and reprocessing (TSR) sites. Each is described in the following sections.

5.6.4.1 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 micro-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 ash, 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, produce cementing characteristics, and harden on curing. With appropriate proportioning with Portland cement, cement/fly ash-treated products can exceed those by 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 (SVOA) due to the normally significant volatilization during the process, although it has been shown that phenols (semi-volatile) 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 (e.g. Sell et al. 1992). Given the organic-specific nature of the technology and the general paucity of data, detailed, 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 and details provided in the DMMP Pilot Studies (USACE 2002f). The bench-scale study to develop laboratory data on the effectiveness in treating contaminated sediments 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 site. 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 geo-technical, 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 2002f).

- 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 metals, and decreasing the leachability of 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 implement ability. 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 within the Ports 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 County Region is expected to be approximately \$46 per cubic meter (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.

5.6.4.2 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 2002b).

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.

5.6.4.3 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 Contaminated Sediments Task Force (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. Estimated costs for this alternative were $49/m^3.

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) critical 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.

5.6.4.4 Sediment Separation

Sediment 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.

5.6.4.5 Thermal Desorption

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 (EPA 2001; 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.

5.6.4.6 Treatment, Storage and Reprocessing (TSR) Site

The use of a TSR site (i.e., Hybrid Plan) is a dredge material management technique that allows flexibility in project sequencing between generators and users of dredged sediments and provides a mechanism for beneficially using dredge materials instead of disposal. The concept is to locate a central facility to receive dredge materials for temporary storage or immediate treatment/processing where unsuitable materials are enhanced to provide for additional beneficial uses.

A similar concept has been developed in New Jersey by the New Jersey State Department of Transportation and has been in operation for several years. In this case, up to 382,300 m^3 of sediment are transported to the facility located in the port district, where is dried and treated to create beneficial use products such as manufactured topsoil and engineered fill material for use in construction projects. In addition to proving a stabilized manufactured fill material for use in roadway and Brownfield projects, the facility offers a low-cost disposal alternative for small quantity generators such as marinas.

This approach could be duplicated in the Region by locating a facility near or within the POLA and POLB. Dredge material could be trucked or piped to the site and stored in large containment cells for drying and storage until processing. Hydro-cyclones could be used to separate the clean sand material from the fine-grained (and typically more contaminated) material. Clean sand could then be reused for construction fill for beach nourishment. The fine-grained material could then be treated with cement or other additives to bind the contaminants and create an engineered fill material.

Sediment treatment was determined to be a feasible alternative for meeting the National and Planning Objectives, and is recommended for further evaluation.

5.6.5 *Disposal*

For this study, disposal refers to management options that rely simply on discarding the dredge material, without the direct intent for providing beneficial reuse or without making any attempts to decontaminate potentially toxic material. Disposal options may range from unconfined off-shore aquatic disposal, isolation and containment within the aquatic environment, or transport and disposal at an upland landfill facility. Some of these options may, however, provide secondary benefits such as confined disposal facilities that serve as port expansion projects after completion.

Disposal alternatives evaluated for this F3 FS include ocean disposal, aquatic capping, confined disposal, geo-textile encapsulation, and upland landfill. Each is described in more detail in the following sections.

5.6.5.1 Ocean Disposal

The Ocean Disposal alternative involves placing the dredged material from regional dredging projects at designated open ocean disposal sites, if the material is tested suitable for such disposal. There are currently two designated open ocean disposal sites within the Region and vicinity: LA-2 located in San Pedro Bay approximately 9.7 kilometers south of the Los Angeles Harbor, and LA-3 off Orange County coast approximately 11.3 kilometers south of Newport Harbor. Over the period of 1976 to 2001, approximately 60 percent of the dredged material from maintenance dredging in the County was disposed of at LA-2. The LA-2 site was designated as a permanent disposal site in 1991 and serves Los Angeles and Long Beach Harbors, LARE, Marina del Rey, Anaheim Bay and Sunset/Huntington Harbor. Although the site was designated without an explicit annual capacity, impact analysis performed for the site was based on an annual volume of 152,900 m^3. Record shows that the recorded annual volumes disposed at the site exceeded this baseline volume 30 percent of the time, which indicates that ocean disposal in the County has become capacity-limited, especially considering the projected future capital improvement dredging needs. LA-3 was designated as an interim disposal site in 1982 to service the disposal needs of the Orange County harbors, although record shows that it occasionally received dredged material from maintenance projects in the POLA. The site is currently not active, but is undergoing an environmental assessment by the USACE for permanent designation.

