Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants Total Maximum Daily Loads

PREPARED BY
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AND

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LIST OF ACRONYMS

µg/g	Micrograms per Gram
µg/kg	Micrograms per Kilogram
µg/L	Micrograms per Liter
BPTCP	Bay Protection and Toxic Cleanup Program
Caltrans	California Department of Transportation
CEQA	California Environmental Quality Act
City BOS	City of Los Angeles Bureau of Sanitation
CFR	Code of Federal Regulations
COMM	Commercial and Sport Fishing
CTR	California Toxics Rule
CWA	Clean Water Act
DDT	dichlorodiphenyltrichloroethane
DL	Detection Limit
EMCs	Event Mean Concentrations
ERL	Effects Range-Low
ERM	Effects Range-Median
EST	Estuarine Habitat
FR	Federal Register
kg	Kilograms
LACDPW	Los Angeles County Department of Public Works
LARWQCB	Los Angeles Regional Water Quality Control Board
LACSD	Los Angeles County Sanitation District
LAR	Los Angeles River
LSPC	Loading Simulation Program in C++
MAR	Marine Habitat
mg/kg	Milligrams per Kilogram
MS4	Municipal Separate Storm Sewer System
MTRL	Maximum Tissue Residue Level
NAV	Navigation
ng/L	Nanograms per Liter
NPDES	National Pollutant Discharge Elimination System
OEHHA	Office of Environmental Health Hazard Assessment
PAHs	Polyaromatic hydrocarbons
PCBs	Polychlorinated biphenyls
PEL	Probable Effects Level
POLA	Port of Los Angeles
POLB	Port of Long Beach
pg/L	Picograms per Liter
ppb	Parts per Billion
ppt	Parts per Thousand
RARE	Rare, Threatened, or Endangered Species
REC1	Water Contact Recreation
REC2	Non-Contact Water Recreation
SGR	San Gabriel River
SHELL	Shellfish Harvesting

SQOs	Sediment Quality Objectives
TEL	Threshold Effects Level
TMDL	Total Maximum Daily Load
TSMP	Toxic Substances Monitoring Program
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
WDRs	Waste Discharge Requirements
WILD	Wildlife Habitat
WLAs	Waste Load Allocations
WQA	Water Quality Assessment
WQOs	Water Quality Objectives

1 INTRODUCTION AND REGULATORY BACKGROUND

The waters of the Dominguez Channel and the Ports of Los Angeles and Long Beach in the San Pedro Bay have enormous economic, recreational and habitat value and fail to meet water quality standards. The California Regional Water Quality Control Board, Los Angeles Region (Regional Board) has developed this total maximum daily load (TMDL) to attain the water quality standards for the Dominguez Channel and greater Los Angeles and Long Beach Harbors waters. The TMDL has been prepared pursuant to state and federal requirements.

The California Water Quality Control Plan, Los Angeles Region (Basin Plan) sets standards for surface waters and ground waters in the Coastal Watersheds of Los Angeles and Ventura Counties. These standards are comprised of designated beneficial uses for surface and ground water, numeric and narrative objectives necessary to support beneficial uses, and the state's antidegradation policy. Such standards are mandated for all waterbodies within the state under the Porter-Cologne Water Quality Act and the Federal Clean Water Act. In addition, the Basin Plan describes implementation programs to protect all waters in the region. The Basin Plan implements the Porter-Cologne Water Quality Act (also known as the "California Water Code") and serves as the State Water Quality Control Plan as required pursuant to the federal Clean Water Act (CWA).

Section 305(b) of the CWA mandates biennial assessment of the nation's water resources, and these water quality assessments are used to identify and list impaired waters. CWA requires that each State "shall identify those waters within its boundaries for which the effluent limitations are not stringent enough to implement any water quality objective applicable to such waters." The resulting list is referred to as the 303(d) list. The CWA also requires states to establish a priority ranking for impaired waters and to develop and implement Total Maximum Daily Loads (TMDL). A TMDL specifies the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and allocates pollutant loadings to point and non-point sources. The elements of a TMDL are described in 40 CFR 130.2 and 130.7 and Section 303(d) of the CWA, as well as in the USEPA guidance (USEPA, 2000a). A TMDL is also required to account for seasonal variations and include a margin of safety to address uncertainty in the analysis (USEPA, 2000a).

States must develop water quality management plans to implement the TMDL (40 CFR 130.6). The USEPA has oversight authority for the 303(d) program and is required to review and either approve or disapprove the TMDLs submitted by states. The State submits TMDLs to USEPA for review and approval pursuant to CWA section 303(d), and section 303(c) as appropriate. In California, the State Water Resources Control Board (State Board) and the nine Regional Water Quality Control Boards are responsible for preparing lists of impaired waterbodies under the 303(d) program and for preparing TMDLs, both subject to USEPA approval. If USEPA disapproves a TMDL submitted by a state, USEPA is required to establish a TMDL for that water body. The Regional Boards also hold regulatory authority for many of the instruments used to implement the TMDLs, such as the National Pollutant Discharge Elimination System (NPDES) permits and state-specified Waste Discharge Requirements (WDRs).

A consent decree between the USEPA, the Santa Monica BayKeeper and Heal the Bay Inc., represented by the Natural Resources Defense Council (NRDC), was signed on March 22, 1999 (consent decree). This consent decree requires that all TMDLs, as required by the 1998 303(d) list, for the Los Angeles Region be adopted within 13 years. For the purpose of scheduling TMDL development, the consent decree combined the more than 700 water body-pollutant combinations into 92 TMDL analytical units and also prescribed schedules for certain TMDLs.

Specific water body-pollutant combinations for Dominguez Channel and greater Los Angeles and Long Beach Harbor waters were identified as impaired on the 1996, 1998, 2002, 2006 and 2008/2010 California 303(d) lists (LA RWQCB, 1996, 1998, 2002, 2007, 2010). The final 2008/2010 list of impaired water body-pollutant combinations for Dominguez Channel and greater Los Angeles and Long Beach Harbor waters is contained in Table 2-7.

On Sept. 2, 2010, the U.S. District Court approved a modification to the consent decree which added and removed certain pollutants from certain Analytical Units from the consent decree-required TMDLs for the Harbor waters. Analytical units (AU) 73, 74, 75 and 78 are addressed via these Harbor Toxics TMDLs. However, parts of two AUs are not addressed in this TMDL project - Copper and lead in Wilmington Drain which is part of AU 75 and Chlordane, DDT and PCBs in Machado Lake which is part of AU 73. A separate TMDL for Chlordane, DDT and PCBs in Machado Lake was approved by the Regional Board in September of 2010. The September 2010 modification of the consent decree included a finding of non-impairment for copper and lead in Wilmington Drain; these impairments will also be removed from the 303(d) list when sufficient data is available to de-list in accordance with the State Listing Policy.

The TMDLs for Dominguez Channel and greater Los Angeles/Long Beach Harbor waters will be established in a Basin Plan Amendment and are therefore subject to Public Resources Code Section 21083.9 that requires California Environmental Quality Act (CEQA) Scoping and Analysis to be conducted for Regional Projects. CEQA Scoping involves identifying a range of project/program related actions, alternatives, mitigation measures, and significant effects to be analyzed in an EIR or its Substitute Environmental Documents (SEDs). On September 21, 2006 a CEQA Scoping meeting was held to present and discuss the foreseeable potential environmental impacts of compliance with the TMDLs for Dominguez Channel and greater Los Angeles/Long Beach Harbor waters at the Los Angeles Regional Water Quality Control Board. Input from all stakeholders and interested parties were solicited for consideration in the development of the CEQA environmental analysis.

Metals TMDLs have already been completed for Los Angeles River, San Gabriel River and Los Cerritos Channel; therefore, metal pollutant allocations have been defined to restore beneficial uses in these watersheds. These three watersheds also contribute freshwater to the greater LA/LB Harbor waters, primarily the LA River Estuary and eastern San Pedro Bay.

2 Problem Statement

The waters of Dominguez Channel, Dominguez Channel estuary, Torrance Lateral Channel (sometimes referred to as Torrance Carson Channel), Los Angeles and Long Beach Harbors (including Inner and Outer Harbor, Main Channel, Consolidated Slip, Southwest Slip, Fish

Harbor, Cabrillo Marina, Inner Cabrillo Beach), San Pedro Bay and Los Angeles River Estuary are impaired by heavy metals and organic pollutants. More specifically, each of these water bodies are included on the 303(d) list for one or more of the following pollutants: cadmium, chromium, copper, mercury, lead, zinc, chlordane, dieldrin, toxaphene, DDT, PCBs, and certain PAH compounds. These impairments may exist in one or more environmental media—water, sediments or tissue. This section provides an overview of water quality criteria and guidelines applicable to the above waterbodies and reviews the fish tissue, and sediment and water quality data compiled for the purpose of these TMDLs.

2.1 Environmental Setting

This report addresses water quality in Dominguez Channel and waters associated with greater Los Angeles and Long Beach Harbor ("greater Los Angeles and Long Beach Harbor waters"). Specifically, the greater Los Angeles/Long Beach Harbor waters include Inner and Outer Harbor, Consolidated Slip, Fish Harbor, Cabrillo Marina, Inner Cabrillo Beach, Los Angeles River estuary, and San Pedro Bay (Figure 2-1). Dominguez Channel includes the Dominguez Channel Estuary and Torrance Lateral Channel (Figure 2-2).

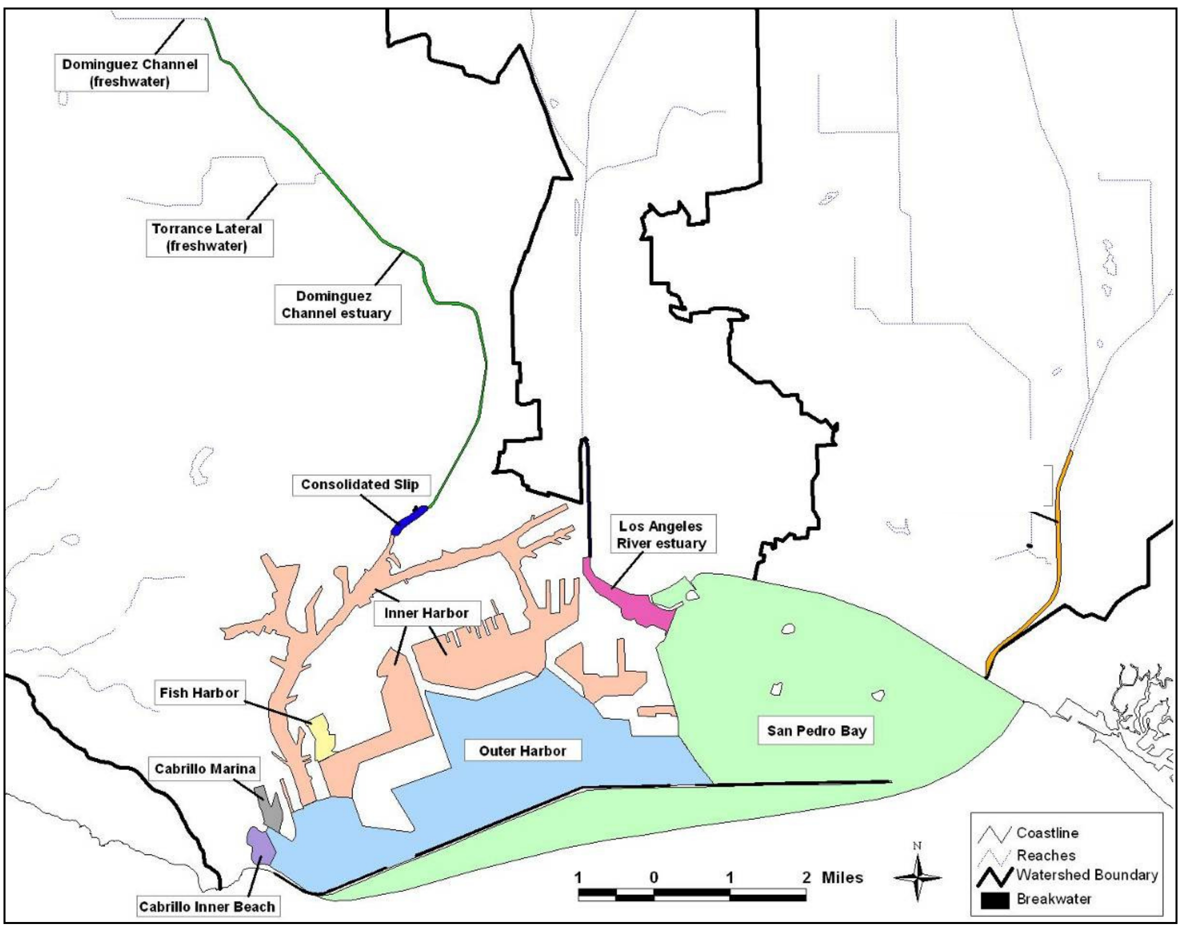


Figure 2-1. Dominguez Channel and greater Los Angeles and Long Beach Harbor waters.

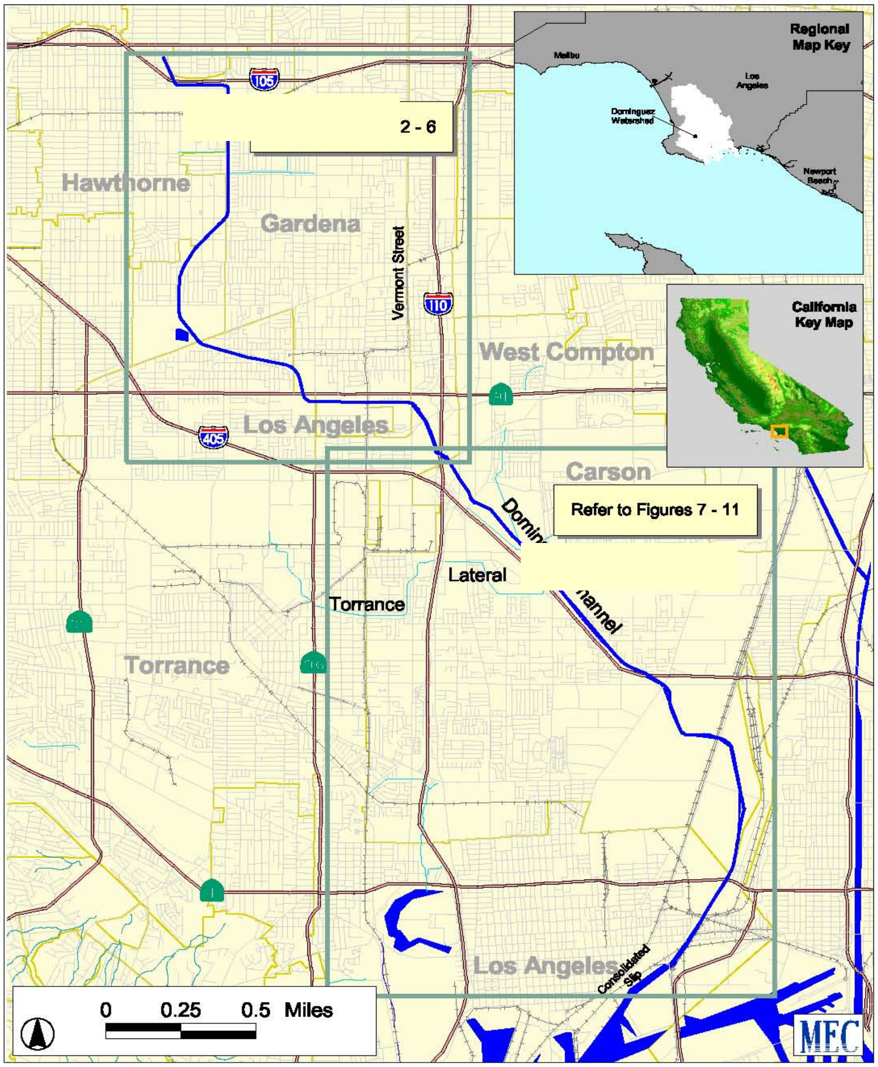


Figure 1. Dominguez Channel Vicinity Map.

Figure 2-2. Dominguez Channel sub-watershed areas
(Source: MEC Analytical; note: boxes in the figure refer to additional figures within the original MEC Analytical report)

2.1.1 Watersheds and Land Use

The watershed of the Dominguez Channel and the Los Angeles and Long Beach Harbors is an important industrial, commercial and residential area with unique and important historical and environmental resources. The area includes 21 municipalities within and including Los Angeles County and roughly 1 million residents. Prior to its development, the area was largely marshland and now almost no wetland or original coastline exists. Water quality decreased with increased development in the 1970s. Since then, the water quality has improved but there are still significant water quality and sediment quality challenges.

The ports of Los Angeles and Long Beach occupy over 10,500 acres of land and water. The Inner Harbors contain piers for ship loading and unloading and several marinas. The outer part of both harbors (the greater San Pedro Bay) has been less disrupted than the inner areas and supports a great diversity of marine life. It is open to the ocean at its eastern end and receives much greater ocean flushing than inner harbor areas.

San Pedro Bay receives the discharges of the Dominguez Channel, Los Angeles and San Gabriel Rivers, although the latter two watersheds are not the focus of these TMDLs. (Machado Lake also may contribute intermittent flows to the Inner Harbor and is also not a focus of this TMDL.) The Los Angeles River is largely treated wastewater flow and the watershed is 834 square miles, 66% developed. The San Gabriel River is 689 square miles (including the Los Cerritos Channel and Alamitos Bay) and is largely developed in the downstream end.

The Dominguez Channel Watershed drains an area of approximately 133 square miles in southwestern Los Angeles. The watershed is composed of two hydrologic subunits. The two subunits drain primarily via an extensive network of underground storm drains. The northern subunit drains into the Dominguez Channel while the southern subunit drains directly into the Los Angeles and Long Beach Harbor Area. The headwaters of the Dominguez Channel consist of an underground storm drain system which daylights approximately 0.25 miles north of the Hawthorne Municipal Airport. The Dominguez Channel drains approximately 62 percent of the watershed before discharging to Los Angeles Harbor. Land use for Dominguez Channel is shown in Table 2-1.

As documented in the Los Angeles County Department of Public and Work (LA Co DPW) Integrated Report (1994-2005), the Dominguez Channel watershed is dominated by urban land uses such as residential, industrial, commercial and transportation, which comprise as much as 85% of the land area. Very little vacant and open space areas are present in the watershed. The watershed is approximately 60% impervious based on assumptions of impervious areas in each land use type. The highest population density in the watershed appears to be in communities of Inglewood and Hawthorne.

The Dominguez Channel and the Los Angeles and Long Beach Harbors watershed has a Mediterranean climate with an average of approximately 14 inches of rain per year, most of it during the winter season. LA Co DPW maintains a water sampling mass emission station, S28, in the Dominguez Channel near the center of the watershed area. At this station in 2004-2005 all daily rainfall totals were below 2.5 inches. The wettest period was in late December and early January.

There are many permitted discharges to the watershed. There are approximately 60 active, individual NPDES permitted discharges to the Dominguez Channel and to the Los Angeles and Long Beach Harbors. These include four refineries that discharge to the Dominguez Channel, two generating stations that discharge to the inner harbor areas and the Terminal Island Water Reclamation Plant (TIWRP). The Terminal Island Treatment Plant discharges secondary-treated effluent to the Outer Harbor and this POTW is under a time schedule order to eliminate their discharge into surface waters. In addition, there are approximately 50 active, general NPDES permitted discharges to the watershed.

Table 2-1. Land Use by Subwatershed Area for Dominguez Channel Watershed

Land Use Type*	Area
Agricultural	1%
Industrial	17%
Mixed Use	1%
Open Space/Recreation	3%
Residential	41%
Retail/Commercial	14%
Transportation	13%
Vacant	4%
Water	6%
Total	100%

* source: LACDPW integrated 1994-2005 report.

Habitats:
A number of fresh and marine habitat types are included in the TMDL area.

The Freshwater habitat areas of Upper Dominguez Channel are concrete lined and offer minimal habitat value at this time. The Torrance Lateral and other tributary channels, 132nd and 135th Street Drains, Del Amo Laterals, and Victoria Creek, are also freshwater and concrete-lined.

From Vermont Street downstream to Los Angeles Harbor, Dominguez Channel has a soft-bottom with riprap banks, and is estuarine.

Within the Harbor areas and San Pedro Bay the habitats are marine and include shallow water habitat, deeper habitat, some beach areas and small wetland areas. A small, man-made wetland (approx. 5 acres), "Salinas de San Pedro" extends about 650 feet north along waterfront on northern Cabrillo Beach.

Shallow water habitat, some man-made during 1999-2000 as part of the Port of Los Angeles' Outer Harbor Channel Deepening and Pier 400 Construction Project occurs within the outer harbor and supports some kelp habitat. The Harbors also include extensive soft bottom areas and eelgrass beds. The ship channels in the Harbors are deeper and maintained by dredging.

Birds:
Over 100 species of birds occupy habitats in the Port of Los Angeles and Port of Long Beach, including three species that are listed as Threatened or Endangered by either the State or federal government [California least tern (*Sterna antillerum browni*), Western Snowy Plover (*Charadrius alexandrinus nivosus*) and Peregrine Falcon (*Falco pereginus anatum*)]. At least 18 bird species nest in the Port area. Birds that use Inner Cabrillo Beach include gulls and pigeons

as well as seasonal snowy plovers, Caspian terns, least terns, black skimmers, Forster's terns, brown pelicans, great blue herons, sanderlings, western and least sandpipers, willets western, Clark's, and eared grebes, cormorants, occasional loons and ducks (S. Vogel, Cabrillo Marine Aquarium, personal communication).