5.6.5.2 Aquatic Capping/Confined Aquatic Disposal

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.

This method was evaluated in great detail by the CSTF by conducting a pilot field study using contaminated dredge materials removed from the LARE and placed in the North Energy Island Borrow Pit, located in Long Beach. Approximately 100,000 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 at a cost of $\$27/m^3$. 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 was completed, intensive monitoring of the cap surface has been conducted annually for the past two years and is scheduled to occur for one additional year, concluding in the summer of 2004. Long-term monitoring will continue (subject to the availability of funds) to confirm the initial findings of the pilot project. Additional details of the aquatic capping pilot study are contained in the final report for the DMMP Pilot Studies.

5.6.5.3 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. 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 POLA and the 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, 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 2.39-square kilometer 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 (POLA website). 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 0.12-square kilometer CDF by filling a former slip at the California Unified Terminal (LA CSTF Interim Advisory Meeting Minutes, August 1998).

5.6.5.4 Geo-Textile Encapsulation

A method of dredge material management that has been used extensively in the southeast United States is Geo-Textile Encapsulation (commonly called a GeoTube). In this process, a large bag constructed of Polypropylene (PP), Polyethylene (PE), and Polyester (PET) is filled with dredge material and then used for various purposes. If the material is clean, it may be placed on land and used to dewater the sediments, or submerged underwater to form dikes and support structures. For contaminated material, the geo-textile bag can be used to isolate and contain the dredge materials prior to use as aquatic fill material. This process was used at the POLA Cabrillo Shallow Water Habitat (CSWH) area with mixed results.

5.6.5.5 Upland/Landfill Disposal

The Upland/Landfill Disposal alternative involves placing dredged material in an upland facility constructed with containment measures such as lining, diking, and covering. Typical upland disposal facilities include upland CDF and commercial landfills.

An upland CDF is operated similar to a nearshore CDF, except that it is constructed entirely inland. 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. The primary issues with upland CDF 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.

Commercial landfills can potentially receive dredged material. Since landfills in the County (Class III) have limited capacities, potentially suitable facilities are all located outside the Region in other counties as well as Arizona and Utah. The primary issues with placing large quantities of dredged material in such landfills include: (1) dewatering requirement; (2) contaminant and chloride leaching; (3) availability of suitable existing landfills; (4) land availability and cost for new landfill facilities; (5) land availability and cost for dewatering facilities; and (6) transportation cost.

Upland disposal was determined to be an implementable alternative for meeting the National and Planning objectives, and is recommended for further evaluation.

5.7 Summary of Preliminary Alternatives Considered

A preliminary evaluation of the alternatives and technologies presented in Section 5.6 found that all of the alternatives meet the National and Planning objectives, and all have the potential to be feasible and implementable by either the Federal government or one of the local sponsors (Port of Los Angeles, County of Los Angeles and City of Long Beach). As such, it is recommended that all be retained for further evaluation in the Feasibility (F4) Study.

5.8 Beneficial Uses for Treated or Clean Material

The following technologies have been identified for beneficially reusing clean and contaminated dredged materials. In some instances, these options require that contaminated dredged materials be subjected to one or more of the treatment technologies identified in Section 5.6.

5.8.1 *Beach Nourishment*

Beach Nourishment involves placing dredged material at regional beaches for nourishment, if the material is tested suitable for open-water disposal and compatible with sand characteristics at the destination beaches. This alternative has been historically practiced in the Region. Examples include decades of beach nourishment at Dockweiler Beach with the dredged material from maintenance dredging projects in Marina del Rey.

5.8.2 *Shallow Water Habitat Creation*

Shallow Water Habitat Creation involves placing dredged material in a diked, sub-aqueous containment area 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. Primary issues of concern with shallow-water habitat creation include final cap elevation determination, cap material thickness and selection, and 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 CSWH project completed in 1999.

5.8.3 *Construction Fill*

Clean or contaminated dredged sediment may be used as construction fill in nearshore or upland applications as a beneficial reuse alternative, subject to regulatory constraints and requirements. Two examples are presented: (1) use as nearshore fill and (2) use as sub-grade fill for transportation projects (e.g., roadways, airports, parking lots, etc.).

<u>Nearshore Fill</u>
Contaminated or clean dredged sediment may be used as construction fill material in nearshore waters where confinement is provided (for contaminated material). 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 from the Marina del Rey/Ballona Creek Entrance Channel maintenance, 97 percent of the 42 million m^3 from Los Angeles Harbor capital improvement dredging, and 32 percent of the 8.4 million m^3 from Long Beach Harbor capital improvement dredging were used as harbor fill for construction and improvement of harbor facilities.

Contaminated dredged sediment could be used as harbor and wetland fills subject to regulatory constraints and requirements. 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 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.

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 2002c). In general, construction fill material is required to exhibit sufficient engineering properties as determined through geo-technical testing. For contaminated dredged sediment, leach testing by Synthetic Precipitation Leaching Procedure (SPLP) as described previously may be required by the Los Angeles Regional Water Quality Control Board (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.

5.8.4 *Landfill Daily Cover*

Clean or contaminated dredged sediment may be used for landfill daily cover and closure works as beneficial reuse alternative, subject to regulatory constraints and requirements.

For placement in landfills, the LARWQCB generally 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 SPLP (U.S. Environmental Protection Agency [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 mg/L chloride and 500 mg/L TDS (USACE 2002b). 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 2002b).

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

5.8.5 *Reclamation Fill*

Clean or contaminated dredged sediment may be used for reclamation fill as a beneficial reuse alternative, subject to regulatory constraints and requirements. Two types of reclamation fill were evaluated for this study: (1) use of the material as part of a Brownfield Re-Development project and (2) use of the material to backfill abandoned mines and gravel pits. Both are briefly described below.

<u>Brownfield Re-Development</u>

Contaminated or clean 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.

<u>Mine and Pit Reclamation</u>

Contaminated or clean dredged sediment may be used as backfill at mine reclamation sites subject to regulatory constraints and requirements. Mine reclamation sites in the 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.

5.8.6 *Oil Well Injections*

This technology involves injecting contaminated dredged sediments into idle oil wells as an alternative to disposal or treatment. Oil wells are commonly re-injected using the oil well cutting material, which has sediment characteristics typical of contaminated dredged sediments (i.e. silts and clays). The process involves fracturing a sediment (sand) layer in excess of 2,000 meters below the surface by hydraulically introducing approximately 300 kilograms per square centimeter (kg/cm^2) pressure near the end of the oil well core through a perforated tube.

The operational procedure consists of a conveyor belt which transports the sediments to a screen. The fine grain materials are sent through two grinding units which introduce water, turning the material into a mud consistency and shears the shales and then to a holding tank, where water is jetted into the tank to maintain the sediment particles in suspension. The slurry is then sent to a pump, which injects the slurried sediments into the injection well. The alternative is suitable for smaller highly contaminated dredge sediment volumes.

5.8.7 *Capping Material for Regional Capping Projects*

A relatively new option for beneficial reuse of dredge material is as capping material for aquatic capping projects in the Region. This option, however, would require coordination between the two dredging projects or would require the use of an aquatic storage site.

Dredged sediment may be stockpiled on a temporary basis at aquatic sites awaiting further transfer to end-use destinations if the material is clean or 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 mildly contaminated sediments, unless some form of isolation were included (e.g., a cap) during the storage process. Additional requirements would prevent the creation of navigational hazards as a result of the alteration of existing nearshore bathymetry, among other aspects.

6 SUMMARY AND RECOMMENDATIONS

6.1 Summary

The overall objectives for the Los Angeles Dredge Material Management Plan (DMMP) Feasibility Study (FS) Baseline Conditions report are to survey and review prior studies by the U.S. Army Corps of Engineers, Los Angeles District (USACE) and others to describe the physical, chemical, and biological conditions of the Study Area, evaluate the regional dredging and disposal needs, and characterize the physical and chemical properties of the regional dredged materials. In addition to these overall objectives, this study was intended to formulate alternatives for managing dredged material for the Los Angeles Region (Region), perform a preliminary evaluation of the alternatives, and recommend alternatives for further evaluation.

The Study Area for this evaluation focused on the primary dredging sites within the Region that include Marina del Rey and King Harbor in Santa Monica Bay and Los Angeles and Long Beach Harbors, the Los Angeles River Estuary (LARE), and Alamitos Bay in San Pedro Bay. A summary of projected dredging and disposal needs was determined for each dredge management area that included routine maintenance as well as capital improvement projects.

A series of alternatives were presented that cover a range of management approaches such as no action, source control, temporary storage, treatment, and disposal. Paramount to each of these alternatives is an overarching goal to maximize beneficial reuse and minimize disposal. As such, several beneficial reuse technologies have also been discussed. Figure 5-1 presents an overview of the alternative plans considered as well as a list of implementable technologies/projects with each management category. After evaluation of each alternative using the criteria presented in USACE (2000e) and summarized in Section 5.5, all of the alternatives were considered potentially implementable by either the USACE or one of the local sponsors.