Fish:
Over 70 species of fish have been noted in the Harbor. From 1993 to 2001 trawls for fish in the Los Angeles Harbor by the City of Los Angeles Environmental Monitoring Division, typically found 20 or 30 fish species, dominated by white croaker (*Genyonemus lineatus*), queenfish (*Seriphus politus*), California tonguefish (*Symphurus atricauda*), and Pacific sanddab (*Citharichthys stigmaeus*) (City of Los Angeles, 2002; 2001; 2000; 1999a; 1998; 1997; 1996). Ports Biological Baseline Study (2000) reported the following fish by mass abundance: Northern anchovy, white croaker, queenfish, topsmelt, specklefin midshipman, speckled sanddab, Pacific sardine, shiner surfperch, white surfperch, and salema. California halibut and barred sandbass had moderate abundance. In beach seines on Inner Cabrillo Beach, commonly caught fish include surfperch, topsmelt, jacksmelt, pipefish and flatfish. In addition, there are grunion runs on the Inner and Outer Cabrillo Beaches from March through July (S. Vogel, Cabrillo Marine Aquarium, personal communication).

Invertebrates:
Over 400 species of invertebrates have been noted in the Harbor. From 1993 to 2001 trawls for invertebrates in the Los Angeles Harbor by the City of Los Angeles Environmental Monitoring Division, were dominated by blackspotted bay shrimp (*Crangdon nigromaculata*), American spider crab (*Pyromaia tuberculata*) and New Zealand cephlaspidian (*Philine auriformis*) (City of Los Angeles, 2002; 2001; 2000; 1999a; 1998; 1997; 1996).

Mammals:
Los Angeles Harbor is used by California sea lions (*Zalophus californianus*) and occasionally harbor seals, elephant seals, dolphins and gray whale calves (S. Vogel, Cabrillo Marine Aquarium, personal communication).

2.2 Water Quality Standards

California state water quality standards consist of the following elements: 1) beneficial uses; 2) narrative and/or numeric water quality objective (WQOs); and 3) an antidegradation policy. In California, beneficial uses are defined by the Regional Boards in the Water Quality Control Plans (Basin Plans). Numeric and narrative objectives are also specified in each region's Basin Plan. The objectives are set to be protective of the beneficial uses in each water body in the region and/or to protect against degradation. Numeric objectives for toxics in water can be found in the California Toxics Rule (40 CFR §131.38).

2.2.1 Beneficial Uses

The first part of California water quality standards is beneficial uses. The Basin Plan for the Los Angeles Regional Board (1994) defines beneficial uses for Dominguez Channel and greater Los Angeles/Long Beach Harbor waters (Table 2-2).

Table 2-2. Beneficial Uses of Dominguez Channel and greater Los Angeles/Long Beach Harbor waters (LARWQCB, 1994)

303(d) list waterbody	Basin Plan waterbody (Hydo # 405.12)	MUN	NAV	IND	REC1	REC2	COMM	WARM	EST	MAR	WILD	RARE	MIGR	SPWN	SHELL	WET
Dominguez Channel fresh Torrance Lateral	Dominguez Channel to Estuary	P			Ps	E		P			P	E				
Dominguez Channel Estuary	Dominguez Channel Estuary		P		Es	E	E		E	E	E	Ee	Ef	Ef		
Consolidated Slip Inner Harbor Fish Harbor	Los Angeles Long Beach Harbor All Other Inner areas		E	E	E	E	E			E		Ee			P	
Cabrillo Marina	Los Angeles Long Beach Harbor Marinas		E	E	E	E	E			E		E			P	
Inner Cabrillo Beach	Los Angeles Long Beach Harbor Public Beach areas		E		E	E	E			E	E	E		E	E	
Los Angeles River Estuary	Los Angeles River Estuary		E	E	E	E	E		E	E	E	Ee	Ef	Ef	P	E
Outer Harbor San Pedro Bay	Los Angeles Long Beach Harbor Outer Harbor		E		E	E	E			E		E			P	

Beneficial use designations apply to all tributaries to the indicated water body, if not listed separately.
E: Existing beneficial use
P: Potential beneficial use
e: One or more rare species utilize all oceans, bays, estuaries, and wetlands for foraging and/or nesting.
f: Aquatic organisms utilize all bays, estuaries, lagoons, and coastal wetlands, to a certain extent, for spawning and early development. This may include migration into areas that are heavily influenced by freshwater inputs.
s: Access prohibited by Los Angeles County Department of Public Works

Greater Los Angeles and Long Beach Harbor waters have designated uses to protect aquatic life including the marine (MAR) and rare, threatened or endangered species habitat (RARE). There are also beneficial uses associated with human use of these waters, including recreational use for water contact (REC1), non-contact water recreation (REC2), navigation (NAV), industrial service supply (IND), commercial and sport fishing (COMM), and shellfish harvesting (SHELL). The estuaries (EST) are recognized as areas for spawning, reproduction and/or early development (SPWN), migration of aquatic organisms (MIGR) and wildlife habitat (WILD). Dominguez Channel also has an existing designated use of warm freshwater habitat (WARM) and the Los Angeles River estuary has the designated use of wetland habitat (WET).

2.2.2 Water Quality Objectives (WQOs)

The second part of California water quality standards is water quality objectives. As stated in the Basin Plan, water quality objectives (WQOs) are intended to protect the public health and welfare and to maintain or enhance water quality in relation to the designated existing and potential beneficial uses of the water. The Basin Plan specifies both narrative and numeric water quality objectives. The following narrative water quality objectives are the most pertinent to this TMDL. These narrative WQOs may be applied to both the water column and the sediments.

> Chemical Constituents: *Surface waters shall not contain concentrations of chemical constituents in amounts that adversely affect any designated beneficial use.*
>
> Bioaccumulation: *Toxic pollutants shall not be present at levels that will bioaccumulate in aquatic life to levels, which are harmful to aquatic life or human health.*
>
> Pesticides: *No individual pesticide or combination of pesticides shall be present in concentrations that adversely affect beneficial uses. There shall be no increase in pesticide concentrations found in bottom sediments or aquatic life.*
>
> Toxicity: *All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life.*

The Regional Board's narrative toxicity objective reflects and implements national policy set by Congress. The Clean Water Act states that, "it is the national policy that the discharge of toxic pollutants in toxic amounts be prohibited." (33 U.S.C. 1251(a)(3).) In 2000, USEPA established numeric water quality objectives for several pollutants addressed in this TMDL in the California Toxics Rule (CTR) (USEPA, 2000b). The CTR establishes numeric aquatic life criteria for 23 priority toxic pollutants and numeric human health criteria for 92 priority toxic pollutants. These criteria are established to protect human health and the environment and are applicable to inland surface waters, enclosed bays and estuaries.

For the protection of aquatic life, the CTR establishes short-term (acute) and long-term (chronic) criteria in both freshwater and saltwater. The acute criterion equals the highest concentration of a pollutant to which aquatic life can be exposed for a short period of time without deleterious effects. The chronic criterion equals the highest concentration of a pollutant to which aquatic life can be exposed for an extended period of time (4 days) without deleterious effects. Freshwater criteria apply to waters in which the salinity is equal to or less than 1 part per thousand (ppt) 95 percent or more of the time. Saltwater criteria apply to waters in which salinity is equal to or greater than 10 ppt, 95 percent or more of the time. For waters in which the salinity is between 1 and 10 ppt, the more stringent of the two criteria apply.

In the CTR, freshwater and saltwater criteria for metals are expressed in terms of the dissolved fraction of the metal in the water column. These criteria were calculated based on methods in USEPA's *Summary of Revisions to Guidelines for Deriving Numerical National Water Quality* d*Criteria for the Protection of Aquatic Organisms and Their Uses* (50 FR 30792, July 29, 1985), developed under Section 304(a) of the CWA. This methodology is used to calculate the total recoverable fraction of metals in the water column and then appropriate conversion factors, included in the CTR are applied, to calculate the dissolved criteria.

The human health criteria are established to protect the general population from priority toxic pollutants regulated as carcinogens (cancer-causing substances) and are based on the consumption of water and aquatic organisms or aquatic organisms only, assuming a typical consumption of 6.5 grams per day of fish and shellfish and drinking 2.0 liters per day of water. Table 2-3 summarizes the aquatic life, and human health criteria for metals and organic constituents, covered under this TMDL.

Table 2-3. Water quality standards established in the CTR for metals and organic compounds

Pollutant	Criteria for the Protection of Aquatic Life		Criteria for the Protection of Human Health	
	Saltwater			
	Acute (µg/L)	Chronic (µg/L)	Water & Organisms (µg/L)	Organisms only (µg/L)
Cadmium	42	9.3		
Copper	4.8	3.1	1300	
Chromium VI	1100	50		
Lead	210	8.1		
Nickel	74	8.2	610	4600
Selenium	290	71		
Silver	1.9	n/a		
Zinc	90	81		
Chlordane	0.09	0.004	0.00057	0.00059
Dieldrin	0.71	0.0019	0.00014	0.00014
4,4'-DDT[1]	0.13	0.001	0.00059	0.00059
Total PCBs[2]		0.014	0.00017	0.00017
Benzo[a]pyrene			0.0044	0.049

[1]Based on total DDT, the sum of all isomer analyses.
[2]Based on total PCBs, the sum of all congener or isomer or homolog or aroclor analyses.

For PCBs, the aquatic life values in the Basin Plan are the same as in the CTR. For PCBs, the human health values are not the same. The Basin Plan human health value for PCBs is based only on the sum of Aroclor analyses; however the CTR human health value (0.17 ng/L) is for total PCBs and is applicable and more stringent since it is calculated as sum of all congener, or isomer, or homolog or Aroclor analyses.

There are no numeric standards for fish tissue in the Basin Plan or CTR. However, the human health criteria in the CTR were developed to ensure that bioaccumulative substances do not concentrate in fish tissue at levels that could impact human health.

There are no sediment quality objectives in the Basin Plan or CTR. The Regional Board applied best professional judgment to define elevated values for metals in sediment during the water quality assessments conducted in 1996, 1998, and 2002. During the water quality assessments for 2006, assessments of sediments for metals and organics followed the sediment quality guidelines in the Functional Equivalent Document for the California Listing policy "Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List." These guidelines were also used in the assessment of sediment quality for this TMDL (Table 2-4).

Table 2-4. Sediment quality guidelines used for determination of impairment for metals and organic compounds

Pollutant	Marine and Estuarine Sediments			Freshwater Sediments
	Effects Range Median[1]	Probable Effects Level[2]	Other Sediment Quality Guideline	Probable Effect Concentration[3]
METALS				
Cadmium		4.21 µg/g dw		4.98 mg/kg dw
Copper	270 µg/g dw			149 mg/kg dw
Chromium	370 µg/g dw			111 mg/kg dw
Lead		112.18 µg/g dw		128 mg/kg dw
Nickel				48.6 mg/kg dw
Selenium				
Silver		1.77 µg/g dw		
Zinc	410 µg/g dw			459 mg/kg dw
ORGANICS				
Chlordane	6 ng/g dw[4]			17.6 µg/kg dw
Dieldrin	8 ng/g dw			61.8 µg/kg dw
Total DDT			590*	572 µg/kg dw
Total PCBs	180 ng/g dw		400 ng/g[5]	676 µg/kg dw
Total PAHs			180,000(µg/kg)[8]	22,800(µg/kg)
Benzo[a]pyrene		763.22 ng/g		1450 µg/kg dw
2-methyl-napthalene		201.28 ng/g dw		
Phenanthrene		543.53 ng/g dw		1170 ug/kg dw
Lo MW PAHs		1442 ng/g dw		
Benza[a]anthracene		692.53 ng/g dw		1050 ug/kg dw

[1]Long et al. 1995 dw = Dry Weight
[2]MacDonald et al., 1996
[3]MacDonald et al., 2000a
[4]Long and Morgan, 1990
[5]MacDonald et al., 2000b
[8]Fairey et al., 2001
Freshwater and saltwater SQG values from CA listing policy, FED pg. 122-123
*marine DDT value from EPA Superfund Risk Assessment (1994)

The California Water Quality Control Board has set a State policy, *The State Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality* (SQO Part 1), for evaluation of sediments by the interpretation and integration of multiple lines of evidence called the sediment "triad": Application of the SQO Part 1 results in assessed sediments being categorized as Unimpacted, Likely Unimpacted, Inconclusive, Possibly Impacted, Likely

Impacted, or Clearly Impacted. The sediment categories of **Unimpacted** and **Likely Unimpacted** are the protective conditions and meet the narrative objective.

2.2.3 Antidegradation

The third part of California water quality standards is antidegradation. State Board Resolution 68-16, "Statement of Policy with Respect to Maintaining High Quality Water" in California, known as the "Antidegradation Policy," protects surface and ground waters from degradation. Any actions that can adversely affect water quality in all surface and ground waters must be consistent with the maximum benefit to the people of the state, must not unreasonably affect present and anticipated beneficial use of such water, and must not result in water quality less than that prescribed in water quality plans and policies. Furthermore, any actions that can adversely affect surface waters are also subject to the federal Antidegradation Policy (40 CFR 131.12).

2.3 **Impairments Identified in 303(d) lists**

The waters of the Dominguez Channel and the Ports of Los Angeles and Long Beach in the San Pedro Bay, addressed by this TMDL, are impaired due to a variety of toxic pollutants, including metals, organic compounds, and sediment toxicity. In addition, certain waterbodies show impairment to the benthic community.

This section reviews the 303(d) lists issued by the State of California and USEPA in 1998 (the list to which the consent decree refers) (Table 2-5), 2002, 2006 (Table 2-6) and 2008/2010 (Table 2-7) which establish the impairments.

The consent decree provides that TMDLs need not be completed for specific water body by pollutant combinations if the State or EPA determines that TMDLs are not needed for these combinations, consistent with the requirements of Section 303(d). The consent decree provides that this determination may be made either through a formal decision to remove a combination from the State Section 303(d) list or through a separate determination that the specific TMDLs are not needed. The September 2010 modification of the consent decree included a finding of non-impairment for copper and lead in Wilmington Drain; these impairments will also be removed from the 303(d) list when sufficient data is available to de-list in accordance with the State Listing Policy

For the 2006 303(d) list, the State of California made several changes in water body-pollutant listings for water in Dominguez Channel and greater Los Angeles and Long Beach Harbor waters. Clarification was provided such that individual PAH compounds were listed as opposed to the general category of polyaromatic hydrocarbons (PAHs). Some areas changes also occurred. In addition, EPA proposed some additions to the State's 2006 list. Table 2-6 provides the waterbody-pollutant combinations for the 2006 list.

Table 2-5. 1998 303(d) list of metal and organic compound impairments, shown here by analytical units as defined in consent decree.

Water body name	Tissue	Sediment
Analytical Unit #73		
Dominguez Channel freshwater	Aldrin*, Chem A* Chlordane*, Dieldrin* DDT*, PCBs*	
Dominguez Channel estuary	Aldrin*, Chem A* Chlordane, Dieldrin DDT, PCBs	Benthic community effects
Consolidated Slip	Chlordane, Dieldrin DDT, PCBs,	Toxicity, benthic community effects
Inner Harbor	DDT, PCBs	Toxicity
Main Channel	DDT, PCBs	Toxicity
SouthWest Slip	DDT, PCBs	Toxicity
Fish Harbor	DDT, PCBs	Toxicity
Long Beach Harbor	DDT, PCBs	Toxicity, benthic community effects
Cabrillo Beach-Inner	DDT, PCBs	Toxicity
San Pedro Bay	DDT, PCBs	Toxicity
Los Angeles River Estuary	DDT, PCBs	Toxicity
Machado Lake **	DDT, PCBs	
Analytical Unit #74		
Dominguez Channel freshwater		PAHs
Dominguez Channel estuary		PAHs
Consolidated Slip		PAHs
Inner Harbor		PAHs
Main Channel		PAHs
Fish Harbor		PAHs
Long Beach Harbor		PAHs
San Pedro Bay		PAHs
Analytical Unit #75		
Torrance Lateral Channel		Cu, Pb
Wilmington Drain *		Cu, Pb
Dominguez Channel freshwater		Cr, Cu, Pb, Zn
Dominguez Channel estuary		Cr, Cu, Pb, Zn
Consolidated Slip		Cr, Pb, Zn
Inner Harbor		Cu, Zn
Main Channel		Cu, Zn
Fish Harbor		Cu, Zn
Analytical Unit #78		
San Pedro Bay		Cr*, Cu*, Zn*

* Pollutants marked are removed from the 303(d) list. Therefore, this TMDL will not address these.
** Machado Lake and Wilmington Drain will not be addressed in these TMDLs.

Table 2-6. 2006 final 303(d) list of individual pollutant impairments by water body.

Water body name	Tissue	Sediment
Dominguez Channel freshwater	Pb, Dieldrin	Zn, Cu Toxicity
Torrance Lateral		Cu, Pb
Dominguez Channel estuary	Chlordane, Dieldrin DDT, Pb	DDT, PCBs, Zn benthic community effects Benzo[a]anthracene, Benzo[a]pyrene, Chrysene, Phenanthrene, Pyrene
Consolidated Slip	Chlordane, Dieldrin DDT, PCBs, toxaphene	Chlordane, DDT, PCBs Cd, Cr, Cu, Hg, Pb, Zn Toxicity, benthic community effects Benzo[a]anthracene, Benzo[a]pyrene, Chrysene, Phenanthrene, Pyrene, 2-methylnaphthalene
Inner Harbor*	DDT, PCBs	Cu, Zn, Toxicity, benthic community effects
Fish Harbor	DDT, PCBs	Cu, Hg, Pb, Zn Chlordane, DDT, PCBs Benzo[a]anthracene, Benzo[a]pyrene Chrysene, Dibenz[a,h]anthracene, Phenanthrene, Pyrene, PAHs, Toxicity
LA Harbor—Cabrillo Marina	DDT, PCBs	
LA Harbor—Inner Cabrillo Beach	DDT, PCBs	Cu
Outer Harbor*	DDT, PCBs	Toxicity
San Pedro Bay	DDT, PCBs	Chlordane, PAHs, Cr, Cu, Zn, Toxicity
Los Angeles River Estuary	--	Chlordane, toxicity DDT, PCBs, Pb, Zn

*Inner Harbor area changes made in 2006, includes Southwest Slip and portions of Main Channel, as well as portions of Los Angeles and Long Beach Harbor. Also Long Beach Harbor area changes were made in 2006, redefined into Inner and Outer Harbor (see Figure 2-1).

The final 2008/2010 303(d) list was approved by EPA on November 12, 2010. Several additional additions and deletions were made based on newer data. Table 2-7 provides the waterbody-pollutant combinations for the 2008/2010 list.

Table 2-7. 2008/10 final 303(d) list of individual pollutant impairments by water body.

Water body name	Tissue	Sediment
Dominguez Channel freshwater		Cu, Pb, Zn Diazinon
Torrance Lateral		Cu, Pb
Dominguez Channel Estuary	Chlordane, Dieldrin DDT, Pb	DDT, PCBs, Zn, benthic community effects Benzo[a]anthracene Benzo(a)pyrene Chrysene Phenanthrene Pyrene Toxicity
Consolidated Slip	Chlordane, Dieldrin DDT, PCBs Toxaphene	Chlordane DDT PCBs Cd, Cr, Cu, Hg, Pb, Zn, Toxicity, Benthic Community Effects Benzo[a]anthracene Benzo(a)pyrene Chrysene Phenanthrene Pyrene 2-Methylnapthalene
Inner Harbor	DDT, PCBs	Cu, Zn, Toxicity Benthic Community Effects Benzo(a)pyrene Chrysene
Fish Harbor	DDT, PCBs	Cu, Hg, Pb, Zn Chlordane, DDT, PCBs Benzo[a]anthracene Benzo(a)pyrene Chrysene Dibenz[a,h]anthracene Phenanthrene *PAHs (Polycyclic Aromatic Hydrocarbons)* Phenanthrene Pyrene, Toxicity
Los Angeles Harbor – Cabrillo Marina	DDT, PCBs	Benzo(a)pyrene
Los Angeles Harbor –Inner Cabrillo Beach	DDT, PCBs	
Outer Harbor	DDT, PCBs	toxicity
San Pedro Bay Near/Off Shore Zones	DDT, PCBs	Chlordane Toxicity
Los Angeles River Estuary		Chlordane, Toxicity, DDT, PCBs

2.4 Data Review/Impairments identified for this TMDL

This section summarizes available monitoring data for Dominguez Channel and greater Los Angeles and Long Beach Harbor waters for the listed pollutants in water, fish and sediments. This section includes more recent data than the listing data, in some instances, and provides more detail in terms of whether impairments are in water, tissue or sediment. The summary includes water quality, fish tissue, and sediment quality data from various monitoring sources, for the period of 1992 to 2010. Thus, the assessment and problem statement sections of this document more accurately reflect current water quality conditions in Dominguez Channel and greater Los Angeles and Long Beach Harbor waters.

2.4.1 Assessment methodology

In general, the protocols used for this assessment are consistent with those outlined in the State's 303(d) listing policy (SWRCB 2004). The benchmarks used in this assessment are consistent with those identified in the policy's supporting Functional Equivalency Document (FED) document. The state's policy was developed by the State for purposes of water quality assessments, and the State applied this policy to develop its decisions for the 2006 and 2008/2010 303(d) lists. In addition, EPA added waterbodies and pollutants to the State's list in 2006.

This assessment builds on the data record evaluated by the State and compiled in the 2006 and 2008/2010 303(d) list factsheets; it also includes more recent information. This more detailed analysis is consistent with procedures provided in the State's Impaired Waters Guidance (SWRCB, 2005) to produce an assessment more accurately reflecting current water conditions.

As described above, this assessment is generally consistent with protocols and benchmarks provided in the State's 303(d) listing policy and supporting (FED) document. For example, this assessment used the same benchmarks for comparison to determine exceedences; e.g., water quality objectives from CTR, sediment quality guideline values and OEHHA fish tissue screening values from the policy's FED. One exception (discussed below) is that this assessment used a sediment chemistry benchmark for DDT, whereas the listing policy did not include a media-pollutant specific value.

Important sources of new data include: Bight 2003 study, recent Los Angeles County MS4 monitoring, City of Los Angeles (TIWRP) Harbor monitoring, Port of Los Angeles (POLA) Prop 13 studies, Port of Long Beach (POLB) water monitoring and POLA/POLB TMDL monitoring of 2006 and some SCCWRP studies. The complete list of data reviewed is provided in Table 2-8. All recent data are final and have received some QA/QC review, thus data are viable for assessment.

Table 2-8. Water Quality, sediment and fish data reviewed for this assessment.

ID	Data Source	Data record	Spatial scope	Sample media
5	POLA/POLB Sediment survey	2006	Greater Los Angeles/Long Beach Harbor waters	Sediment, porewater, overlying water
3	POLB water data	2006	Inner Harbor	Water
8	SCCWRP	2006	Consolidated Slip	Sediment, porewater, overlying water
		2006	Dominguez Channel estuary	Air
4	POLA Prop. 13 POLA water data	2004—2006	Dominguez Channel estuary, Consolidated Slip, Inner Harbor	Water
		2004—2006	Consolidated Slip, Inner Harbor	Water
11	Bight '03	2003	greater Los Angeles/Long Beach Harbor waters	Sediment
21	LA RWQCB SWAMP	2003	Dominguez Channel freshwater	Water
7	SCCWRP DDE Inventory	2003	So. Calif. Bight and LA Harbor	Water
18	SCCWRP	2002-03	Dominguez Channel freshwater	Water
10	POLA/AMEC	2002	Consolidated Slip	Fish
13	USEPA Superfund Montrose site	2002 and 1994	Stormwater pathway from site downstream to Consolidated Slip	Sediment DDT
17	POLA Biological baseline	2002 and 2008	Inner & Outer Harbor; San Pedro Bay	Biology
1	LACDPW NPDES MS4	2002—2010	Dominguez Channel freshwater	Water
19	ACTA 2001	2000-01	Dominguez Channel estuary	Mussels
6	City of LA BOS TIWRP	1999-2004	Outer Harbor	Sediment, Fish; Water in 2002-03
16	Oil Refineries NPDES	1998-2004	Dominguez Channel estuary	Sediment
2	POLB stormwater NPDES data	1996—2005	LB Harbor	Water
20	LACSD	1995—2004	San Gabriel River Estuary	Water, Sediments
9	CSTF sediment database	1988-2001	greater Los Angeles/Long Beach Harbor waters	Sediment, Fish
14	NOAA status & trends data	1986—1998	Outer Harbor and San Pedro Bay	Mussels
15	TSMP	1978—2000	Dominguez Channel estuary	Fish
14	SMW	1977—2000	Inner & Outer Harbor	Mussels
12	OEHHA OEHHA/CFCP	1991	So. Calif. Bight	Fish
		1999 & 2000	San Pedro Bay, Belmont Pier	Fish

note: numbered data sources are discussed further below.
POLA – Port of Los Angeles, POLB – Port of Long Beach

2.4.2 Water Column

2.4.2.1 1. LACDPW NPDES MS4 Los Angeles County Department of Public Works - Freshwater Dominguez Channel

Los Angeles County Department of Public Works (LACDPW) collects samples at the Dominguez Channel mass emissions monitoring station (S28), which is above tidal influence. The upper portion of Dominguez Channel contains freshwater down to Artesia Blvd. S28 is in a concrete-lined, rectangular channel. LACDPW monitoring results from this site provides data for both wet and dry weather.

Metals data was reviewed for both wet and dry weather. All metal data were compared to sample-specific hardness adjusted CTR standards. From 2002 to 2010, CTR criteria for dissolved metals were exceeded in wet weather for copper, lead and zinc: Cu, 29 exceedances out of 35wet weather samples; Pb: 16 exceedances of 35 and Zn: 27 exceedances out of 35. While pre-2005 Pb results contain some uncertainty because the lab reporting limit (5 ug/L) was occasionally above the hardness specific Pb criteria, Pb results as of 2004 -2010 were reliably assessed, since the method detection limit was lowered to 0.5 ug/L at that time. In dry weather, no dissolved exceedences were observed for these three metals. In addition, no exceedences were observed for dissolved cadmium, chromium, mercury, nickel, selenium and silver in wet or dry weather.

Also, water column toxicity was repeatedly observed at S28 monitoring station from 2002 to 2010. Chronic *Ceriodaphnia dubia* tests showed inhibited survival during wet weather events in 2002, 2003 and 2005. *C. dubia* tests also showed inhibited reproductive success in the same timeframe. Toxic responses occurred in 6 of 14 wet weather sampling events during this timeframe. Dry weather results showed only one toxic result in 14 sampling events. Few water toxicity identification evaluation (TIE) studies have been performed to identify the category of causative agent(s). TIEs in 2003-04 indicated some volatile organic compounds may have caused toxicity; whereas 2002-03 TIEs indicated toxicity may be due to one or more non-polar organic compounds, cationic metals, and/or metabolically-activated organophosphates.

Five of 21 samples collected as part of the Los Angeles County Stormwater monitoring program exceeded the chronic DFG fresh water hazard assessment criteria for diazinon (three of which also exceeded the acute criteria) for the protection of aquatic life. Trend analysis of sample results collected over 8 years, showed that diazinon levels were below the DFG criteria after 2005, this is concurrent with EPA's deadline to ban on urban use of this pesticide. While toxicity is apparent in Dominguez Channel freshwater after 2005, it does not appear attributable to elevated diazinon.

Torrance Lateral

Torrance Lateral is a sub-watershed within the larger Dominguez Channel watershed that flows directly into Dominguez Channel Estuary (approx. 2 miles below S28). Recently Los Angeles County DPW completed more monitoring within Torrance Lateral as part of the Dominguez Channel tributary study (LAC DPW, 2009; 2010). Torrance Lateral refers to waters upstream of confluence with Dominguez Channel, consistent with LAC DPW sampling site TS19. Available water column results (2008 & 2009) reveal exceedences of dissolved copper (8 of 10) and zinc (9 of 10) CTR criteria during wet weather conditions. Dissolved lead was below the criteria in wet weather conditions and no dry weather exceedences occurred for any of these three metals. Currently there is no flow gauge associated with stream flows within Torrance Lateral, thus the daily storm volume or load duration approach can not apply.

2.4.2.2 2. POLB stormwater NPDES data Port of Long Beach—Inner Harbor (mid-water column)

Port of Long Beach has collected ambient samples from one site (3RW) within Long Beach Harbor. Available data from 1996 to 2005, include only total recoverable metals. Careful review of these ambient results, revealed some possible QA/QC concerns that require further clarification prior to assessment. Most notably, results from dates prior to and including 2002 are much higher than those reported from 2003 to present. These results will not be included in the assessment of Inner Harbor waters until the QA issues have been resolved.

2.4.2.3 3. POLB water data

In 2006, POLB performed one sampling event with numerous sites within the Inner Harbor. All samples were below criteria. Results are summarized in Table 2-9.

Table 2-9. Water column dissolved metal results from Port of Long Beach—Inner Harbor (2006).

Pollutant	Detection Limit	# of detections	Conc. Range (ug/L)	CTR chronic saltwater objective (ug/L)
Cadmium	0.005	14	0.01 – 0.06	9.3
Copper	0.01	14	0.28 – 1.41	3.1
Lead	0.005	14	0.10 – 0.07	8.1
Mercury	0.005	14	<0.01	0.05¥
Nickel	0.005	14	0.19 – 0.39	8.2
Silver	0.02	14	<0.02	1.9*
Zinc	0.005	14	0.58 – 3.81	81

*silver value is acute criterion; ¥mercury value is human health criterion

2.4.2.4 4. POLA water data Port of Los Angeles—various Harbor waters (mid-water column)

Port of Los Angeles (POLA) currently has a monitoring program which obtains monthly samples for conventional parameters (DO, pH, TSS) at fixed stations which began in 2003. In 2005, POLA collected extra samples for an enhanced suite of analytes; i.e., metals and priority organics during two sampling events. Waterbodies sampled included Inner and Outer Harbor, Fish Harbor, Consolidated Slip, Cabrillo Marina and Inner Cabrillo Beach. Results for the two enhanced suite events are presented in Table 2-10 and compared with CTR chronic criteria.

Table 2-10. Water column data (2005) for POLA Inner, Fish and Outer Harbor.

Pollutant	Detection Limit	# of sites	Conc. Range (ug/L)	CTR chronic saltwater objective (ug/L)
Cadmium*	0.005	22	0.015 – 0.104	9.3
Copper*	0.01	22	0.28 – 3.16	3.1
Lead*	0.005	22	0.02 – 0.834	8.1
Mercury*	0.005	22	0.0005 – 0.0046	0.05¥
Nickel*	0.005	22	0.27 – 0.71	8.2
Silver *	0.02	22	0.007 – 0.11	1.9*
Zinc*	0.005	22	3.28 – 58.8	81
totDDT	0.01	22	ND	0.001
totPAHs	0.01	22	0.09 – 0.28	0.049**
totPCBs	0.01	22	ND	0.03

*silver value is acute criterion; ¥mercury value is human health criterion;
** total PAHs CTR criterion is for benzo[a]pyrene, protection of human health (consumption of organisms only).
Dissolved results for metals; unfiltered total results for organics.

POLA has also collected freshwater samples in Dominguez Channel at Artesia, the same site as the mass emission station (S28) maintained by LACDPW. Pollutograph samples were collected by capturing samples at distinct time intervals to evaluate concentration changes over short time frame such as one day. POLA has also collected some Dominguez Channel estuary water samples during wet and dry weather to support hydrodynamic and water quality modeling for the estuary. Results are pending.

2.4.2.5 5. POLA/POLB Sediment survey Ports of Long Beach and Los Angeles—Inner and Outer Harbor (waters overlying sediments)

In fall 2006, POLB and POLA performed a joint monitoring survey of sediments and overlying waters at 60 sites within greater Los Angeles/Long Beach Harbor waters. More description of this survey is provided in the section describing sediment monitoring results. Analytical results for total, unfiltered samples of waters overlying the sediment are summarized in Table 2-11.

Table 2-11. Overlying Water data (2006) for Ports—Inner and Outer Harbor.

Pollutant	Detection Limit	# of detections	Conc. Range (ug/L)	CTR chronic saltwater objective (ug/L)
Cadmium*	0.005	43		9.3
Copper*	0.01	43	0.3 – 3.9	3.1
Lead*	0.005	43	<0.005 – 1	8.1
Mercury*	0.005	43	<0.005	0.05¥
Silver *	0.02	43	<0.02	1.9*
Zinc*	0.005	43	0.4 – 7.1	81
totDDT		43	ND— 0.0043	0.001
totPAHs		43	0.0046 – 0.42	
totPCBs		43	ND	0.03

*silver value is acute criterion; ¥mercury value is human health criterion
All results are total unfiltered samples collected one foot above sediment-water interface.

2.4.2.6 6. City of LA BOS TIWRP- Outer Harbor

City of Los Angeles, Bureau of Sanitation, collects ambient samples in compliance with an NPDES permit for TIWRP. Some water samples were collected as part of the Interim Monitoring Program (IMP) in 2002-03, from station HW50 in the Outer Harbor. The vast majority of these water column results are below the detection limits, however, the detection limits are above the water quality criteria. The metal results have some detections for (presumably) total recoverable metal analytes. Some exceedences of water quality criteria are noted for copper (5-31.5 ppb), lead (11-58 ppb) and silver (6.7-11.6 ppb).
NOTE: These results may require additional investigation regarding appropriate QA/QC for saltwater matrices and potential confounding interferences for accurate instrumental analysis.

2.4.2.7 7. SCCWRP DDE Inventory SCCWRP – Inner & Outer Harbor, San Pedro Bay

SCCWRP has utilized special analytical techniques to obtain measurements of priority organics in the water column at various sites along the Southern California Bight. Special, highly sensitive, solid phase microextraction (SPME) devices were deployed into the water column for sufficient time periods as to yield actual ambient results for DDT and PCBs with extremely low detection levels (sub-ng/L). The initial research efforts measured dissolved phase DDE (metabolite form of parent DDT compound) throughout the Bight (Zeng et al. 2005). Results from four stations within Inner and Outer Harbor waters show elevated levels of DDE in comparison to CTR human health numeric criteria. Total PCB measurements also exceed the CTR human health numeric criteria at these stations. Concentrations of DDE and total PCBs were higher at surface (2 m sub-surface) than those measured in water overlying (2m above) contaminated sediments.

2.4.2.8 8. SCCWRP – Consolidated Slip

In fall 2006, SCCWRP performed repeated sampling at one site in Consolidated Slip. The sampling was designed to obtain chemical measurements of priority organics from sediment, porewater and overlying water to characterize the sediment flux values for the pollutants of concern in the Consolidated Slip. During each of three sampling events, the overlying waters were sampled via in-situ high volume pump to obtain high sample volumes (e.g., 1000+ L) for chemical extraction via PUF methods and to generate lower detection limits. Average results showed elevated levels of total DDT (0.47 ng/L) and total PCBs (0.45 ng/L) in comparison to CTR human health criteria (10^{-6}) for consumption of organisms only. Measured concentration ranges for listed organic compounds are provided in Table 2-12, along with CTR human health criteria.

Table 2-12. SCCWRP (2006) overlying water data for Consolidated Slip.

Pollutant	Detection Limit	# of detections	Conc. Range (ng/L)	CTR Human health (ng/L)
Chlordane total	0.010	3	0.055 – 0.07	0.59
Dieldrin	0.020	3	<0.020	0.59
p,p-DDE*	0.050	3	0.15 – 0.23	0.59
DDT total	0.050	3	0.41 – 0.47	0.59[¥]
PCBs total	0.020	3	0.37 – 0.43	0.17
Benzo[a]pyrene	0.020	3	0.147 – 0.827	49
Benzo[a]anthracene	0.050	3	0.743 – 1.006	49
Chrysene	0.050	3	0.747 – 1.319	49
Phenanthrene	0.050	3	5.772 – 12.169	n/a
Pyrene	0.050	3	8.670 – 11.173	11,000

2.4.3 Sediment

Several sources provide sediment results for both sediment chemistry as well as sediment toxicity. Data were compiled through the Contaminated Sediments Task Force (CSTF), representing the data record from 1992 to 2001. For Consolidated Slip, there are also sediment results from the EPA Superfund sampling event in 2002, with added analyses by AMEC in contract with the Port of Los Angeles. In addition, for Dominguez Channel freshwater, NPDES-collected data from LA County DPW were analyzed and for Dominguez Channel estuary NPDES-collected data from oil refineries were analyzed.

To assess impacts to sediments, sediment results from the 2006 303(d) list as well as more recent additional data for the waterbodies of concern in these TMDLs were reviewed. The more recent data includes: Bight 2003 study, TIWRP NPDES samples, Los Angeles and Long Beach Harbor's 2006 survey and the SCCWRP sediment flux study in 2006. Below is a brief discussion of each sediment data set to provide general spatial and temporal information.

2.4.3.1 Consolidated Sediment Task Force database (CSTF)

Numerous sediment results have been compiled by SCCWRP into one database (CSTF 2001). The database contains records from numerous sampling events by various monitoring groups/studies. Records from 1992 to 2001, including results from Bay Protection Toxic Cleanup Program (1992, 1994, 1996, 1997), Bight 1998, Western EMAP 1999 and dredge studies were reviewed.

2.4.3.2 Refineries (NPDES)

Oil refineries that discharge process waters into Dominguez Channel are required to collect receiving water samples from within the Channel as part of their NPDES permits. Most years, however, the refineries do not discharge. Sampling sites are located within Dominguez Channel estuary. From 1994 to 2004, sampling frequency has decreased and now occurs only in years when there is a discharge, such as 2005. Analytical detection limits for DDT, PCBs and PAHs were not sufficiently sensitive to allow assessment in comparison to sediment quality guidelines.

For example, results for individual PAH compounds in sediments were expressed as "<0.8mg/kg" in 2003; whereas the State's Listing Policy has identified sediment quality guidelines values (all in dry wt.) for 2-methylnaphthalene (201 µg/kg), phenanthrene (543.5 µg/kg), benzo[a]pryrene (763.2 µg/kg), benzo[a]anthracene (692.5 µg/kg), chrysene (845.9 µg/kg), pyrene (1397.4 µg/kg). Future monitoring efforts will benefit significantly from lower detection limits for comparison with these and other relevant sediment quality guidelines.

2.4.3.3 Terminal Island Water Reclamation Plant (NPDES)

City of Los Angeles Terminal Island Water Reclamation Plant monitors sediment in five locations in Outer Harbor. Sediment chemistry results from 1999-2004 were reviewed.

2.4.3.4 Bight 03—Southern California Bight Regional Monitoring Project

Bight 03 provides an integrated assessment of Southern California coastal estuaries (SCCWRP 2004, 2006). Multiple agencies coordinated to collect samples in summer 2003 which were analyzed for sediment chemistry, toxicity, and benthic community response. The sediment toxicity and bulk chemistry results for stations in the greater Harbor waterbodies have been included in this assessment report relevant to these TMDLs. These sediment chemistry results supplement the sediment data record provided by CSTF and provide review of more recent ambient sediment concentrations.

2.4.3.5 PORTs (POLB & POLA)—sediment survey 2006

In fall 2006, the Ports of Los Angeles and Long Beach performed a monitoring survey of 60 sites in greater Los Angeles/Long Beach Harbor waters. The sampling approach was discussed by both Ports, Regional Board staff, USEPA, SCCWRP and Weston Solutions, and agreed upon as part of a more comprehensive data collection plan to support the TMDL development process. One goal was to characterize contaminant concentrations in sediment, porewater and overlying water. Physical parameters, such as grain size and percent moisture, were also measured to provide ancillary data. Another goal was to reduce uncertainty associated with spatial variability thus sampling occurred at 30 randomly selected sites within each of the Port's jurisdictional areas. A complementary study by SCCWRP (see immediately below) provided additional data at co-located sites. These studies were designed to help characterize site-specific sediment-water flux rates within these greater Los Angeles/Long Beach Harbor waters. To ensure compatibility of all data, both Weston and SCCWRP used the same analytical laboratory, therefore analytical methods and method detection limits were consistent across both programs.

2.4.3.6 SCCWRP—Sediment flux study 2006

In fall 2006, SCCWRP, under separate contract with the Regional Board, performed complementary monitoring to the Port's study described above. One goal was to perform similar matrix sampling of sediment, porewater, overlying waters at one site in the Consolidated Slip and to collect samples at three different times to evaluate individual site variability. Another goal was to co-locate solid phase microextraction (SPME) devices at 11 stations with the Ports' sites to measure organics in waters overlying sediments via a different analytical approach. As mentioned above, the overall goal was to obtain site-specific data for generating sediment-water flux estimates of organochlorines and PAHs at the Consolidated Slip site and then extrapolate this information to other Harbor sites using other chemical data collected by Ports at the 60 other sites.

2.4.4 Fish and Shellfish Tissue

While fish tissue data are limited, analysis of fish tissue for chemical contaminants provides a good measure of water quality since this media represents a long term integrator of bioaccumulation of pollutants and more reliable indication of water quality impacts. The following summary discusses the existing fish advisory and then presents more recent results along with some older data for perspective.

2.4.4.1 OEHHA—LA Harbor, Cabrillo Marina, Inner Cabrillo Beach, San Pedro Bay

In 1991, OEHHA issued a fish consumption advisory for various waters along the coastline between Point Dume and Dana Point, including waters in the Harbor area. High levels of DDT and PCBs were measured in sportfish representing a human health risk. Samples collected inside the Harbor breakwater, at Pier J and at Belmont Pier clearly showed elevated total DDT and PCBs in comparison to risk-based values. Total chlordane levels (ranged from 0 to 53 ppb) in these same samples were not above risk values so chlordane was not included in the advisory.

As part of the Coastal Fish Contamination Project (CFCP), OEHHA collected more fish tissue samples off Belmont Pier in 1999 and 2000. Results are summarized in Table 2-13.

Table 2-13. Fish tissue composite results from OEHHA/CFCP (1999 & 2000) (µg/kg, wet weight).

Pollutant	White Croaker (n=2)	Queenfish (n=1)	Spotted Turbot (n=1)	Total # of exceedences	OEHHA screening value
Chlordane	5.4 – 17.5	12.4	2.3	0	30
DDT total	92.4 – 254.0	396.6	104.0	3	100
PCBs total	98.0 – 294	207	116	4	20

Composite results shown for filets only, organics reported for skin-on filets

2.4.4.2 Terminal Island Water Reclamation Plant–LA Harbor

City of Los Angeles Terminal Island Water Reclamation Plant monitoring program has also collected fish tissue samples within the Outer Harbor. Results for 2000-2004 are summarized in Table 2-14. These results indicate non-impairment of fish tissue for arsenic, cadmium, mercury, selenium and chlordane, based on samples lower than Listing Policy screening values. The continued presence of high DDT and PCB levels indicates these pollutants are still creating adverse impacts and provide corroborating evidence for the consumption advisory in these waters.

Table 2-14. Fish tissue data from Terminal Island Water Reclamation Plant (1999-2004) (ppb = ug/kg, wet weight).

Pollutant	Count	Fish Tissue (conc. range)	Total # of exceedences	OEHHA screening value
As	30	0.46 – 1.14	1	1.0
Cd	30	<0.4	0	3.0
Hg	30	0.01 – 0.11	0	0.3
Se	30	0.10 – 0.46	0	1*
Chlordane	30	0.30 – <3.0	0	30
DDT total	40	22 – 6514	36	100
PCBs total	40	19 – 1000	36	20

*Se tissue value from USFWS for protecting birds. Dieldrin in fish tissue was not reported.

2.4.4.3 USEPA Superfund (and POLA)

In 2002, USEPA Superfund Division collected fish samples via separate projects in various waters of concern to these TMDLs. The Consolidated Slip was sampled to determine DDT levels in fish tissue. POLA coordinated with EPA to have these samples analyzed by AMEC for other parameters. Two fish species were collected and four individuals of each species (halibut and white croaker) were analyzed. Various sample preparation methods were used and yielded different analytical results consistent with each approach. Analytical results for fish filets are presented in Table 2-15 below. In general, tissue levels were below Listing Policy tissue screening values for arsenic, cadmium, mercury, selenium and chlordane. DDT and PCB total levels exceeded Listing Policy values in several samples indicating impairment due to these pollutants.