6.2 Recommendations

As stated in the previous section, one of the overall objectives for this document was to provide a recommendation of alternatives for further evaluation. Based on the evaluation of alternatives according to the Principle and Guidelines in Section 5, all of the alternatives are recommended for further evaluation in the DMMP FS F4 Evaluation to form the basis of the development of a regional dredged material management document.

Through participation and consultation with the CSTF members, as well as input from local sponsors, USACE also identified three “implementable projects” to be further evaluated with the F4 Study to determine whether there would be a federal interest to implement one or more of these projects. The three projects identified for further evaluation are:

- Development of a Multi-User confined aquatic disposal (CAD) Site at the North Energy Island Borrow Pit (NEIBP)
- Development of a regional sediment treatment, storage, and reprocessing (TSR) facility in the Los Angeles Region

- Development of a confined disposal facility (CDF) Site near the City of Long Beach Downtown Marina

Each is described in more detail in the following sections.

6.2.1 *Multi-User Confined Aquatic Disposal Site at the North Energy Island Borrow Pit*

The USACE conducted a pilot study to evaluate aquatic disposal and capping of contaminated sediment from the LARE at the NEIBP. Figure 6-1 shows the location of the NEIBP in relationship to other project features. The first two years of a long-term monitoring program indicate the CAD site has performed as designed in isolating the contaminated sediments within the NEIBP. With the apparent success of the pilot study, the CSTF has been evaluating the CAD site as part of its strategy for managing contaminated sediments in the LA Region. A white paper was prepared to address several management issues related to using NEIBP as a multi-user disposal site. Some of the issues identified in the white paper are summarized here and a recommendation is provided that these items be further evaluated during the DMMP F4 Study. Because many issues remain unresolved, further study is needed to determine if Federal interest exists to implement a multi-user CAD site at the NEIBP. The primary issues to be resolved include management, regulatory and technical issues. The management and regulatory issues include:

- State and federal permitting
- Operations and long-term liability
- Host jurisdictions
- Environmental monitoring
- Corrective action triggers and actions
- Administrative costs
- Allocations of capacity

One of the unresolved technical issues surrounds the need for additional information regarding minimum cap thickness for future disposal activities. The monitoring results have shown that the pilot CAD site at the NEIBP has been effective with the 1 to 1.5-meter thick cap, but a thinner cap may be adequate as well. Furthermore, field monitoring showed that the surface of the cap is covered by a soft fluffy layer of fine sediments which has been speculated as originating from the LARE.

If the soft material on top of the CAD site was indeed contaminated sediment from the LARE, there may not be a need to require the placement of a thick cap at the CAD site immediately after each future disposal event since the cap will soon be covered by the contaminated LARE material. A cap may only be required on a regular basis but not upon completion of each disposal event. A thick cap may only be needed for the last disposal event that would bring the NEIBP up to the bathymetry of the surrounding surface layer. With no surface depression, future LARE material will continue past the NEIBP location and likely be carried out of the Inner Harbor.

Figure 6-1
Location of the NEIBP Pilot Study CAD Site

It is recommended that, as part of the F4 study, further research be conducted to identify the source(s) and rate of sediment deposition at the NEIBP. This study would likely require the development of a hydrodynamic model for that portion of the harbor and the use of sediment traps, or other collection devices.

6.2.2 *Regional Treatment, Storage, and Reprocessing Facility*

The basic concept for a TSR facility (first described in Section 5.6.4.6), is to locate a central area in the Region where dredge materials can be stored and/or treated to enhance unsuitable materials and make them available for beneficial reuse. The processed/separated clean sediment can be used for beach nourishment if the grain sizes are compatible or for other beneficial uses. The use of the processed clean material for beach nourishment will benefit local beaches and can be integrated as part of another ongoing USACE study to develop a Regional Sediment Management (RSM) Program. The RSM was implemented to develop methodologies and protocols to address and abate site-specific shoreline erosion problems at regional scale.