Table 2-15. Fish tissue data from Consolidated Slip (ppb = ug/kg, wet weight; EPA Superfund & POLA/AMEC).

Pollutant	White Croaker (n=4) Conc. Range	Halibut (n=4) Conc. Range	Total # of exceedences	OEHHA screening value
As	0.42—0.63	0.19—0.56	0	1.0
Cd	0.01	0.01—0.07	0	3.0
Hg	0.08—0.13	0.05—0.11	0	0.3
Se	0.31—1	0.23—0.41	1	1*
Chlordane	1—8.2	1	0	30
Dieldrin	n/a	n/a	--	2.0
DDT total	399—569	6—15	4	100
PCBs total	131—888	47	3	20

Metals reported for filets only, organics reported for skin-on filets
*Se value from USFWS (not OEHHA) for protecting birds

As part of Montrose Settlement Restoration Program, USEPA (Superfund Division) and other federal agencies collected fish samples from Point Dume to Dana Pt. in 2002. The objective of this project was to measure DDT and PCB contamination in fish tissue. Over 1000 individual fish from 123 species were collected in Santa Monica Bay, around Palos Verde peninsula, San

Pedro Bay, Huntington Harbor, Newport Harbor, etc. Tissue results from three "segments" are pertinent to waterbodies within the scope of these TMDLs (EPA 2007). These segments are all inside the San Pedro Bay breakwater ranging from Cabrillo fishing pier in the west (segment #16) to Pier J/Finger Piers (segment #17) to Belmont Pier/Seaport Village in the east (segment #18). Fish tissue results for these segments are summarized in Table 2-16 below.

Table 2-16. Individual Fish tissue results from inside breakwater of Outer Harbor and eastern San Pedro Bay. (EPA /NMFS/OEHHA, 2002) (ppb = µg/kg, wet weight).

	Cabrillo Pier-inside bkwtr (Segment 16)		Pier J/Fingers Pier (Segment 17)		Belmont Pier/Seaport Village (Segment 18)	
Pollutant	Conc. range	# exceeds/total	Conc. range	# exceeds/total	Conc. range	# exceeds/total
Chlordane	3 – 23	0 / 80	2 – 63	5 / 68	3 – 33	3 / 69
Dieldrin	0.4 – 1.4	0 / 74	0.4 – 7.9	8 / 65	0.5 – 1.5	0 / 69
DDT total	9 – 2522	27 / 80	0.4 – 764	13 / 68	1.4 – 206	12 / 69
PCBs total	0.5 – 278	50 / 80	46 – 188	46 / 68	4.1 – 190	50 / 69

organics reported for skin-on filets

In 1994, to demonstrate DDT contamination in the stormwater pathway coming off the Montrose Chemical plant site, USEPA Superfund Division collected biota samples in waterbodies downstream of the Montrose site in the Dominguez Channel watershed and into Consolidated Slip. Various tissue samples were obtained ranging from mosquito fish (in freshwater Torrance Lateral) to mussels, whole crabs and mallard eggs (in Dominguez Channel estuary) to whole topsmelt and black surfperch filets (in Consolidated Slip). Total DDT results for majority of these samples exceeded the OEHHA screening value (100 ppb wet wt.). No chlordane, dieldrin or PCB results were determined for these samples.

2.4.4.4 Mussel Watch data—greater Los Angeles/Long Beach Harbor waters

Both NOAA and SWRCB have monitoring programs of mussels in bay, harbor and coastal waters. Given the nature of this program which is to transplant mussels to specific sites on annual basis, these analytical results can be used for evaluating long term trends. State Mussel Watch (SMW) results for Consolidated Slip in 1982-2000 showed declining trends for chlordane, DDT, and PCBs. SMW chlordane results did not exceed the OEHHA value, and DDT results were often below the corresponding OEHHA value, whereas, PCB results were never below the OEHHA PCB value. SMW results for dieldrin and toxaphene were the basis for listing Consolidated Slip in 1996; dieldrin had one exceedence (1/20) above the OEHHA value, whereas toxaphene had more exceedences, (5/10) in ten years.

2.4.4.5 CSTF database—Inner Harbor, Outer Harbor, Inner Cabrillo Beach, San Pedro Bay

The CSTF database contains fish tissue results from BPTCP 1997 and Bight 1998. Composite results were presented for whole fish, mostly small forage species such as goby. No metal results were reported in the database. There were exceedances of Listing Policy tissue guidelines for DDT and PCBs: total DDT = 4 exceedance of 18 detections, and total PCBs = 7 exceedances of 18 detections. Chlordane, detected 13 times, showed no exceedances.

2.4.4.6 Toxic Substances Monitoring Program—Dominguez Channel

In 1992, Toxic Substances Monitoring Program (TSMP) collected one fish sample (white croaker) in Dominguez Channel. The 1998 and 2002 303(d) lists utilized this data to indicate the freshwater portion of Dominguez Channel as impaired due to high levels of organics in fish tissue. For the 2006 303(d) list, the State of California concluded that the conclusion of impairment within Dominguez Channel freshwater segment were inaccurate because the actual sampling site for the one fish was collected in the estuary. The 2006 303(d) list analysis stated the TSMP sampling report verifies that the white croaker was caught downstream of Vermont Ave., in the estuary segment of Dominguez Channel. Thus there is no impairment due to dieldrin within Dominguez Channel; no TMDL will be developed for this specific waterbody-pollutant combination. Table 2-17 is a summary of the TSMP data.

Table 2-17. Fish tissue data (1992) from Dominguez Channel estuary (ppb, wet weight).

Program	**TSMP**	**SWRCB**	**SWRCB**
Date	**1992**	**Maximum Tissue Residue Level (MTRL)**	**Screening Value (µg/kg)**
Species	**White Croaker (n=1)**		
Cd	n/d	--	3
Hg	0.09	--	0.3
Se	0.68	--	1*
Chlordane	164	8.3	30
Dieldrin	5.3	0.7	2.0
Total DDTs	6487	--	100
Total PCBs	1780	5.3	20

Note: MTRLs are not used for assessment purposes , but provided for perspective.
*Se value from USFWS for protecting birds

2.5 **Summary of data on pollutant basis**

2.5.1 <u>Metals</u>

Copper, lead and zinc were most commonly above numeric criteria for various waterbodies. Elevated levels of these three metals were observed in the freshwaters of Dominguez Channel, and Torrance Lateral. Dissolved copper occasionally exceeds in Inner and Fish Harbor. Elevated copper, lead and zinc levels in sediments were evident within Dominguez Channel estuary, Consolidated Slip, Inner Harbor, and Fish Harbor. Cadmium and chromium were elevated in sediments of Consolidated Slip or Dominguez Channel estuary but do not exceed in sediments elsewhere in the watershed or receiving waters. Mercury levels in fish tissue were not above Listing Policy screening values for any water body. Mercury sediment levels were high only in Consolidated Slip and Fish Harbor. Some water bodies appeared to show non-impairment for metals, Cabrillo Beach, Outer Harbor, Los Angeles River estuary and San Pedro Bay. Arsenic did not exceed water or sediment numeric criteria in any waters.

2.5.2 PAHs

Individual PAH results exceeded numeric sediment guidelines most frequently in Dominguez Channel estuary, Consolidated Slip, Inner Harbor and Fish Harbor. A few sediment exceedences for benzo[a]pyrene were also observed in Cabrillo Marina and Los Angeles River Estuary. Measurements of PAH compounds in water were not reliable for assessment due to inadequate method detection limits in comparison to numeric criteria. Fish tissue results for PAHs were either non-existent or do not provide sufficient information to be utilized for assessment with screening values.

2.5.3 Organochlorines

Chlordane sediment levels were observed above sediment guidelines in Dominguez Channel estuary, Consolidated Slip, Fish Harbor and Los Angeles River Estuary. The vast majority of fish tissue results of chlordane were below Listing Policy screening values in all waterbodies. Mussel results show declining trend for chlordane at two locations in receiving waters.

Dieldrin tissue and sediment results were elevated and isolated to Dominguez Channel estuary and Consolidated Slip. Toxaphene is elevated in tissue in Consolidated Slip only.

DDT and PCB fish results were elevated above Listing Policy screening values in nearly all receiving waters. This does not include Dominguez Channel freshwater; although DDT has been detected in stormwater samples collected in Torrance Lateral (SCCWRP 2002-03). The more recent (1999-2004) tissue results corroborated the previously established consumption advisory in these greater Los Angeles/Long Beach Harbor waters (OEHHA 1991; 2009). Sediment results for DDT and PCBs were elevated in transitional waters; e.g., Dominguez Channel estuary, Consolidated Slip and Los Angeles River Estuary.

2.5.4 Sediment Toxicity

Water toxicity was repeatedly observed in Dominguez Channel freshwaters. Sediment toxicity was observed in Dominguez Channel estuary, Consolidated Slip, Inner and Outer Harbor, Fish Harbor, Los Angeles River estuary and San Pablo Bay. The Bight 03 and Ports' 2008 BioBaseline studies provided the most recent sediment toxicity results.

2.5.5 Benthic Community Effects

The Dominguez Channel estuary, Consolidated Slip and Inner Harbor were previously listed for degraded benthic communities (infauna population and species composition). The recent survey of benthic infauna (Bight 2003; Ports' 2006 and 2008) provided results in more current conditions; whereas previous studies provided historical information (BPTCP 1992-97, Bight 1998). While certain areas in the Inner Harbor have shown dramatic improvement, most notably the Cabrillo and Pier 400 Shallow Water Habitat areas, the 2003-08 results did not change the overall assessment conclusion of impairment for three waterbodies mentioned above.

2.6 **Assessment Findings for each water body**

2.6.1 Dominguez Channel freshwaters

Dissolved copper, lead and zinc exceeded numeric hardness-specific CTR criteria during wet weather events. No exceedences for these three metals occurred during dry weather conditions. Results for other metals or organochlorine compounds did not exceed criteria or detection limits were too high for adequate assessment determinations. Water toxicity has been repeatedly observed in the freshwater at the mass emissions station during wet weather conditions, only one exceedence was observed during dry conditions. Whereas elevated diazinon levels had been observed concurrently with toxicity in 2002-2005 wet weather samples and therefore diazinon was presumed to be contributing to adverse toxicity results; post-2005 results show no diazinon concentrations above the freshwater guideline. Therefore, it is appropriate to develop freshwater metals and toxicity TMDLs for wet weather; however, the more recent toxicity results are not attributable to diazinon and therefore no diazinon TMDLs have been developed for Dominguez Channel.

2.6.2 Torrance Lateral

Torrance Lateral contains freshwater and is currently included on the State's 2008/2010 CWA 303(d) list as impaired due to copper and lead. Sediment results for copper and lead were above the State listing policy sediment quality values for these heavy metals (POLA/AMEC 2002). Recently Los Angeles County DPW completed water column monitoring within Torrance Lateral as part of the Dominguez Channel tributary study (LAC DPW, 2009; 2010). Available water column results reveal exceedences of dissolved copper (8 of 10) and zinc (9 of 10) CTR criteria during wet weather conditions. Dissolved lead was below the criteria in wet weather conditions and no dry weather exceedences occurred for any of these three metals. Based on this information, we conclude water column impairments for copper and zinc.

2.6.3 Dominguez Channel estuary

Sediment toxicity has been observed in 4 of 7 results, including 3 of 6 highly toxic results in Bight 03. In recent sediment triad studies, bulk levels of Cd, Cu, Pb and Zn were above sediment guidelines (Bight 03). Historical sediment results showed elevated levels of these metals, also. PAH sediment data showed levels of five individual compounds were above guidelines and maybe contributing to sediment toxicity. Elevated DDT and PCBs occurred in fish tissue and some sediment samples. Chlordane was elevated in recent sediment samples and historical fish tissue results. Dieldrin was not measured in sediments and was observed at slightly elevated levels in the individual fish sample reported in 1992. Degraded benthic community effects were observed in BPTCP 96 & 97 and confirmed in Bight 03 (3 of 5 in poor condition).

2.6.4 Los Angeles Harbor - Consolidated Slip

Water results showed elevated levels of DDT and PCBs (SCCWRP, 2006). Sediment toxicity has been observed in 12 of 13 historical samples, including one highly toxic result in Bight 03. In recent sediment triad studies, bulk levels of Hg, Pb and Zn were above sediment guidelines (Bight 03). Historical sediment results showed elevated levels of these metals and Cd, Cr, Cu, also. PAH sediment data showed that levels of six individual compounds were above guidelines and may be contributing to sediment toxicity. Chlordane and dieldrin have not been measured in recent sediment samples. Tissue results were mixed. Elevated DDT and PCBs occurred in fish tissue and nearly all sediment samples. Toxaphene was originally listed due to elevated levels in mussels and remains impaired until new data shows significant decreases. Benthic community effects were observed in BPTCP 96 & 97 and moderate degradation observed in the Bight 03 results.

2.6.5 ***Los Angeles and Long Beach Inner Harbor***

A fish consumption advisory for certain DDT and PCBs in certain fish species is currently in place and is corroborated by recent fish tissue results (OEHHA 2009).

Sediment toxicity has been observed in 10 of 23 samples, including 3 of 8 toxicity samples in Bight 03. Historical sediment data (pre- 1996) showed elevated levels of metals, PAHs and PCBs. In sediment triad studies, individual PAH levels were above PAH sediment guidelines (BPTCP 96 & 97, Bight 98). PAH sediment data showed sufficient exceedences of benzo[a]pyrene and chrysene (8/80) as to be impaired. There are fewer exceedences of benzo[a]anthracene, pyrene and phenanthrene (2/72) so these PAH compounds appear to not contributing to sediment toxicity. PCB sediment results from two older studies were also above sediment guidelines (BPTCP 96 & 97, Bight 98). More recent triad studies did not show such elevated (nor threatening) levels of PCBs; however, Pb and Zn were above guidelines (Bight 03). There are some reliable measurements of metals in water and only copper exceedences were evident (POLA 2005-06, Ports 2006). DDT and PCBs in water column have been detected via solid phase microextraction (SPME) devices; DDE results showed exceedences of CTR human health criteria (Zeng, et al. 2005). Benthic community effects were observed in BPTCP 96 & 97, Bight 98 & 03 and a few in Biobaseline 08.

2.6.6 ***Outer Harbor***

A fish consumption advisory for DDT and PCBs in certain fish species is currently in place and is corroborated by recent fish tissue results (OEHHA 2009). Additional support is provided by 2004 -06 fish tissue results (TIWRP). Sediment toxicity has been observed in 7 of 26 samples, including 3 of 7 moderately toxic samples in Bight 03. No individual contaminants were above sediment guidelines in more recent studies (Bight 98, WEMAP 99, Bight 03). Individual PAH levels were above pollutant sediment guidelines only in historical results; e.g., BPTCP 1997 and earlier. Trend analyses of NOAA mussel data for PAHs were inconclusive. There are a few reliable measurements of metals, PAHs, DDT and PCBs in the water column. DDE measured in water column showed 2 of 4 exceedences of CTR criteria (Zeng, et al. 2005). Benthic community effects were observed in Bight 98 & 03 and a few in Biobaseline 08.

2.6.7 ***Los Angeles Fish Harbor***

A fish consumption advisory for DDT and PCBs in certain fish species is currently in place and is corroborated by recent fish tissue results (OEHHA 2009). Sediment toxicity has been observed in 2 of 4 results, including 1 of 1 moderate toxicity result in Bight 03. In recent sediment triad studies, bulk levels of Cu, Pb and Zn were above sediment guidelines (Bight 03). Historical sediment results showed elevated levels of chlordane, mercury, and six individual PAH compounds. There are a few reliable measurements of aqueous metals or organics in this waterbody.

2.6.8 Cabrillo Marina

A fish consumption advisory for DDT and PCBs in certain fish species is currently in place and is corroborated by recent fish tissue results (OEHHA 2009). Only one sediment toxicity result (Bight 03) exists and showed moderate to high toxicity, with corresponding and repeatedly elevated results for benzo[a]pyrene (5 of 26 exceedences of sediment quality guideline). Historical sediment results showed elevated levels of chlordane and chrysene in comparison to sediment guidelines, yet these do not correspond with sediment toxicity results, so impairment is not associated with these two compounds. Sediment results did not show elevated levels of metals or other organic compounds. There are a few reliable measurements of aqueous metals or organics exist in this waterbody; no exceedences have been recorded.

2.6.9 Cabrillo Beach - Inner

A fish consumption advisory for DDT and PCBs in certain fish species is currently in place and is corroborated by recent fish tissue results (OEHHA 2009). Only historical sediment toxicity results exist for this segment; however no corresponding elevated levels of individual PAHs, total PAHs or organochlorine compounds were associated with the one toxic result. Sediment metal results are not elevated values relative to sediment quality guidelines, except for copper (2 of 16 in BPTCP 1994). More recent sediment results do not show any exceedences for any metal or organic compounds (PORTs 2006). There are a few reliable measurements of aqueous metals or organics exist in this waterbody; no exceedences have been recorded, including copper 0 of 4 dissolved (POLA 2005-06). Based on available data in this pre-TMDL assessment, this waterbody is not impaired for copper, although it is on 2006 303(d) list.

2.6.10 Los Angeles River Estuary

A fish consumption advisory for DDT and PCBs in certain fish species is currently in place and extends into the estuary based on recent fish results collected at Pier J/Fingers Pier, both near the estuary mouth (OEHHA 2009). Sediment toxicity has been observed in 4 of 7 results, including 2 of 5 moderate toxicity results in Bight 03. Historical sediment results showed elevated levels of chlordane. In recent sediment triad studies, bulk levels of chlordane, PCBs, and benzo[a]pyrene were above sediment guidelines (Bight 03). A few reliable measurements of aqueous metals or organics exist in this waterbody; no exceedences have been recorded. Based on available data in this pre-TMDL assessment, this waterbody is not impaired for lead and zinc.

2.6.11 San Pedro Bay

A fish consumption advisory for DDT and PCBs in certain fish species is currently in place and is corroborated by recent fish tissue results (OEHHA 2009). Chlordane in fish tissue did not appear to be elevated above OEHHA screening values. Sediment toxicity has been observed in 4 of 18 results, including 1 of 2 moderate toxicity results in Bight 03. Elevated levels of chlordane have been repeatedly occurring (6 of 19) and are associated with sediment toxicity. Other sediment results do not show exceedences for metals nor PCBs, nor other organics. A few reliable measurements of aqueous metals or organics exist in this waterbody (Ports 2006, SCCWRP 2006). Based on available data, this waterbody is not impaired for chromium, copper, zinc, and total PAHs and these listings have been removed from the 2008/2010 303(d) list.

2.7 Assessment changes

2.7.1 New findings of impairment

In the course of this assessment, some waterbodies were identified as impaired due to pollutants not identified on previous 303d lists. Please note that previous "PAHs" listings have been clarified, where feasible, for individual PAH compounds; these may be construed as new listings.

- Dominguez Channel for water toxicity.
- Dominguez Channel Estuary for cadmium and copper.
- Torrance Lateral for zinc.

2.7.2 Assessment findings of non-impairment

This assessment has identified some water body-pollutant combinations as non-impaired. Even though this combination is on the 2010 303(d) list, based on review of available data, the pollutant levels are not elevated relative to water quality benchmarks, therefore, the assessment conclusion yields the water body is attaining standards for this particular pollutant.

- Dominguez Channel for Diazinon

2.8 Conclusions

Based on review of available data, including information with 2008-2010 303(d) list factsheets and more recent monitoring information, the water-quality limited segments are identified in Table 2-18 below. Each waterbody-pollutant combination will require TMDL development.

Using available sediment triad results (Bight 98, 03; WEMAP 99,05; BioBaseline 2008), we performed an assessment for each saline waterbody using SQO Part I-Direct Effects methodology. An exceedence of SQO Part I was considered for Possibly Impacted, Likely Impacted or Clearly Impacted at each station. Following the CA 303(d) Listing Policy procedures, including those outlined in Table 3-1 of that document, two or more exceedences per waterbody was interpreted as impaired. These assessment results confirmed impairment within the estuaries and and greater LA/LB Harbor waters identified in Table 2-18. See Appendix III.9 for sediment triad results compiled per waterbody.

Table 2-18. Assessment Findings for each water body

Waterbody	Metals	PAHs	PCBs, DDT, etc	Toxicity	Benthic Community	SQO Impaired
Dominguez Channel fresh	Cu, Pb, Zn			**Water (diazinon)**		
Torrance Lateral	Cu, Pb, **Zn**					
Dominguez Channel estuary	**Cd**, Cu, Pb, Zn	Benzo[a]anthracene, Benzo[a]pyrene, Chrysene, Pyrene, Phenanthrene	DDT, PCBs, Chlordane, Dieldrin	sediment	X	X
Consolidated Slip	Cd, Cr, **Cu**, Hg, Pb, Zn	Benzo[a]anthracene, Benzo[a]pyrene, Chrysene, Pyrene, Phenanthrene, 2-methylnapthalene	DDT, PCBs, Chlordane, Dieldrin, Toxaphene	sediment	X	X
Inner Harbor	Cu, Zn	Benzo[a]pyrene, Chrysene	DDT, PCBs	sediment	X	X
Outer Harbor			DDT, PCBs	sediment		X
Fish Harbor	Cu, Pb, Zn, Hg	Benzo[a]anthracene, Benzo[a]pyrene, Chrysene, Pyrene, Phenanthrene, Dibenzoanthracene	DDT, PCBs, Chlordane	sediment		X
Cabrillo Marina		Benzo[a]pyrene,	DDT, PCBs,			X
Inner Cabrillo Beach			DDT, PCBs			
LA River Estuary			DDT, PCBs, Chlordane	sediment		X
San Pedro Bay			DDT, PCBs, Chlordane	sediment		X

Bold indicates impairment although not included on 2008/2010 303(d) list
No impairment due to diazinon in freshwaters of Dominguez Channel

3 Numeric Targets

Numeric targets were developed for all toxic pollutants identified in Section 2, above. Metal, chlordane and individual PAH compound target values are provided for water and sediment (Tables 3-1 and 3-7). DDT and PCBs and toxaphene targets are provided for water and sediment (Tables 3-1 and 3-7) as well as for fish tissue and tissue residues (Table 3-8 and 3-9). Also, ambient water toxicity and sediment toxicity targets are included since TMDLs will be developed for these impairments, which may not be alleviated by attainment of water quality standards for metals, PAHs, or organochlorine compounds. Both freshwater and saltwater targets are provided in this section.

3.1 Water

Numeric water targets are established in this TMDL for metals, organics and toxicity. Water targets are guided by the Basin Plan and the California Toxics Rule (CTR).

3.1.1 Water: Metals and Organics

Numeric water targets for metals and organics, consistent with CTR water quality criteria for protecting aquatic life, are established in Table 3-1. All metal water targets are for dissolved forms of the metals and are hardness dependent, except mercury which is for total mercury and is not hardness dependent.

The human health target was determined using the "organism only" values from the CTR versus the "organism and water" values because the waters of the Harbors are not drinking waters.

Table 3-1. Water quality criteria established in CTR for metals and organics.

Pollutant	Criteria for the Protection of Aquatic Life				Human Health
	Freshwater		Saltwater		Organism only
	Acute (µg/L)	Chronic (µg/L)	Acute (µg/L)	Chronic (µg/L)	(ug/L)
Copper	6.99*	4.95*	4.8	3.1	n/a
Lead	30.14*	1.17*	210	8.1	n/a
Zinc	65.13*	65.66*	90	81	n/a
Mercury	n/a	n/a	n/a	n/a	0.051
Chlordane	2.4	0.0043	0.09	0.004	0.00059
Dieldrin	0.24	0.056	0.71	0.0019	0.00014
4,4'-DDT	1.1	0.001	0.13	0.001	0.00059
Total PCBs	n/a	0.014	n/a	0.03	0.00017
Benzo[a]pyrene	n/a	n/a	n/a	n/a	0.049**

* Freshwater aquatic life criteria for Cd, Cu, Pb, Zn are expressed as a function of total hardness (mg/L) in the water body. Values presented correspond to average hardness from/to 2002-2010 of 50 mg/L (n=35).

** CTR criteria for individual PAH of benzo(a)anthracene, benzo(a)pyrene, and chrysene equals 0.049 µg/L. CTR criteria for pyrene is 11,000 ug/L.

n/a = no criteria available in CTR

3.1.2 Water: Total metals

Wet weather monitoring results were evaluated for the potential use of site-specific wet-weather factors to converting the acute CTR criteria from dissolved metals concentrations to total recoverable concentrations. LAC DPW stormwater data collected at Vermont Ave (MES site# S28, 2002 to 2010), included hardness, TSS, dissolved and total metals.

Staff used EPA Guidance *The Metals Translator: Guidance For Calculating A Total Recoverable Permit Limit From A Dissolved Criterion* (USEPA, 1996) on developing metal translators, to evaluate the potential for site-specific wet weather conversion factors for copper, lead and zinc. CTR identifies default translators which were compared to the USEPA guidance on three options for deriving a site-specific translator:

- Direct Measurement - Assuming no Relationship to Total Suspended Solids (TSS), uses descriptive statistics and may be developed directly as the ratio of dissolved to total recoverable metal;
- Direct Measurement - Based upon Relationship to TSS, uses regression equations to evaluate correlations and yield r^2 values, which indicate the strength of the relationship with TSS and fraction of particulate metals;
- Partition coefficient – Based on relationship to TSS and is functionally related to the number of metal binding sites on the particulate surfaces in the water column (i.e., concentrations of TSS, TOC, or humic substances), and r^2 values also indicate the strength of the relationships and the conversion factor (fraction of particulate metals).

Option 1 (“percentile method”) was selected as viable for estimating site-specific wet weather hardness specific conversion factors for each metal (Table 3-2). For translation of acute metals criteria, the 90% value was determined, which is consistent with the State’s Implementation Policy (SIP) for CTR (SWRCB, 2005). Analysis via Options 2 and 3 revealed a very poor correlation of particulate metals fractions with TSS (r^2 values ranged from 0.345 - 0.378). Without any reliable relationship with TSS, translators derived from Options 2 and 3 were disregarded.

Table 3-2. Freshwater wet weather dissolved/total metals targets (ug/L) – using different translators

Metal	Diss. CTR Criteria*	CTR default translator	Total metals w/ CTR	Site specific Conv. Factor*	Total metals w/ Site Sp. Conv. Factor
Copper	6.99	0.96	7.3	0.722	9.7
Lead	30.14	0.895	33.8	0.706	42.7
Zinc	65.13	0.978	66.6	0.935	69.7

*LAC DPW results at S28, data record 2002-2010, median hardness – 50 mg/L; sample size = 35

3.1.3 Water: Toxicity

The Basin Plan includes a narrative toxicity objective which states, in part: “All Waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in, human, plant, animal, or aquatic life.” This objective does not allow acute toxicity in any receiving waters or chronic toxicity outside designated mixing zones.

A numeric toxicity target of 1 chronic toxicity unit (1 TUc) is established for this TMDL to allow evaluation of the narrative toxicity objective. The 1 TUc target maybe replaced by an equivalent toxicity target based upon any Statewide Toxicity Policy. A chronic toxicity target was selected because it addresses the potential adverse effects of long term exposure to lower concentrations of a pollutant and is therefore more protective than an acute toxicity target that may not address potential effects of longer term exposures. Equation 1 describes the calculation of a TUc.

Equation 1 TU_c = Toxicity Unit Chronic = 100/NOEC (no observable effects concentration).

Or: TUc = 100% ÷ the sample concentration, derived using hypothesis testing, to cause no observable effect, with the sample concentration expressed as a percentage.

The numeric toxicity target is set at no observable toxicity with water samples defined as toxic by toxicity testing if the following two criteria are met: 1) there is a significant difference ($p<0.05$) in mean organism response (e.g., percent survival) between a sample and the control as determined using a separate-variance t-test, and 2) the mean organism response in the toxicity test (expressed as a percent of the laboratory control) was less than the threshold based on the 90th percentile Minimum Significant Difference (MSD) value expressed as a percent of the control value.

The 90^{th} percentile MSD value is specific for each specific toxicity test protocol and is determined by identifying the magnitude of difference that can be detected 90% of the time by a specific test method. The following is a description of MSDs and how a toxic effect would be identified (SWRCB, 1996): "In toxicity tests, the MSD represents the smallest difference between the control mean and a treatment mean (the effect size) that leads to the statistical rejection of the null hypothesis (H^o: no difference). Any effect size equal to or larger than the MSD would result in a finding of statistically significant difference. For example, if the control mean for mysid growth were 80 ug/mysid and the MSD were 20, any treatment with mean mysid weight less than or equal to 60 ug would be significantly different from the control and considered toxic."

3.2 **Sediment**

Numeric sediment targets are established in this TMDL for metals, PAHs, and some priority organic compounds. Sediment targets are guided by the Basin Plan and the State Board Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality (SQO Part 1) which include descriptive narrative goals and methods for integrating sediment triad results. The numeric sediment quality guidelines of Long and MacDonald (Long et al., 1995; MacDonald et al., 2000) are recommended by the State Listing Policy. In this section, the Sediment Quality Plan is discussed first, as it guides sediment conditions for restoration and protection of benthic infauna (or sediment dwelling organisms) Consistent with SQO Part I, the sediment quality condition for direct effects is based on interpreting multiple lines of evidence using sediment triad results. Later, Section 3.3 presents sediment targets related to fish tissue values using an indirect effects approach.

3.2.1 Sediment: Applicability of the State Board Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality

California recently adopted the Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality (SQO Part 1) which applies to sediments within enclosed bays and estuaries. EPA approved the Sediment Quality Plan on September 25, 2009. Part 1 of the Sediment Quality Plan establishes a method to assess sediment quality which integrates chemical and biological measures to determine if the aquatic life within ambient sediment are protected or degraded by exposure to toxic pollutants in sediment. The Sediment Quality Plan establishes sediment quality objectives (SQO) based on three lines of evidence including sediment chemistry, sediment toxicity and benthic community condition. These three lines of evidence are referred to as the sediment triad.

The Sediment Quality Plan-Part 1 describes a method of using the three lines of evidence to categorize a sediment as "Unimpacted," "Likely unimpacted," "Inconclusive," "Possibly impacted," Likely impacted," or "Clearly impacted." The categories -"Unimpacted," and "Likely unimpacted" - are considered as achieving the protective condition for aquatic life in ambient sediment; these categories integrate three lines of evidence to define the TMDL targets for impaired sediments. Possibly Impacted, Likely Impacted and Clearly Impacted indicate impaired conditions; while Inconclusive is not impaired. T hese target conditions - "Unimpacted," and "Likely unimpacted" are the goal conditions, however TMDLs and allocations need to be numeric according to federal regulations. Both the narrative and numeric target are described in more detail below.

The SQOs for the protection of aquatic life and human health are described below:

a. Aquatic Life – Benthic Community Protection

   Pollutants in sediments shall not be present in quantities that, alone or in combination, are toxic to benthic communities in bays and estuaries of California. This narrative objective shall be implemented using the integration of multiple lines of evidence. The assessment of sediment quality consists of the measurement and integration of three lines of evidence (LOE). The LOE are:

- Sediment Toxicity: Sediment toxicity is a measure of the response of invertebrates exposed to surficial sediments under controlled laboratory conditions. The sediment toxicity LOE is used to assess both pollutant related biological effects and exposure. Sediment toxicity tests are of short durations and may not duplicate exposure conditions in natural systems. This LOE provides a measure of exposure to all pollutants present, including non-traditional or unmeasured chemicals.
- Benthic Community Condition: Benthic community condition is a measure of the species composition, abundance and diversity of the sediment-dwelling invertebrates inhabiting surficial sediments. The benthic community LOE is used to assess impacts to the primary receptors targeted for protection of aquatic life. Benthic community composition is a measure of the biological effects of both natural and anthropogenic stressors.
- Sediment Chemistry: Sediment chemistry is the measurement of the concentration of chemicals of concern in surficial sediments. The chemistry LOE is used to assess the potential risk to benthic organisms from toxic pollutants in surficial sediments. The sediment chemistry LOE is intended only to evaluate overall exposure risk from chemical pollutants. This LOE does not establish causality associated with specific chemicals.

b. Human Health

> Pollutants shall not be present in sediments at levels that will bioaccumulate in aquatic life to levels that are harmful to human health. The narrative human health objective shall be implemented on a case-by-case basis, based upon a human health risk assessment. In conducting a risk assessment, the Water Boards shall consider any applicable and relevant information, including California Environmental Protection Agency's (Cal/EPA), Office of Environmental Health Hazard Assessment (OEHHA) policies for fish consumption and risk assessment, Cal/EPA's Department of Toxic Substances Control (DTSC) Risk Assessment, and USEPA Human Health Risk Assessment policies.

Each line of evidence produces specific information that, when integrated with the other lines of evidence provides a more confident assessment of sediment quality relative to sediment chemistry alone. When the exposure (chemistry) and effects (toxicity and benthic community assessment) are integrated, the approach can quantify protection through effects measures and also provide predictive capability through the exposure measure.

3.2.2 Benthic community effects

This TMDL establishes benthic community targets based on the Sediment Quality Plan. Benthic community condition is a measure of the species composition, abundance and diversity of the sediment-dwelling invertebrates inhabiting surficial sediments. The narrative SQOs in the Sediment Quality Plan are designed to protect the biological organisms within marine sediments and provide a direct measure of impact to these communities.

The Sediment Quality Plan identifies methods to evaluate a waterbody's benthic community condition and its alteration from reference conditions. Four different benthic indices are provided in the Sediment Quality Plan each using the same benthic community data: the Benthic Response Index (BRI); the Index of Biological Integrity as adapted for California bays and estuaries (IBI); the Relative Benthic Index (RBI); and the River Invertebrate Prediction and Classification System (RIVPACS) which was adapted for use in California bays and estuaries.

Categorical thresholds for each of the four biological indices (BRI, IBI, RBI, RIVPACS) were developed based in comparison to reference condition and categorized into four levels of biological disturbance:

> Reference: Equivalent to least affected or unaffected site
> Low Disturbance: Some indication of stress is present, but within measurement error of unaffected condition
> Moderate Disturbance: clear evidence of stress
> High Disturbance: high magnitude of stress

The combination of the four benthic indices provides more information than any single index (Ranasinghe, et al., 2007). These benthic-response categories are integrated by taking the median value, rounding up when the median falls midway between two benthic-response categories.

Because the SQOs were developed in part based on a local reference condition specific to Southern California marine bays, benthic assessments can rely on these published indices in a weight of evidence approach. The target for benthic community effects are either reference or low disturbance condition for any of the four biological indices included in the SQOs (Table 3-3, shaded boxes).

Table 3-3. Benthic Index Categorization Values (Recreated from Sediment Quality Plan Part 1 Table 5)

Index	1. Reference	2. Low Disturbance	3. Moderate Disturbance	4. High Disturbance
Southern California Marine Bays				
BRI	**<39.96**	**39.96 to 49.14**	**49.15 to 73.26**	**>73.26**
IBI	**0**	**1**	**2**	**3 or 4**
RBI	**>0.27**	**0.17 to 0.27**	**0.09 to 0.16**	**<0.09**
RIVPACS	**>0.90 to <1.10**	**0.75 to 0.90 or 1.10 to 1.25**	**0.33 to 0.74 or >1.25**	**<0.33**

3.2.3 Sediment toxicity

This TMDL establishes sediment toxicity targets based on the Sediment Quality Plan. Sediment toxicity is a measure of the response of invertebrates exposed to surficial sediments under controlled laboratory conditions. This provides a measure of exposure to all pollutants present in the sediment, including non-traditional or unmeasured chemicals.

Application of SQOs per the Sediment Quality Plan requires a minimum of two sediment toxicity tests—at least one short-term survival test and at least one sub-lethal test.

For the short-term survival tests, the acceptable species are all amphipods species (*Eohaustorius estuarius, Leptocheirus plumulosus, and Rhepoxynius abronius*). For these species, toxicity is defined by tests that are statistically significant (from reference sediment sample) and exhibit more than 10% mortality. Thus the target conditions for short-term survival tests are less than or equal to 10% toxicity in comparison to a reference sediment sample. The thresholds established in the Sediment Quality Plan are based on statistical significance and magnitude of the toxic effect. Acceptable test organisms and methods are summarized in Table 3-4.

Table 3-4. Acceptable Short Term Survival Sediment Toxicity Test Methods.

Test Organism	Exposure Type	Duration	Endpoint
Eohaustorius estuarius	Whole Sediment	10 days	Survival
Leptocheirus plumulosus	Whole Sediment	10 days	Survival
Rhepoxynius abronius	Whole Sediment	10 days	Survival

The sub-lethal sediment toxicity tests, growth or development tests are required by the SQOs. For the acute sub-lethal tests, the selection of test organisms is constrained to two organisms—Neanthes for juvenile growth or Mytillus embryo for reproductive development. The target conditions for sub-lethal sediment toxicity tests are less than or equal to 10% toxicity for juvenile growth and 20% for reproductive development in comparison to a reference sediment sample. Acceptable test organisms and methods are summarized in Table 3-5.

Table 3-5. Acceptable Sublethal Sediment Toxicity Test Methods.

Test Organism	Exposure Type	Duration	Endpoint
Neanthes arenaceodentata	Whole Sediment	28 days	Growth
Mytilus gallopprovincialis	Sediment-water Interface	48 hours	Embryo Development

Because the SQOs require both toxicity tests, the desired condition for a waterbody is a non-toxic category from each type of toxicity test as shaded in Table 3-6, Disturbance Category 1.

Table 3-6. Sediment toxicity categorization values (Sediment Quality Plan Part 1. Table 4).

		Score (Disturbance Category)			
Test Species/ Endpoint	**Statistical Significance**	**1 Nontoxic (Percent)**	**2 Low Toxicity (Percent of Control)**	**3 Moderate toxicity (Percent of Control)**	**4 High Toxicity (Percent of Control)**
Eohaustorius Survival	**Significant**	**90 to 100**	**82 to 89**	**59 to 81**	**<59**
Eohaustorius Survival	**Not Significant**	**82 to 100**	**59 to 81**		**<59**
Leptocheirus Survival	**Significant**	**90 to 100**	**78 to 89**	**56 to 77**	**<56**
Leptocheirus Survival	**Not Significant**	**78 to 100**	**56 to 77**		**<56**
Rhepoxynius Survival	**Significant**	**90 to 100**	**83 to 89**	**70 to 82**	**<70**
Rhepoxynius Survival	**Not Significant**	**83 to 100**	**70 to 82**		**<70**
Neanthes Growth	**Significant**	**90 to 100***	**68 to 90**	**46 to 67**	**<46**
Neanthes Growth	**Not Significant**	**68 to 100**	**46 to 67**		**<46**
***Mytilus* Normal**	**Significant**	**80 to 100**	**77 to 79**	**42 to 76**	**<42**
***Mytilus* Normal**	**Not Significant**	**77 to 79**	**42 to 76**		**<42**

*Expressed as a percentage of the control

3.2.4 Sediment Chemistry: Metals and organics

Sediment targets are the desired surface sediment concentrations for specific toxic pollutants to protect human health, aquatic organisms and wildlife as well as to restore all beneficial uses. Sediment targets represent longer term goals than water quality targets.

This TMDL establishes numeric targets that are protective of aquatic life beneficial uses for organochlorine pesticides, PCBs, PAHs, and metals in sediments. While chlordane, dieldrin, toxaphene, DDT, and PCB impairments have been documented in fish tissue only, sediment targets are necessary as these fish tissue contaminants are directly associated with sediments which are the transport mechanism of these compounds to the fish.

The Sediment Quality Objectives (SQOs) established by the Sediment Quality Plan provide objectives based on multiple lines of evidence that can be applied to sediments but does not provide individual numeric targets for sediment chemistry. To develop a TMDL, it is necessary to translate the narrative objectives in the Basin Plan and the lines of evidences in the SQOs into numeric targets that identify the measurable endpoint or goal of the TMDL and represent attainment of applicable numeric and narrative sediment and water quality standards.

The sediment quality guidelines of Long and MacDonald (Long et al., 1995; MacDonald et al., 2000) provide applicable numeric sediment targets because the impairments and the 303(d) listings for PAHs, metals, toxicity and benthic community effects - are primarily based on sediment quality data for the Dominguez Channel estuary, Consolidated Slip, Fish Harbor, Inner and Outer Harbor, Cabrillo Beach-Inner, San Pedro Bay, and Los Angeles River Estuary. In addition, the pollutants being addressed have a high affinity for particles and the delivery of these pollutants is generally associated with the transport of suspended solids from the watershed or from sediments via porewater diffusion within the estuaries and greater Los Angeles/Long Beach Harbor waters.

The sediment quality guidelines of Effect Range Low (Long et al., 1995) and Threshold Effects Concentrations (MacDonald et al., 2000) are used to establish the numeric targets for freshwater sediment for Dominguez Channel, and marine sediment for the greater Los Angeles/Long Beach Harbor waters, as shown in Table 3-7. The State Board listing policy recommends the use of the Effect Range Medians (ERMs), Probable Effect Levels (PELs), and other sediment quality guidelines as a threshold for 303d listing decisions. ERM and PEL values are interpreted as levels above which the adverse biological effects are expected, which make them applicable in the determination of impairment. The Threshold Effects Concentration (TEC) for freshwater sediment and Effect Range Low (ERL) for marine sediment values, on the other hand, represent the levels below which adverse biological effects are not expected to occur, and are more applicable to the prevention of impairment. The goal of the TMDL is to remove impairment and to restore beneficial uses; therefore, the TEC for freshwater sediment and ERLs for marine sediment are selected as numeric targets over the ERMs and PELs to limit adverse effects to aquatic life.

Sediment targets must also be established at levels which will be protective of fish tissue contaminant levels. The organic pollutants addressed by this TMDL (e.g. Chlordane, Dieldrin, Toxaphene, DDT, and PCBs) have the potential to bioaccumulate. To account for bioaccumulation, these TMDLs will rely on the simplified assumption that reduced sediment pollutants will correspond to reduced fish tissue levels. This is reasonable based on the observation that white croaker is a bottom feeding fish and DDT and PCB levels in this fish species are contributing to the fish advisory throughout the greater Los Angeles/Long Beach Harbor waters. The Chlordane, Dieldrin, Toxaphene, DDT and PCBs sediment targets presented in section 3.2.1 may need to be revised in the future to attain the fish tissue targets. Assessment of indirect impacts of sediment contamination via bioaccumulation is currently under development by State Board and SCCWRP, as part of the State’s Sediment Quality Plan –Part II. Scientific information from such studies, based on local fish species and biogeochemistry specific to Southern California will be helpful in evaluating possible revision of sediment quality targets.

Table 3-7. Targets for sediment chemistry in fresh and saline waters (conc. in dry wt.)

Metals	Freshwater Sediment (mg/kg)	Marine Sediment (mg/kg)
Cadmium	n/a	1.2
Chromium	n/a	81
Copper	31.6	34
Lead	35.8	46.7
Mercury	n/a	0.15
Zinc	121	150
Organics	**Marine Sediment (ug/kg)**	
Chlordane, total	0.5	
Dieldrin	0.02	
Toxaphene	0.10*	
Total PCBs	22.7	
Benzo[a]anthracene	261	
Benzo[a]pyrene	430	
Chrysene	384	
Pyrene	665	
2-methylnaphthalene	201	
Dibenz[a,h]anthracene	260	
Phenanthrene	240	
Hi MW PAHs	1700	
Lo MW PAHs	552	
Total PAHs	4,022	
Total DDT	1.58	

n/a = not applicable since target not needed for this pollutant in freshwater sediment
*Toxaphene value from New York DEP (1999), assumes 1% TOC

Sediment targets, defined in Table 3-7 or 3-8, are not intended to be used as ~~necessarily~~ 'clean-up standards' for navigational, capital or maintenance dredging or capping activities; rather they are long-term sediment concentrations that should be attained after reduction of external loads, targeted actions addressing internal reservoirs of contaminants, and environmental decay of contaminants in sediment.