In order to evaluate the feasibility of setting up a TSR facility in the Region, the following tasks are recommended for the DMMP F4 Study:

- Complete a detailed opportunities and constraints analysis of the issue, resulting in a list of criteria for suitable locations
- Locate potential suitable locations in Los Angeles County
- Design and construct a field-scale pilot study (or studies) to test feasibility and effectiveness of multiple processing methods, and develop cost scenarios for various production rates and durations
- Locate potential end users for “treated” material and distribute the product
- Develop an implementation plan for a full-scale facility using the information gathered from the pilot study
- Integrate the TSR facility as part of the RSM Program

6.2.3 *City of Long Beach CDF*

One of the local sponsors for the DMMP FS Study − the City of Long Beach, has expressed interest in the development of a CDF site near the LARE next to the City Downtown Marina. The location of the proposed CDF site is shown in Figure 6-2. Depending on the final configuration, the CDF can provide a capacity of over 100,000 m^3, which will be used for the placement of the LARE material. The City intends to use the reclaimed area for additional parking lots for the downtown marina. The development of the CDF will provide the Corps with a viable option to dispose the LARE dredged material for their maintenance dredging. This alternative is recommended for further study to evaluate different construction and disposal methods, environmental impact assessment under National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA), as well as economic analyses.

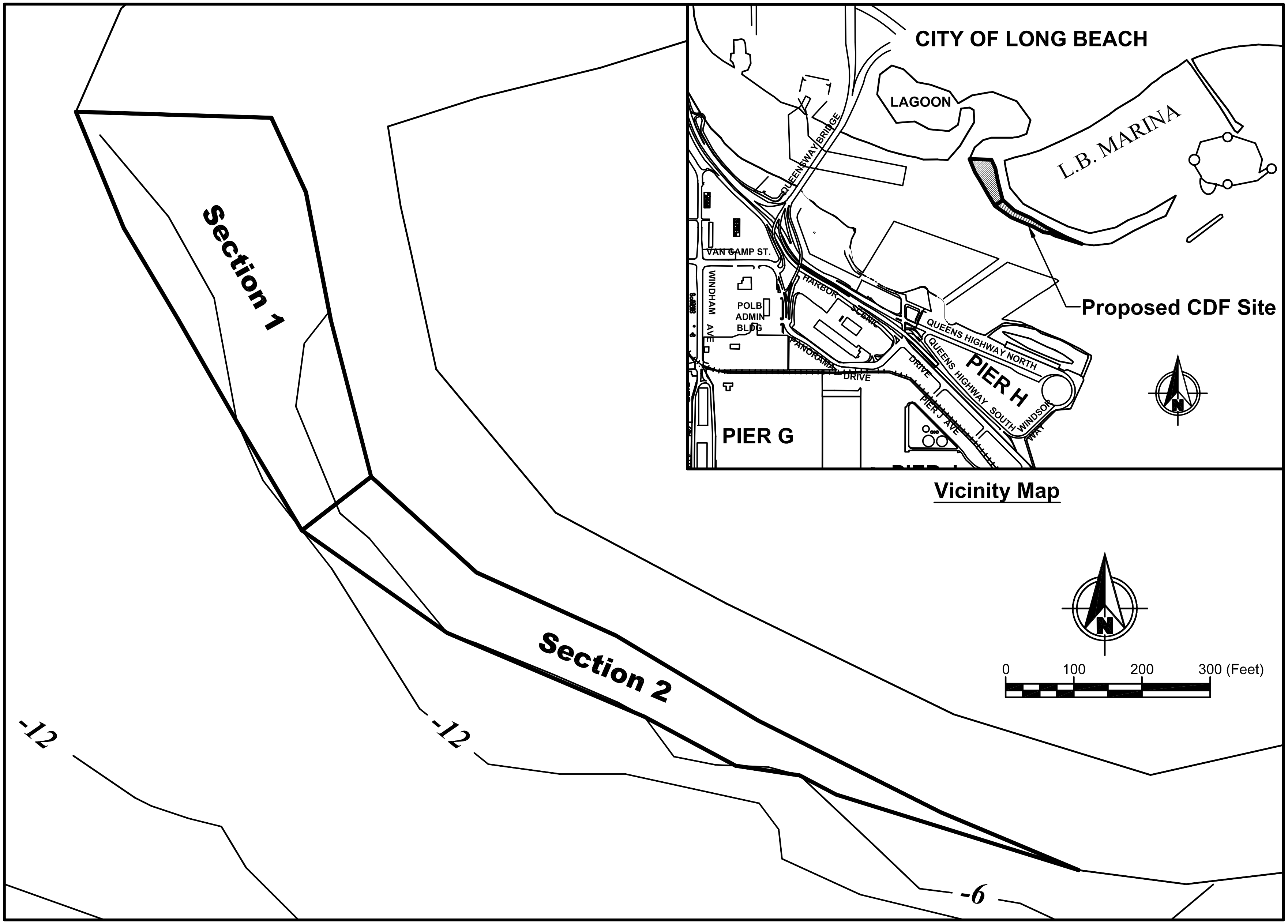


Figure 6-2

City of Long Beach Proposed CDF Site

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