3.3 Fish Tissue for the protection of Human Health

Fish tissue targets for DDT and PCBs are selected from "Fish Contaminant Goals and Advisory Tissue Levels for Common Contaminants in California Sport Fish: Chlordane, DDTs, Dieldrin, Methylmercury, PCBs, Selenium, and Toxaphene", which are recently developed by OEHHA in June 2008 to assist other agencies to develop fish tissue-based criteria with a goal toward pollution mitigation or elimination and to protect humans from consumption of contaminated fish or other aquatic organisms (OEHHA 2008). Use of fish tissue targets is appropriate to account for uncertainty in the relationship between pollutant loadings and beneficial use effects (USEPA, 2002) and directly addresses potential human health impacts from consumption of contaminated fish or other aquatic organisms. Use of fish tissue targets also allows the TMDL analysis to more completely use site-specific data where limited water column data are available, consistent with the provisions of 40 CFR 130.7(c)(1)(i). Thus, use of Fish Contaminant Goals (FCGs) provides an effective method for accurately quantifying achievement of the water quality objectives/standards (Table 3-8). Associated sediment targets are not provided for Dieldrin and PAHs because the relationship between sediment and fish tissue is not sufficiently well established to determine an associated sediment target.

Table 3-8. Targets for bioaccumulatives in fish tissue.

Pollutant	Fish Tissue target (ug/kg wet)	Associated sediment target (ug/kg dry)
Chlordane	**5.6**	**1.3** [b]
Dieldrin	**0.46**	**n/a**
Total DDT	**21**	**1.9** [b]
Total PCBs	**3.6**	**3.2** [c]
PAHs – total	**5.47**[a]	**n/a**
Toxaphene	**6.1**	**0.1** [d]

[a] PAHs –total in fish is EPA screening value (EPA 2000c)
[b] Chlordane and total DDT associated sediment values from Newport Bay Indirect Effects draft report (SFEI, 2007)
[c] PCBs-total associated sediment target from SF Bay bioaccumulation study (Gobas & Arnot, 2010)
[d] Toxaphene value from New York DEP (1999), assumes 1%TOC
n/a indicates that a target is not established in this TMDL for this constituent.

3.4 Tissue residues for the protection of Wildlife

Tissue residue goals are identified for protection of wildlife habitat (WILD) and preservation of rare and endangered species (RARE) can also be achieved through tissue/residue levels for DDT and PCBs (Table 3-9). Reducing pollutant loads to attain human health targets will yield progress toward restoring all beneficial uses, yet additional wildlife specific goals must be considered to address possible impairments to reproductive success (birds) or immune system suppression (seals).

Table 3-9. Goals for DDT and PCBs in tissue residues for protecting wildlife habitat and rare and endangered species.

Pollutant	Birds	Harbor Seals
Total DDT	n/a	0.3 ug/g lipid*
Total PCBs	2.2 ug/g in eggs**	5.2 ug/g lipid*

*Barron et al (2003; citations therein) no-effect level for total DDT and total PCBs in harbor seals from Europe.
**Muir et al (1999) no-effect level for total PCBs in Forster's Tern eggs.

4 SOURCE ASSESSMENT

This section identifies the potential sources of OC Pesticides, PCBs, sediment toxicity, PAHs and metals compounds to Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters including discharges directly to these waterbodies and also through the Los Angeles River above the estuary (Los Angeles River estuary, itself, is included in "Greater Los Angeles and Long Beach Harbor Waters") and the San Gabriel River and estuary. As introduced in Section 2, Environmental Setting, the Los Angeles River Watershed and San Gabriel River watershed are not focus of these TMDLs. Detailed discussion of sources of OC Pesticides, PCBs, sediment toxicity, PAHs and metals *within* the Los Angeles and San Gabriel River watershed will not be provided in this section. However, a discussion of the Los Angeles River above the estuary and the San Gabriel River and estuary as a source to the Harbors on the whole, is included.

Briefly, there are two categories of pollutant sources to the waters of concern in these TMDLs. Point source discharges are regulated through National Pollutant Discharge Elimination System (NPDES) permits. Point sources include stormwater and urban runoff (MS4) and other NPDES discharges, including but not limited to the Terminal Island Water Reclamation Plant, refineries (5), and power generating plants (2), etc. Non-point sources, by definition, include pollutants that reach waters from a number of diffuse land uses and are not regulated through NPDES permits. Non-point sources include existing contaminated sediments within these waters and direct (air) deposition to the waterbody surface.

Metals and PAHs are currently generated or deposited in the watersheds and are then washed into storm drains and channels that discharge to the Dominguez Channel and greater Harbor waters. PCBs, DDT, dieldrin, toxaphene, and chlordane are legacy pollutants for the most part, yet, they remain ubiquitous in the environment, bound to fine-grained particles. When these particles become waterborne, the chemicals are often transported downstream and deposited within estuarine or marine waters. Urban runoff and rainfall higher in the watersheds mobilize the particles, which are then washed into storm drains and channels that discharge to the Dominguez Channel and greater Harbor waters.

Monitoring data from NPDES discharges, land use runoff coefficients, and air deposition studies were used to estimate the magnitude of metals, organo-chlorine pesticides, PCBs, and PAHs loads to Dominguez Channel and Greater Los Angeles and Long Beach Harbor waters.

4.1 **Point Sources**

A point source, according to 40 CFR 122.3, is defined as “any discernable, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel, or other floating craft from which pollutants are or may be discharged.” The NPDES program, under CWA Sections 318, 402, and 405, requires permits for the discharge of pollutants from point sources.

The NPDES permits in the Dominguez Channel watershed, Los Angeles River Watershed, San Gabriel Watershed, and Greater Los Angeles and Long Beach Harbor Waters include the MS4 and Caltrans Storm Water Permits, general construction storm water permits, general industrial storm water permits, individual NPDES permits, minor NPDES permits, and general NPDES permits (Table 4-1).

Table 4-1. Summary of Active NPDES Permits in the Dominguez Channel and Greater Harbor Waters and the Los Angeles River, and San Gabriel River (Summer 2010)

Order Title	Number of Permits		
	Dominguez Channel and Greater Harbor Waters	**Los Angeles River**	**San Gabriel River**
Municipal Stormwater Permits:			
▪ Municipal Stormwater Permit (number of municipalities in the Los Angeles County MS4)	24	32	34
▪ California Department of Transportation Storm Water	1	1	1
▪ Municipal Storm Water Permit for the City of Long Beach	1	1	1
Individual NPDES Permits			
Individual NPDES Permits (Major including POTW, refineries, and generating stations)	6	3	8
Individual NPDES Permits (Minors)	12	13	16
General Permits:			
▪ Statewide Industrial storm water permits	207		
▪ Statewide Construction storm water permits	90		
▪ Statewide Discharges of Aquatic Pesticides for Vector and Aquatic Weed Control permits		2	
▪ Statewide Permit for discharges from utility vaults and underground structures		3	
▪ Specified discharges to groundwater in Santa Clara River and Los Angeles River Basins		1	
▪ Treated Groundwater from Construction and Project Dewatering to Surface Waters		2	
▪ Groundwater from Construction and Project Dewatering to Surface Waters		2	
▪ Waste Discharge Requirements for discharges of groundwater from potable water supply wells to surface waters	13	33	26
▪ Waste Discharge Requirements for discharges of nonprocess wastewater to surface waters in coastal watersheds	1	8	3
▪ Waste Discharge Requirements for discharges of low threat hydrostatic test water to surface waters in coastal waters	2	12	3
▪ Waste Discharge Requirements for discharges of groundwater from construction and project dewatering to surface waters in coastal watersheds	1	32	12
▪ Waste Discharge Requirements for treated groundwater and other wastewaters from investigation and/or cleanup of petroleum fuel-contaminated sites to surface waters in coastal watersheds		2	2
▪ Waste Discharge Requirements for discharges of treated groundwater from investigation and/or cleanup of volatile organic compound Contaminated-sites to surface waters in coastal watersheds		5	5
Total	**358**	**155**	**110**

4.1.1 Stormwater Permits in Dominguez Channel Watershed and Greater Harbor Waters Nearshore Watershed

Storm water runoff in the Dominguez Channel watershed and in the nearshore watershed to the greater harbor waters is regulated through a number of permits including:

1) The municipal separate storm sewer system (MS4) permit issued to the County of Los Angeles and the incorporated jurisdictions therein (except the City of Long Beach);
2) The municipal separate storm sewer system (MS4) permit issued to the City of Long Beach;
3) A separate statewide storm water permit specifically for the California Department of Transportation (Caltrans);
4) The statewide Construction Activities Storm Water General Permit; and
5) The statewide Industrial Activities Storm Water General Permit.

These discharges are point sources because the storm water discharges from the end of a storm water conveyance system.

4.1.1.1 MS4 Storm Water Permits

A. Regulation under MS4 Permit

Federal regulations for controlling pollutants in storm water discharges were issued by the USEPA on November 16, 1990 (40 Code of Federal Regulations [CFR] Parts 122, 123, and 124). As part of these regulations, USEPA developed rules establishing Phase I of the 'Municipal Separate Storm Sewer System' storm water program, designed to prevent harmful pollutants from being washed by storm water runoff into MS4s (or from being discharged directly into the MS4s) and then discharged from the MS4s into local waterbodies. Phase I of the program required operators of medium and large MS4s (those generally serving populations of 100,000 or more) to implement a storm water management program as a means to control polluted discharges from the MS4s. (Phase II of the MS4 program will focuses on smaller municipalities.) Approved storm water management programs for medium and large MS4s are required to address a variety of water quality-related issues, including roadway runoff management, municipally owned operations, and hazardous waste treatment. Large and medium MS4 operators are required to develop and implement Storm Water Management Plans that address, at a minimum, the following elements:

- Structural control maintenance
- Areas of significant development or redevelopment
- Roadway runoff management
- Flood control related to water quality issues
- Municipally owned operations such as landfills, and wastewater treatment plants
- Municipally owned hazardous waste treatment, storage, or disposal sites
- Application of pesticides, herbicides, and fertilizers
- Illicit discharge detection and elimination
- Regulation of sites classified as associated with industrial activity

- Construction site and post-construction site runoff control
- Public education and outreach

The municipalities in Los Angeles County are covered by Phase I MS4 permits. The current County of Los Angeles MS4 permit was issued to the Los Angeles County Flood Control District, County of Los Angeles, and 84 incorporated cities on December 13, 2001 (Order No. 01-182, NPDES No. CAS004001) and was amended on amended on September 14, 2006 by Order R4-2006-0074, on August 9, 2007 by Order R4-2007-0042, on December 10, 2009 by Order No. R4-2009-0130, and on October 19, 2010, pursuant to a Preemptory Writ of Mandate.

The permittees in the Dominguez Channel or Greater Harbors waters watersheds include the following:

- City of Bellflower
- City of Carson
- City of Compton
- City of El Segundo
- City of Gardena
- City of Hawthorne
- City of Inglewood
- City of Lakewood
- City of Lawndale
- City of Long Beach
- ~~City of Lomita~~
- City of Los Angeles
- City of Manhattan Beach
- City of Paramount
- City of Rancho Palos Verdes
- City of Redondo Beach
- City of Rolling Hills
- City of Rolling Hills Estates
- City of Signal Hill
- City of Torrance
- County of Los Angeles
- County of Los Angeles, Flood Control District

The current City of Long Beach MS4 Permit was issued on June 30, 1999 (Order No. 99-060, NPDES No. CAS004003).

Both the County of Los Angeles and City of Long Beach MS4 permits were scheduled to expire five years after they were issued but remain in effect until new MS4 permits are issued and these rescinded.

B. Summary of Los Angeles County MS4 Stormwater Monitoring

As part of the Los Angeles County MS4 Permit Core Monitoring Program, flow and water quality are measured in Dominguez Channel at station, S28 (mass emission station) which is located near the center of the watershed. Data from the mass emission station has been used for flow data in Dominguez Channel.

In addition, as part of the Los Angeles County MS4 Permit Core Monitoring Program, tributary monitoring is conducted in specific subwatersheds each year. Tributary monitoring was conducted at six locations in the Dominguez Channel watershed in 2008-2009. Automatic flow weighted composite samples and grab samples were taken from each tributary location; five wet-weather and three dry-weather events were monitored for each location. The samples were analyzed for OC pesticides and PCBs, although only non-detect results were reported (Los Angeles County Stormwater Monitoring Report, 2008-09). Based on insufficient sensitivity of analytical methods and difficulty with accurately interpreting these results, current stormwater discharge from the Dominguez Channel watershed appears to be an uncertain load of contaminants to the Dominguez Channel and Greater Harbor Waters. However, detections have been measured by other parties within these waters (SCCWRP, 2003), thus it is possible for small amounts of contaminated sediment to transport downstream, become bioavailable and accumulate in tissue to levels that cause impairment.

4.1.1.2 Caltrans Storm Water Permit

Caltrans is regulated by a statewide storm water discharge permit that covers all municipal storm water activities and construction activities (State Board Order No. 99-06-DWQ, NPDES No. CAS000003). The Caltrans storm water permit authorizes storm water discharges from Caltrans properties such as the state highway system, park and ride facilities, and maintenance yards.

The storm water discharges from most of these Caltrans properties and facilities eventually end up in either a city or county storm drain. The metals loading specifically from Caltrans properties have not been determined in the Greater Harbors and Dominguez Channel watershed. A conservative estimate of the percentage of the Greater Harbors and Dominguez Channel watershed covered by state highways is 2.4% (approximately 618 acres). This area represents Caltrans' right-of-way that drains to Dominguez Channel. This percentage does not represent all the watershed area that Caltrans is responsible for under the storm water permit. For example, the park and ride facilities and the maintenance yards were not included in the estimate.

4.1.1.3 General Storm Water Permits

The federal Phase I stormwater regulations for controlling pollutants in storm water issued by the USEPA in 1990, require operators of facilities where discharges of storm water associated with industrial activity occur to obtain an NPDES permit and to implement Best Available Technology Economically Achievable (BAT) to reduce or prevent pollutants associated with industrial activity in storm water discharges and authorized non-storm discharges. The regulations also require discharges of storm water associated with construction activity including clearing, grading, and excavation activities (except operations that result in disturbance of less than five acres of total land area) to obtain an NPDES permit and to implement BAT to reduce or eliminate storm water pollution.

The federal Phase II stormwater rules promulgated by USEPA on December 8, 1999, (40CFR Parts 122, 123, and 124) expanded the NPDES storm water program to include storm water discharges from construction sites that resulted in land disturbances equal to or greater than one acre but less than five acres. Now, under Phase II, any construction site that is greater than one acre must obtain a storm water permit.

On April 17, 1997, State Board issued a statewide general NPDES permit for Discharges of Storm Water Associated with Industrial Activities Excluding Construction Activities Permit (Order No. 97-03-DWQ). This Order regulates storm water discharges and authorized non-storm water discharges from ten specific categories of industrial facilities, including but not limited to manufacturing facilities, oil and gas mining facilities, landfills, and transportation facilities. Under Order No. 97-03-DWQ, non-storm water discharges are authorized only when they do not contain significant quantities of pollutants, where BMPs are in place to minimize contact with significant materials and to reduce flow, and when they are in compliance with Regional Board and local agency requirements.

As of summer 2010, there are 207 discharges enrolled under the general industrial storm water permit within the Dominguez Channel watershed and Greater Harbor Waters.

Potential pollutants from an industrial site will depend on the type of facility and operations that take place at that facility. There is a potential for metals loadings from these types of facilities, especially transportation, recycling and manufacturing facilities. During wet weather, runoff from industrial sites has the potential to contribute metals loadings to the Dominguez channel. This finding is supported by Stenstrom et al. in their final report (2005) on the industrial storm water monitoring program under the existing general permit. In the summary of existing data, the report found that although the data collected by the monitoring program were highly variable, the mean values for copper, lead and zinc were 1010, 2960, and 4960 µg/L, respectively (Stenstrom et al., 2005). During dry weather, the potential contribution of metals loadings from industrial storm water is low.

On August 19, 1999, State Board issued a statewide general NPDES permit for Discharges of Storm Water Runoff Associated with Construction Activities (Order No. 99-08-DQW, NPDES NO. CAS000002). On September 2, 2009 the State Board updated the permit (Order No. 2009-009-DWQ). There are 90 construction sites enrolled under the general construction storm water permit within the Dominguez Channel watershed and Greater Harbor Waters.

Potential pollutants from construction sites include sediment, which may contain metals as well as metals from construction materials and the heavy equipment used on construction sites. During wet weather, runoff from construction sites has the potential to contribute metals loadings to the channel. During dry weather, the potential contribution of metals loadings is low. Under Order No. 99-08-DWQ, discharges of non-storm water are authorized only where they do not cause or contribute to a violation of any water quality standard and are controlled through implementation of appropriate BMPs for elimination or reduction of pollutants.

4.1.2 ***Other General and Individual NPDES Permits***

An individual NPDES permit may be classified as either a major or a minor permit. The discharge flows associated with minor individual NPDES permits and general NPDES permits are typically less than 1 million gallons per day (MGD). There are six major NPDES discharges in Dominguez Channel watershed: one POTW, two generating stations, and three refineries. Other than the major NPDES discharges, there are total of 12 minor NPDES discharges and 17 discharges covered by general NPDES permits. General NPDES permits often regulate episodic discharges (e.g. dewatering operations) rather than continuous flows. The minor NPDES permits issued within the Dominguez Channel watershed are also for episodic discharges.

- Major and Minor Individual NPDES Permits

Terminal Island Water Reclamation Plant (TIWRP) (NPDES No. CA005386) is the only Publically-Owned Treatment Works (POTW) that discharges to Dominguez Channel watershed or Greater Harbor Waters. The TIWRP discharges tertiary-treated effluent to the Outer Harbor and is under a time schedule order to remove the discharge. The discharger's plan consists of achieving full reclamation (mostly for industrial reuse purposes) by 2020 which would eliminate the effluent discharge completely.

The Harbor Generating Station and Long Beach Generating Station discharge to the Inner Harbor area. Several oil refineries discharge to Dominguez Channel Estuary. Exxon Mobil discharges to Torrance Lateral.

Facility	**NPDES NO.**	**Regional Board Order No.**
Conoco Phillips (Los Angeles Refinery)	CA0000051	R4-2006-0082
BP Carson Refinery	CA0000680	R4-2007-0015
Tesoro (Los Angeles Refinery)	CA0003778	R4-2010-0179
Exxon Mobil Torrance Refinery	CA0055387	R4-2007-0049
Shell/Equilon Carson Terminal	CA0000809	R4-2007-0026
Long Beach Generating Station	CA0001171	R4-2009-0112
Harbor Generating Station	CA000361	R4-2003-0101

Many smaller, non-process waste discharges also occur into the harbors.

- General NPDES Permits

Pursuant to 40 CFR parts 122 and 123, the State Board and the Regional Boards have the authority to issue general NPDES permits to regulate a category of point sources if the sources: involve the same or substantially similar types of operations; discharge the same type of waste; require the same type of effluent limitations; and require similar monitoring. The Regional Board has issued general NPDES permits for six categories of discharges: construction and project dewatering; petroleum fuel cleanup sites; volatile organic compounds (VOCs) cleanup sites; potable water; non-process wastewater; and hydrostatic test water.

The general NPDES permit for Discharges of Groundwater from Potable Water Supply Wells to Surface Waters (Order No. R4-2003-0108) covers discharges of groundwater from potable supply wells generated during well purging, well rehabilitation and redevelopment, and well drilling, construction and development. As of summer 2010, there are 13 dischargers enrolled under this Order in the Dominguez Channel watershed for a combined total discharge flow of 21.7 MGD.

The general NPDES permit for Discharges of Nonprocess Wastewater to Surface Waters (Order No. R4-2004-0058) covers waste discharges, including but not limited to, noncontact cooling water, boiler blowdown, air conditioning condensate, water treatment plant filter backwash, filter backwash, swimming pool drainage, and/or groundwater seepage. Currently, there is only one discharger enrolled under this Order. The facility discharges only up to 5,000 gallons per day of wastewater into a nearby storm drain that flows into Dominguez Channel.

The general NPDES permits for Discharges of Low Threat Hydrostatic Test Water to Surface Waters (Order No. R4-2009-0068) covers waste discharges from hydrostatic testing of pipes, tanks, and storage vessels using domestic/potable water. Currently, there is only one discharger enrolled under this Order in the Dominguez Channel watershed with design flow of 2.5 MGD.

The general NPDES permit for Discharges of groundwater from construction and project dewatering to surface waters in coastal watersheds of Los Angeles and Ventura Counties (Order No. R4-2008-0032) covers wastewater discharges, including but not limited to, treated or untreated groundwater generated from permanent or temporary dewatering operations. Currently, there is one discharger enrolled under this Order in the Dominguez Channel watershed with design flow of 0.6 MGD.

4.1.3 Superfund Sites within Torrance Lateral subwatershed

Two Superfund sites are located in the watershed: the Montrose Superfund site (DDT) and the Del Amo Superfund site (benzene). Montrose Superfund site includes multiple operable units, which are identified as investigation areas potentially contributing site-related contamination. Both sites are located in the Kenwood Drain subwatershed, which discharges stormwater into Torrance Lateral and flows downstream into saline waters of Dominguez Channel Estuary and Consolidated Slip. Torrance Lateral, Dominguez Channel Estuary and Consolidated Slp (OU2) contain sediments contaminated with multiple pollutants including DDT (potentially from various sources). In 1994 and 2002, USEPA performed a sediment transect study by measuring DDT levels in sediments at numerous sites throughout OU2. Individual grab samples were collected at each site and a comparative analysis was performed on 1994 vs. 2002 results at each site. Briefly, average DDT levels within Kenwood Drain were considerably lower in 2002 when compared to 1994 levels. DDT levels in Consolidated Slip were somewhat higher in 2002 than 1994. Given the 'snapshot' nature of these results, one might infer that DDT contaminated sediments in waters of OU2 have moved to more downstream locations in this stormwater pathway (CH2M Hill, 2003).

4.1.4 Point Sources Summary

Dominguez Channel drains a highly industrialized area and also contains remnants of persistent legacy pesticides as well as PCBs which results in poor sediment quality both within the Channel and in adjacent Inner Harbor areas. The total loading of OC pesticides, PCBs, PAHs, and metals reflects the sum of inputs from urban runoff and multiple NPDES permits within the watershed (Table 4-2). In the Dominguez Channel Watershed storm water discharges are regulated under the MS4 permit, the Caltrans permit, the general industrial storm water permit and the general construction storm water permit.

Table 4-2. Summary of permits in Dominguez Channel Watershed

Type of NPDES Permit	Number of Permits	Permitted Volume (MGD)	Screening for pollutants?	Potential for significant contribution?
Municipal Storm Water	24	NA	Yes	High
Caltrans Storm Water	1	NA	Yes	High
Municipal Storm Water Permit for the City of Long Beach	1	NA	Yes	High
General Construction Storm Water	90	NA	Yes	High
General Industrial Storm Water	207	NA	Yes	High
POTW	1	16	Yes	Medium
Individual NPDES Permits (majors) (incl refineries)	6	24.8	Yes	Medium
Individual NPDES Permits (minors)	12	4.1	Yes	Medium
General Permits	17	24.3	Yes	Low

"Potential for significant contribution" is based on professional judgment on type of discharges and associated potential pollutants maybe carried by the discharges."

4.2 Non-point Sources

A nonpoint source is a source that discharges to water of the US or State via sheet flow or natural processes. Surface water runoff within the watershed occurs as sheet flow near the shores. Additional non-point sources include air deposition and contaminant fluxes from existing sediments within the receiving waters into porewater and overlying water.

4.2.1 Air Deposition

Nonpoint source inputs not only occur from the runoff of precipitation, but also from precipitation falling directly onto the land surface or the harbors. Precipitation occurs as wet deposition of rain droplets, and dry deposition of particulate matter. In the atmosphere, the mixture of gases, water vapor, particulate matter, and wind currents form a dynamic environment in which changes in chemical composition of precipitation can frequently occur. Precipitation can carry significant amounts of inorganic contaminants and sediments to the harbors. Atmospheric deposition is a nonpoint source of metals to the watershed through both direct deposition onto waterbody surface and indirect deposition onto land and then urban runoff carries into the waterbody.

Atmospheric Deposition Loads of Metals in Los Angeles Area Study (Atmospheric Deposition Report) completed by the Regional Board in 2009, summarizes the findings of previous studies on the air deposition loads of metals resulting from direct sources of major facilities in Los Angeles area including Los Angeles River watershed, San Gabriel River watershed, Dominguez Channel and Los Angeles and Long Beach Harbors Watershed, Santa Monica Bay Watershed, and Ballona Creek Watershed. The study also uses the existing information of the previous studies to estimate the indirect atmospheric deposition loads of metals in the Los Angeles area. The study is referenced in this section to provide estimated loadings from direct and indirect atmospheric deposition.

Direct atmospheric deposition of metals to Los Angeles River, San Gabriel River, and Dominguez Channel watersheds was calculated using monitoring data. The estimates are shown in Table 4-3. In general, direct atmospheric deposition from Los Angeles River and San Gabriel River watersheds is smaller in comparison to the deposition from Dominguez Channel and Harbors watershed because the actual surface area of the river systems themselves are smaller than surface areas of the Harbors and Dominguez Channel.

Table 4-3 Direct Atmospheric Deposition of Metals Provided by Dischargers

Constituent	Direct Source	Los Angeles River Watershed	San Gabriel River Watershed	Dominguez Channel and LA/LB Harbors Watershed
Copper (g/year)				
	WSPA			43
	Rangers Die Casting	21,909		
	Total	**21,909**		**43**
Lead (g/year)				
	WSPA			32
	Exide Tech	11,340		
	Trojan Battery		83	
	Total	**11,340**	**83**	**32**
Zinc (g/year)				
	WSPA			490
	Bandag Licensing	454		
	Quemetco		222	
	US Borax			3,112
	Western Tube and Conduit	907		454
	Total	**1,361**	**222**	**4,056**

Direct atmospheric deposition rates used in this TMDL are based on the most recent study performed by the Southern California Coastal Water Research Project (SCCWRP): *Metals Dry Deposition Rates along a Coastal Transect in Southern California study* performed by Sabin et al. in 2007. Differences in metal dry deposition flux rates observed between sites were dominated by proximity to urban areas and/or other nearby sources, with the highest metal fluxes observed near the Los Angeles Harbor and San Diego Bay sites. Compared with data from the 1970s, lead fluxes were typically one to two orders of magnitude lower in the present study (2007), indicating atmospheric sources of these metals have decreased over the past three decades. The median dry deposition fluxes for all metals measured at the Los Angeles Harbor site were comparable to measurements in other studies in Los Angeles and Chicago and provided in Table 4-4.

Table 4-4. Comparison of metal dry deposition flux rates (Sabin et al. 2007)

Air Deposition Study	Constituents (µg/m^2-day)			
	Chromium	Copper	Lead	Zinc
Lim et al., 2006 Urban Sites in Los Angeles and Orange County, CA USA				
Los Angeles River -1	6	21	15	130
Los Angeles River -2	2.3	30	31	160
Los Angeles River -3	9	16	32	110
Ballona Creek	2.7	18	20	77
Dominguez Channel	3.3	12	11	74
Santa Ana River	4.3	30	10	180
Yi et al., 2001				
Chicago, IL USA	5.7	63	38	120
South Haven, MI USA	0.7	31	23	51
Sleeping Bear Dunes, MI USA	1.6	79	35	68
Sabin et al., 2007				
Santa Barbara	0.34	2.0	1.3	14
Oxnard	0.23	0.89	0.52	4.8
Malibu	0.29	1.9	1.0	12
Hyperion	0.39	3.9	1.0	16
Los Angeles Harbor (a.k.a Wilmington)	3.6	22	14	160
Newport	0.64	5.1	1.8	22
Oceanside	0.48	4.2	1.4	40
San Diego Bay	0.99	29	3.3	63

Note: Shaded rows indicate inland monitoring sites

The SCCWRP study (2006) collected air deposition samples at a Los Angeles Harbor air monitoring site, also known as 'Wilmington' site, (located 3 km inland) and these results are more comparable to other inland sites (shaded sites in Table 4-4). Therefore, the deposition rate for LA Harbor is applied to calculate the estimated current air deposition loads for certain waterbodies: Dominguez Channel Estuary, Consolidated Slip, Inner Harbor and LA River Estuary. The average of six coastal site values (underlined in table immediately above) are applied to the following waterbodies: Fish Harbor, Cabrillo Marina, Inner Cabrillo Beach, Outer Harbor and San Pedro Bay. The estimates of copper, lead, zinc, DDT, and PAHs loading from atmospheric deposition are presented in Table 4-5. See also Appendix III, Part 6.

Table 4-5. Estimated Atmospheric Deposition of Copper, Lead, Zinc, and PAHs in Dominguez Channel Estuary and Greater Harbor Waters based on monitoring results from Sabin & Schiff (2007).

		Wilmington site ($\mu g/m^2$-day)			Coastal sites (n= 6) ($\mu g/m^2$-day)			(ng/m^2-day)
		Cu	Pb	Zn	Cu	Pb	Zn	PAHs
Water Bodies	Area (m^2)	22	14	160	3	1.17	18.1	244
Dominguez Channel	567,900	4.56	2.90	33.2				0.051
Consolidated Slip	147,103	1.18	0.75	8.59				0.013
Inner Harbor	12,154,560	97.6	62.1	709.8				1.08
LA River Estuary	837,873	6.73	4.28	48.93				0.075
Fish Harbor	368,524				0.40	0.16	2.43	0.033
Cabrillo Marina	310,259				0.34	0.13	2.05	0.028
Cabrillo Inner Beach	331,799				0.36	0.14	2.19	0.03
Outer Harbor	16,358,366				17.9	6.99	108.1	1.46
San Pedro Bay	33,073,517				36.2	14.1	218.5	2.95

Shaded rows indicate monitoring results from Wilmington (inland) site; other rows based on average of six coastal sites from Sabin et al., 2007 in Table 4-4 above.

Indirect deposition of metals is generally associated with the accumulation and wash-off of metals on the land surface during rain events. Metals washed off the land surface are delivered to the river through creeks and stormwater collection systems. As such, indirect loading varies depending on the amount of rainfall and size of storms in a given year.

Indirect atmospheric deposition is the amount of airborne metals deposited on land surface that may be washed into a water body during storm events. The amount of deposited metals available for transport to Los Angeles area (i.e., not infiltrated) is unknown.

Indirect atmospheric deposition reflects the process by which metals deposited on the land surface may be washed off during rain events and be delivered to the river and tributaries. Not all the metals deposited on the land from the atmosphere are loaded to the river. Estimates of metals deposited on land are much higher than estimates of loadings to the river system. The loadings of metals associated with indirect atmospheric deposition are accounted for in the estimates of the stormwater loadings.

4.3 Model Estimated Loads from Point and Non Point Sources

4.3.1 Existing Loads within Dominguez Channel freshwater

Current loads of metals into Dominguez Channel freshwater were estimated using Loading Simulation Program in C++ (LSPC) model output from simulated flows for 1995-2005. Monitoring data from NPDES discharges and land use runoff coefficients were analyzed along with Channel stream flow rates to estimate the magnitude of metal loadings. The PAH loads were calculated using simulated flow and PAH Event Mean Concentrations (EMC), while the DDT and PBC loads were calculated by applying observed sediment concentrations to the LSPC simulated sediment concentrations (see Appendix II). In recognition of the wide variety of stream flow rates generated by various rainfall conditions, flow duration curves were utilized to analyze the metals loading during wet weather.

The LSPC model was also updated for freshwater inputs from Los Angeles River and San Gabriel River. These models were previously developed by Tetra Tech to support metals TMDLs in those watersheds. The nearshore areas were also modeled using LSPC. These nearshore areas refer to freshwater inputs that discharge either directly into the saline TMDL receiving waters or to the Channels, Rivers, or Bays that ultimately discharge to the saline TMDL receiving waters. More discussion of the LSPC model and results are provided in the Linkage Analysis section of this document. Additional information is provided in Appendix II and III.

4.3.2 Existing Pollutants in in Dominguez Channel Estuary and Greater Harbor Waters

A variety of activities in the past decades in Dominguez Estuary, Los Angeles and Long Beach Harbors, and surrounding areas contributed to contamination of existing sediment bed. The sediment bed is represented by multiple layers with internal transport of contaminants by pore water advection and diffusion. Sediment and water is exchanged between the water column and bed by deposition, erosion and re-suspension, with corresponding exchange of adsorbed and dissolved contaminants. Re-suspension may occur via natural processes and/or anthropogenic activities including (ship) propeller wash. Dissolved phase contaminants are also exchanged by diffusion between bed pore water and the overlying water column. Sediment bed conditions are persistent with changes in bed sediment composition and contamination levels occurring slowly at annual scales and longer. Sediment conditions influence both sediment transport dynamics and the phase distribution and mobility of contaminants in the bed.

Existing sediment loading for metals, PAHs, DDT, and PCBs for Dominguez Channel Estuary and greater Harbor waters were estimated via Environment Fluid Dynamics Code (EFDC) model for 2002-2005. (Summary information for the EFDC model used for these TMDLs are included in Linkage Analysis, Section 5. Detailed model reports are included in Appendices I, II and III.) This involved using the existing average sediment concentration predicted by the EFDC model for 2002-2005 in the top 5 cm and the total sediment deposition rate per waterbody (see Appendix III, Part 1). Table 4-6 presents the modeled existing sediment bed pollutant loads in Dominguez Channel Estuary and Greater Harbor waters.

Table 4-6. Estimated pollutant loadings in existing sediment bed based on average EFDC model output for 2002-2005 (deposition rate * existing concentration in top 5 cm = total existing load).

Waterbody	Pollutants (g/yr)					
	Cu	Pb	Zn	DDT	PAH	PCB
Dominguez Channel Estuary	327,600	457,905	1,799,038	54	28,082	57
Consolidated Slip	92,143	127,260	398,941	49	11,510	84
Inner Harbor	178,444	105,916	542,093	22	3,524	30
Outer Harbor	118,991	66,725	403,429	31	626	35
Fish Harbor	1,434	600	4,209	0.17	3	0.08
Los Angeles River Estuary	1,611,961	2,641,274	20,096,108	232	8,722	402
Cabrillo Inner Beach	2,980	655	4,518	1.0	24	0.3
Cabrillo Marina	9,164	2,307	9,144	1.7	236	1.1
San Pedro Bay	1,250,794	1,737,044	8,166,507	205	3,634	111

4.4 Sources Summary

Dominguez Channel freshwater waters: The major pollutant sources of metals into Dominguez Channel and Torrance Lateral freshwaters are stormwater and urban runoff discharges. Nonpoint sources include atmospheric deposition.

Current loads of metals into Dominguez Channel were estimated using Loading Simulation Program in C++ (LSPC) model output from simulated flows for 1995-2005. Monitoring data from NPDES discharges and land use runoff coefficients were analyzed along with Channel stream flow rates to estimate the magnitude of metal loadings. In recognition of the wide variety of stream flow rates generated by various rainfall conditions, flow duration curves were utilized to analyze the metals loading during wet weather.

Dominguez Channel Estuary and Greater Los Angeles and Long Beach Harbor waters: A variety of activities over the past decades in the four contributing watersheds (Dominguez Channel, Los Angeles River, San Gabriel River and the nearshore watershed) and in the Harbors themselves have contributed to the sediment contamination. The contaminated sediments are a reservoir of historically deposited pollutants. Stormwater runoff from manufacturing, military facilities, fish processing plants, wastewater treatment plants, oil production facilities, and shipbuilding or repair yards in both Ports discharged untreated or partially treated wastes into Harbor waters. Current activities also contribute pollutants to Harbor sediments including, stormwater runoff from upstream sources and port sources, commercial vessels (ocean going vessels and harbor craft), recreational vessels, and the re-suspension of contaminated sediments from propeller wash within Ports' slips and unmaintained areas also contributes to transport of pollutants within the Harbors. Loadings from the four contributing watersheds and intermittent overflows from Machado Lake are also potential sources of metals, pesticides, PCBs, and PAHs to the Harbors.

The pollutants of concern in Machado Lake (a.k.a. Harbor Lake) are similar to those in this TMDL. Some intermittent overflows from Machado Lake reach LA Inner Harbor via storm channel; however, there is a paucity of available data and information for chemical concentrations and flow rates from Machado Lake overflows. For this TMDL, the freshwater hydrologic model incorporated pollutant loads into Machado Lake, treating it as a sink, but we did not have sufficient data to quantify loadings that may occur in intermittent overflows reaching the Inner Harbor. (See Appendix II for additional discussion.) A Toxics TMDL has been developed and approved for Machado Lake and implementation is planned (and funded) to occur through Prop O project which includes dredging contaminated sediment in the Lake.

Another nonpoint source of pesticides and PCBs to the greater Harbor waters are fluxes from currently contaminated sediments into the overlying water. The re-suspension of these sediments as well as desorption of pollutants into the water column contributes to the fish tissue impairments. In addition, atmospheric deposition appears to be a potentially significant nonpoint source of metals, DDT and PAHs to the watershed, through either direct deposition or indirect deposition.

Current loading of metals, PAHs, DDT and PCBs to the Dominguez Channel Estuary and Greater Harbor waters were calculated by adding the stormwater runoff and other point source contributions (including TIWRP into Outer Harbor) and the nonpoint sources – existing sediment loads and direct deposition to each waterbody surface. The total current load for each water body-pollutant combination is included in Section 6, Tables 6-9 and 6-11 along with required percent reductions.

5 LINKAGE ANALYSIS

The linkage analysis connects pollutant loads to the numeric targets and protection of beneficial uses of the listed waterbodies. The numeric targets selected for pollutants in fish tissue, water, and sediments define acceptable levels to restore habitat conditions and protect benthic infauna, other aquatic organisms including fish and marine mammals, wildlife and human health.

For direct effects, the linkage between pollutants and sediment dwelling organisms is presented in Figure 5-1. Benthic organisms are exposed to pollutants via ingestion of sediment, intake of sediment porewater or overlying water, and possible consumption of other bottom dwelling organisms, algae or detritus. Furthermore benthic organisms reside in these sediments and are relatively immobile so they endure continual exposure to pollutants in sediments, porewater or overlying water.

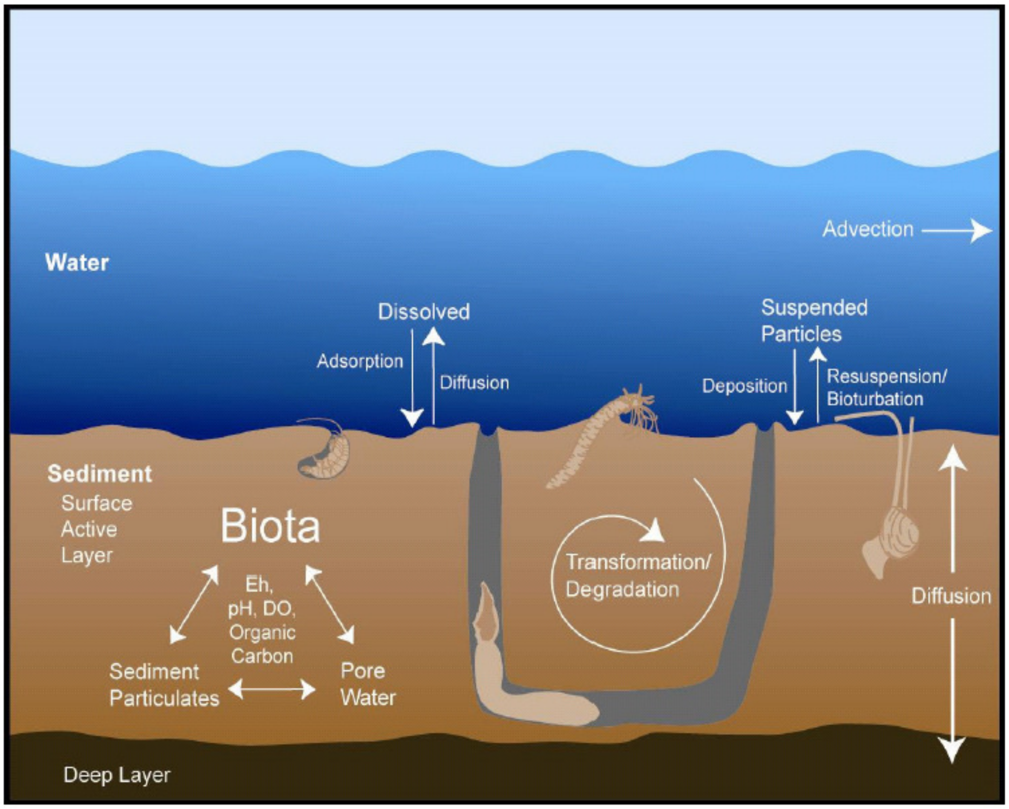


Figure 5-1. Sediment processes affecting the distribution and form of contaminants to benthic and aquatic organisms. (Source: SWRCB, 2008; Figure 2-2)

A food web diagram is presented in Figure 5-2 to describe linkage between bioaccumulative pollutants in water and sediment and transfer across trophic levels. This conceptual model represents organisms in various trophic levels or guilds in the San Francisco Bay food web bioaccumulation model (Gobas and Arnot 2010). The organisms and pollutant transfer pathways closely resemble those within greater Harbor waters, namely: phytoplankton and algae; zooplankton; filter-feeding invertebrates (bivalves and amphipods); sediment detritovores (shrimp and mysids); juvenile and adult fish; fish-eating birds; juvenile and adult marine mammals and humans (not shown). The biological species with empirical data used in S.F Bay bioaccumulation study are also residents of greater Harbor waters, including Pacific oysters, California mussels, shiner surfperch, jack smelt, white croaker, double-crested cormorant and harbor seals. The Newport Bay bioaccumulation study has similar trophic guilds and has included many fish species that also reside in greater Harbor waters, e.g., striped anchovy, topsmelt, halibut, sandbass, corbina and croaker. Again, once such studies are completed in local waters with corresponding empirical data to revise food web models, then site-specific sediment and tissue targets may be reconsidered.

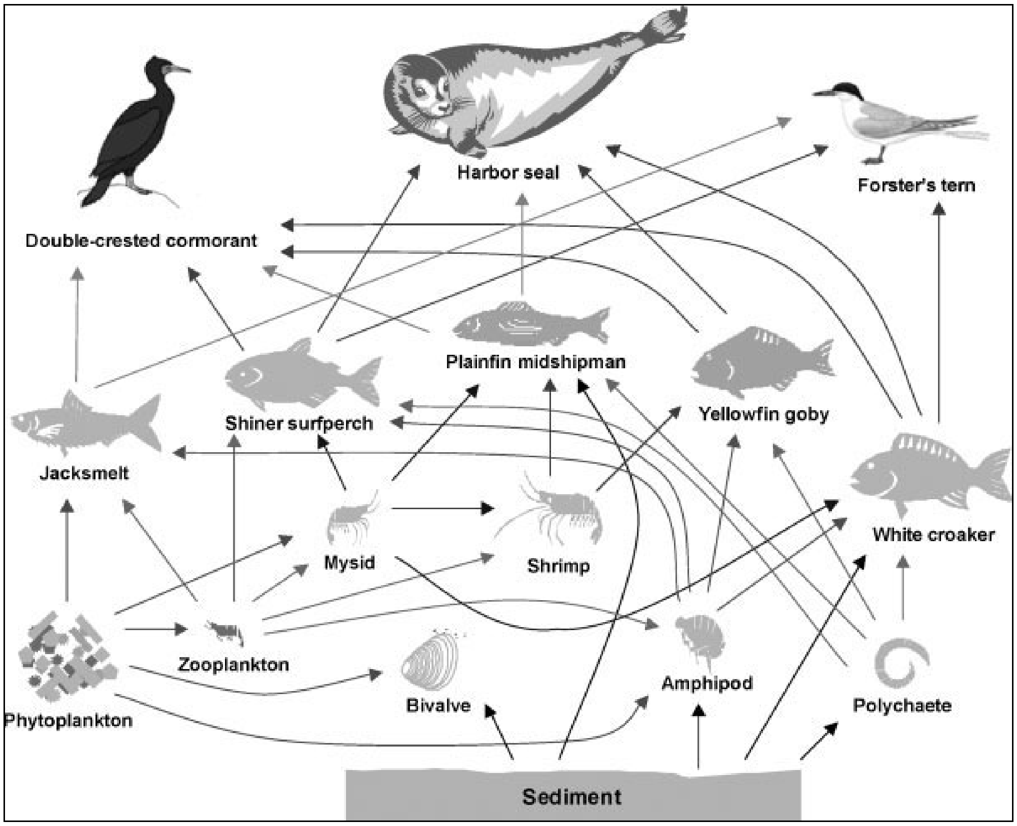
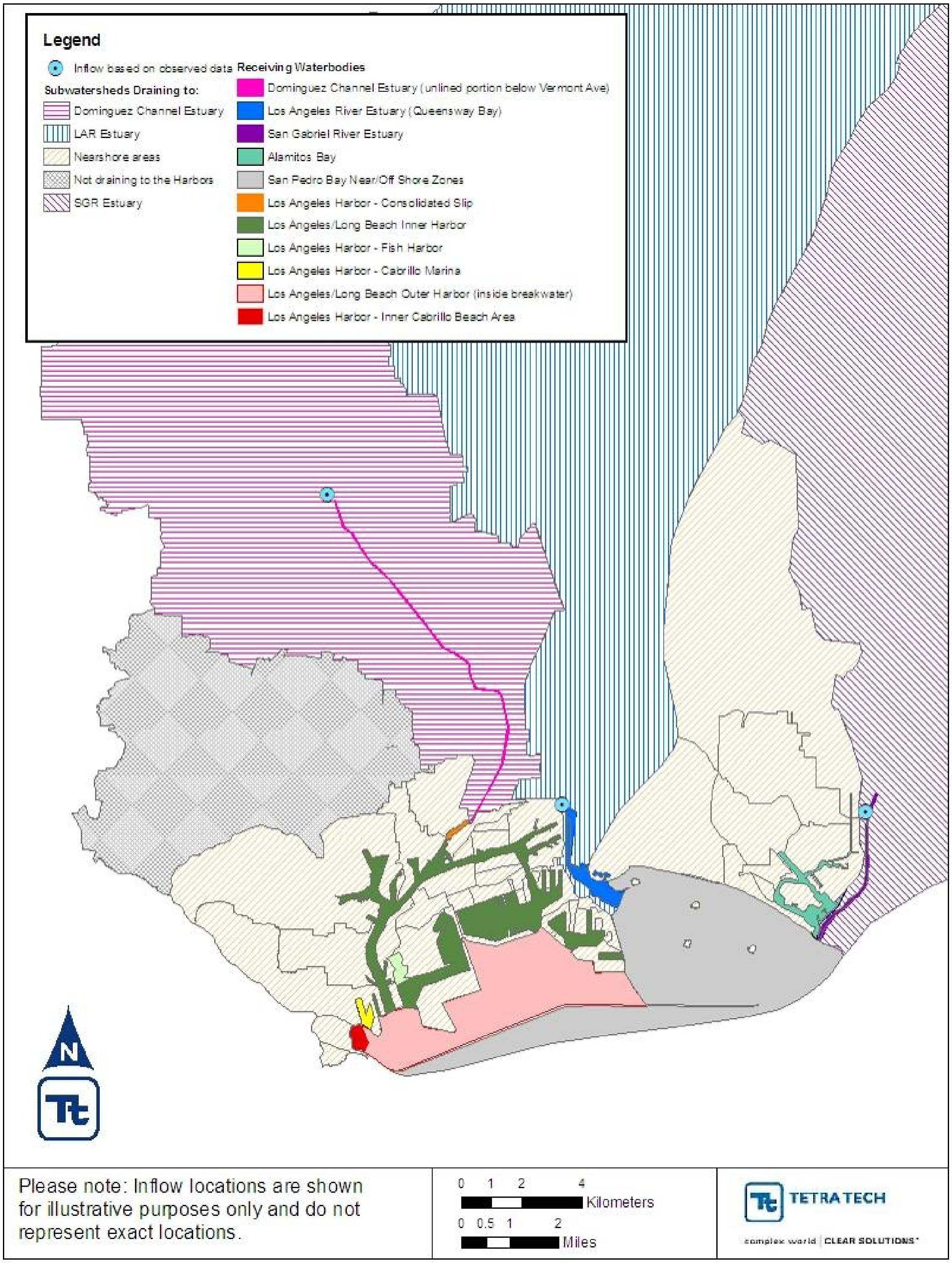


Figure 5-2. Conceptual model of food web in S.F Bay bioaccumulation study, used for this TMDL to set sediment PCBs targets. (Reproduced from Gobas and Arnot, 2010).

5.1 Model Development

This section will also describe model development for use in the area of the Los Angeles and Long Beach Harbors and San Pedro Bay, including their tributaries, the Los Angeles and San Gabriel Rivers and Dominguez Channel (Figure 5-3), which will be used to evaluate the results of different input scenarios for the TMDL allocation plan in the following Section.

To represent the linkage between source contributions and in receiving water response, a dynamic water quality model was developed to simulate source loadings and transport of the listed pollutants in the greater harbor water area. Hydrodynamic and sediment and contaminant transport models provide an important tool to evaluate existing conditions, including identifying point and non-point source load contributions, source controls, and TMDL allocation alternatives. A modeling system that includes hydrodynamic, sediment transport, and contaminant transport and fate is necessary to estimate current conditions and potential load reduction scenarios for the listed waterbodies.



5.2 **Figure 5-3. Watershed associated with each receiving waterbody.**

Three appendices are included with the Staff Report to fully document the modeling approach.

Appendix I, *The Los Angeles-Long Beach Harbors and San Pedro Bay Hydrodynamic and Sediment- Contaminant Transport Model Report* describes the estimation of metals and organic pollutant concentrations using Environmental Fluid Dynamics Code (EFDC) in the Dominguez Channel Estuary and Greater Los Angeles and Long Beach Harbor Waters. Appendix I gives a complete description of the hydrodynamic, water quality, and sediment transport developed to simulate the dynamic interactions in saline waters of the greater harbor system.

Appendix II, *The Watershed Model Development for Simulation of Loadings to the Los Angeles/Long Beach Harbors Report* describes the approach used to estimate metals and organic pollutant loads from the Los Angeles River, the San Gabriel River, and nearshore watershed areas. These models, based on the Loading Simulation Program in C++ (LSPC) watershed model, and in addition to the Dominguez Channel model, were used to determine the pollutant loadings into Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters.

Appendix III includes additional material developed by Tetra Tech including: TMDL Loading Calculations for Saltwater Waterbodies; Dominguez Channel Freshwater Loading Calculations; Initial Conditions for EFDC Model; Applicable Maps; SCCWRP Flux Monitoring Study; Metals Aerial Deposition Rates; Justification for Addition of Waterbody-Pollutant Combinations (in addition to 2006 303(d) list); Tetra Tech Memo on TMDL Scenarios.

Dominguez Channel and other freshwater

The LSPC model was used to estimate freshwater loadings of total metals and totals of PAHs, DDT, and PCBs from the four contributing watersheds (Dominguez Channel, Los Angeles River (LAR) , San Gabriel River (SGR), and the nearshore watersheds) (see Appendix II for more information). An LSPC model developed for the Dominguez Channel watershed was based on information initially provided by SCCWRP. LAR and SGR models were updated from earlier versions used for metals TMDLs in those two watersheds. The nearshore watershed was analyzed and modeled using LSPC by breaking it into 67 subwatersheds that discharge directly to the Greater Los Angeles and Long Beach Harbor waters. These sub-watersheds were then aggregated by receiving waterbody; e.g. nearshore contributions to Inner Harbor consisted of stormdrains and surface (sheet) flows that discharge directly into the Inner Harbor. See Figure 5-5 at the end of this section for nearshore watersheds and associated neighboring waters.

Model development throughout Los Angeles waters relies on regionally-calibrated metals parameters, stormwater event mean concentrations (EMCs) for PAHs, predicted sediment loads and receiving water sediment concentrations for DDT and PCBs as well as simulated (and LAR hourly observed) flows to estimate pollutant loadings. The simulation time frames for the LSPC watershed model were expanded to 1995-2005 to generate temporally consistent model output from each contributing watershed. A separate approach was used to estimate dry weather loads, as described in Appendix II, Section 2. These were combined with the wet weather loads and the resulting loads from all contributing watersheds were applied to the estuarine and marine receiving waters.

Detailed model results are presented in Appendix II. This modeling approach relied on a regional modeling approach using regionally-calibrated parameter values, consistent with other TMDLs in the Los Angeles Region. While the watershed model results did not always predict the observed values, they generally captured the range of observations; however, deviations from the observed values did occur (see Appendix II). Given the limited data available for model calibration and validation, there were not enough data to justify refinement of the calibrated and validated parameter values associated with the regional modeling approach (which were developed using significantly larger datasets). Overall, the TMDL model made use of the best available data at the time of modeling.

Table 5-1 below shows total loads from the four contributing watersheds to the Greater Harbor waters by comparing them to one another. Overall, the Los Angeles River is the largest freshwater contributor of pollutants to the greater Harbor waters; LA River flows primarily impact water quality in eastern San Pedro Bay. The Inner Harbor receives the bulk of the loading from the nearshore watershed, which is expected since this waterbody has the largest nearshore drainage areas and acts as a pollutant sink. See Table 5-2. For Dominguez Channel, Los Angeles River, and San Gabriel River, all of their loadings are directly received by their downstream estuaries (Dominguez Channel Estuary, Los Angeles River Estuary, and San Gabriel River Estuary, respectively).

Table 5-1. Comparative Watershed Loadings to Greater Harbor Waters.

Contaminant	LSPC Modeled Existing Loading by Watershed (1995-2005)							
	Dominguez Channel		Los Angeles River		San Gabriel River		Nearshore Watershed	
	Percent of Total Loading	Average Daily Load (kg/day)	Percent of Total Loading	Average Daily Load (kg/day)	Percent of Total Loading	Average Daily Load (kg/day)	Percent of Total Loading	Average Daily Load (kg/day)
Wet Conditions								
Sediment	5.6%	1.88E+05	72.0%	2.79E+06	20.4%	4.90E+05	1.9%	6.54E+04
Total Copper	4.3%	3.58E+01	81.1%	7.85E+02	12.5%	7.51E+01	2.1%	1.78E+01
Total Lead	3.0%	2.08E+01	71.5%	5.67E+02	23.3%	1.15E+02	2.2%	1.53E+01
Total Zinc	5.0%	3.56E+02	72.2%	5.89E+03	20.2%	1.02E+03	2.6%	1.84E+02
Total DDT	9.2%	2.20E-02	89.5%	2.46E-01	0.7%	1.15E-03	0.7%	1.59E-03
Total PAH	8.0%	2.04E+00	70.2%	2.07E+01	16.1%	2.95E+00	5.8%	1.50E+00
Total PCB	2.3%	1.38E-02	97.5%	6.86E-01	0.1%	3.11E-04	0.2%	9.92E-04
Dry Conditions								
Sediment	0.7%	8.57E+01	19.0%	2.27E+03	80.1%	1.01E+04	0.1%	1.54E+01
Total Copper	2.6%	2.56E-01	48.7%	4.69E+00	40.8%	4.18E+00	8.0%	7.78E-01
Total Lead	0.9%	3.48E-02	19.8%	7.86E-01	72.9%	3.07E+00	6.5%	2.59E-01
Total Zinc	0.9%	5.65E-01	30.4%	1.90E+01	62.6%	4.15E+01	6.2%	3.89E+00
Total DDT	7.7%	1.90E-05	83.0%	2.01E-04	9.3%	2.38E-05	0.0%	2.88E-10
Total PAH	6.8%	7.06E-02	62.7%	6.39E-01	30.4%	3.29E-01	0.0%	4.18E-05
Total PCB	1.8%	1.06E-05	97.1%	5.59E-04	1.1%	6.43E-06	0.0%	1.45E-10

Table 5-2. Receiving Waterbody and Contaminant Loading from the Near Shore Watershed (based on LSPC model output).

Contaminant		Alamitos Bay	Los Angeles Harbor - Cabrillo Marina	Los Angeles Harbor - Consolidated Slip	Los Angeles Harbor - Fish Harbor	Los Angeles Harbor - Inner Cabrillo Beach Area	Los Angeles River Estuary	Los Angeles/Long Beach Inner Harbor	Los Angeles/ Long Beach Outer Harbor (inside breakwater)	San Pedro Bay Near/Off Shore Zones
Total Copper	Percent of Total Loading	54.9%	3.1%	0.1%	1.2%	0.8%	0.6%	28.2%	4.9%	6.2%
	Average Daily Load (kg/day)	1.36E+00	7.74E-02	1.50E-03	3.04E-02	1.97E-02	1.52E-02	6.97E-01	1.21E-01	1.54E-01
Total Lead	Percent of Total Loading	59.9%	2.8%	0.1%	1.1%	0.7%	0.5%	25.0%	4.0%	5.9%
	Average Daily Load (kg/day)	1.05E+00	4.95E-02	9.29E-04	2.02E-02	1.20E-02	9.03E-03	4.39E-01	7.12E-02	1.04E-01
Total Zinc	Percent of Total Loading	59.5%	2.7%	0.1%	1.0%	0.6%	0.6%	25.2%	4.3%	5.9%
	Average Daily Load (kg/day)	1.30E+01	6.00E-01	1.23E-02	2.28E-01	1.40E-01	1.31E-01	5.51E+00	9.41E-01	1.30E+00
Total DDT	Percent of Total Loading	15.5%	3.0%	0.1%	2.2%	0.7%	2.4%	66.9%	7.3%	2.0%
	Average Daily Load (kg/day)	2.46E-05	4.81E-06	9.93E-08	3.43E-06	1.11E-06	3.78E-06	1.06E-04	1.16E-05	3.25E-06
Total PAH	Percent of Total Loading	53.5%	2.9%	0.1%	1.3%	0.7%	0.6%	29.1%	4.2%	7.6%
	Average Daily Load (kg/day)	8.04E-02	4.32E-03	1.32E-04	1.97E-03	1.13E-03	9.16E-04	4.37E-02	6.27E-03	1.14E-02
Total PCB	Percent of Total Loading	11.0%	2.5%	0.0%	2.5%	0.6%	2.7%	71.4%	7.7%	1.5%
	Average Daily Load (kg/day)	1.10E-05	2.45E-06	4.46E-08	2.47E-06	5.69E-07	2.68E-06	7.08E-05	7.68E-06	1.53E-06

Dominguez Channel Estuary and Greater Los Angeles and Long Beach Harbor waters

The EFDC model was used to simulate hydrodynamics and water and sediment quality of Dominguez Channel Estuary and the Greater LA/LB Harbor waters (see Appendix I for more details). The EFDC model applied a simulated time period of 2002-2005. The model was calibrated with numerous sediment monitoring studies, and it benefitted significantly from POLA/POLB sediment characterization study (2006) which yielded sediment, porewater and overlying water concentrations as well as results from highly sensitive monitoring (SPME) devices for detecting DDT, PCBs, and PAHs in the water column (SCCWRP 2007). The EFDC model also considered ocean water (outside breakwater) conditions as well as fine and course sediment transport and deposition within this hydrologically connected system of fresh and saline waters. While a grid was used to represent Dominguez Channel Estuary and the Greater LA/LB Harbor waters, it is important to note that the grid was not modeled as a closed system. Specifically, water, sediment, and associated pollutant loads can be exchanged both in and out of the model grid through the open ocean boundary.

Ultimately the EFDC model was integrated with LSPC output – hourly for three watersheds, daily for nearshore watersheds – to model total metals, PAHs, PCBs, and DDT (total) concentrations in the receiving waters. The EFDC model was used to quantify fine and coarse sediment deposition rates associated with each waterbody. These rates were summed, yielding the total deposition rate for each waterbody multiplied by the corresponding average modeled existing sediment concentration (in the top 5 cm of active sediment layer) or the target concentration to estimate the existing and target pollutant loads, respectively, within each waterbody (Table 5-3). The sediment flux is dependent on watershed inputs as well as tidal movements between waterbodies.

Table 5-3. Sediment Deposition Rates per Waterbody

Waterbody Name	TMDL Zone	Area (acres)[1]	Area (m^2)[1]	Total Deposition (kg/yr)[2]
Dominguez Channel Estuary	01	140	567,900	2,470,201
Consolidated Slip	02	36	147,103	355,560
Inner Harbor - POLA	03	1,539	6,228,431	1,580,809
Inner Harbor - POLB	08	1,464	5,926,130	674,604
Fish Harbor	04	91	368,524	30,593
Cabrillo Marina	05	77	310,259	38,859
Cabrillo Beach	06	82	331,799	27,089
Outer Harbor - POLA	07	1,454	5,885,626	572,349
Outer Harbor - POLB	09	2,588	10,472,741	1,828,407
Los Angeles River Estuary	10	207	837,873	21,610,283
San Pedro Bay	11	8,173	33,073,517	19,056,271

[1] Area obtained from GIS layer of the 2006 303(d) list. Available at: http://www.waterboards.ca.gov/water_issues/programs/tmdl/303d_lists2006_gis.shtml

[2] Sediment deposition rates were calculated by approximating the average mass of total sediment (fine and coarse particles) deposited in each waterbody annually based on 2002-2005 EFDC output. Sediment flux for each grid cell, which is dependent on watershed inputs as well as tidal movements between waterbodies, was obtained from the EFDC model output. These values were summarized across each TMDL zone, resulting in the average deposition of both sediment fines and sand by waterbody. The total deposition rate is simply the sum of the rates for fines and sand and this value is the waterbody-specific average annual (clean) sediment deposition rate.

EFDC is a multidimensional (i.e., 1-D, 2-D, or 3-D) hydrodynamic and water quality model that has been used by EPA for TMDL development in river, lake, estuary, wetland, and coastal regions throughout the United States. The model has three primary components (hydrodynamics, sediment-toxic transport and fate, and water quality) integrated into a single model. The hydrodynamic component is dynamically coupled to salinity and temperature transport as well as to sediment-toxic transport and water quality components.

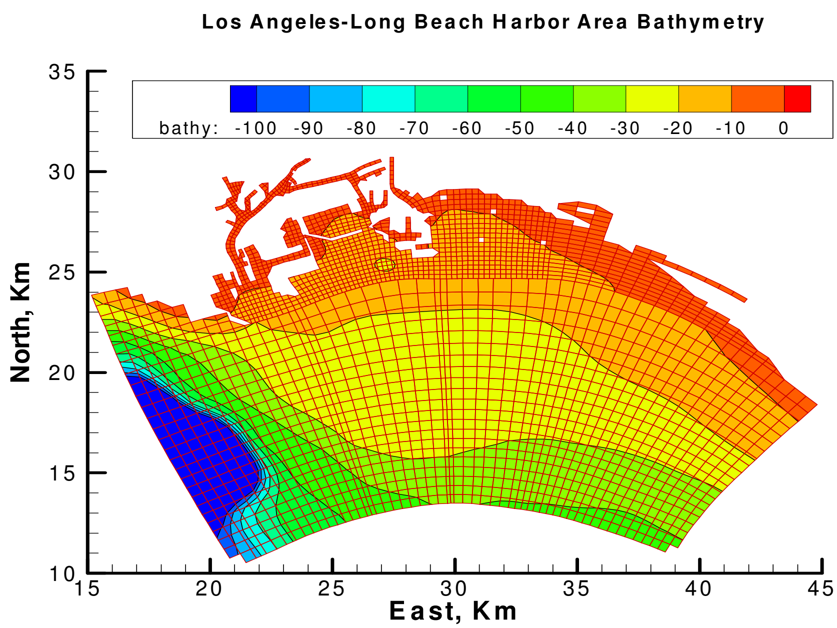
The water quality component of EFDC simulates eutrophication and sediment biogeochemical (diagenesis) processes. The eutrophication kinetics and sediment processes are similar to those in the USACE CE-QUAL-ICM or Chesapeake Bay water quality model. EFDC can simulate multiple classes of sediment such as suspended loads and bed loads as well as sediment deposition and re-suspension. The sediment transport is linked to toxic or contaminant transport and fate components. EFDC is capable of simulating any number of contaminants, including metals and hydrophobic organics, adsorbed to any sediment size class.

A brief overview of the hydrodynamic simulation model including grid set-up and model parameters are presented in the next section (additional details are provided in Appendix I).

5.2.1 Hydrodynamic Model

Computational Grid Setup and Boundary Conditions

A multi-resolution, curvilinear spatial grid of the greater Los Angeles and Long Beach Harbor waters and San Pedro Bay was constructed using the Visual Orthogonal Grid Generation (VOGG) grid generation system (Tetra Tech, 2002). Shoreline boundaries for the grid were based on the NOAA/NOS electronic navigation charts in GIS format. The Dominguez Channel grid from a previous study was incorporated into the model (Everest, 2006). The grid system uses a multi-domain mapping, unique to the EFDC model, which allow a course resolution outside the breakwater in San Pedro Bay and a finer resolution in the harbors system. Bathymetric data were interpolated on to the model grid using an average of the bathymetric data points falling within a cell. The primary bathymetric data set used was the NOAA High Resolution Coastal Relief Data, which has a horizontal resolution of approximately 90 meters. Model grid and bathymetry are shown in Figure 5-4, except the Dominguez Channel estuary area.



Note: Elevation in meters relative to local mean sea level.
The portion of the grid in Dominguez Channel extending to Vermont Avenue is not shown. The grid for this area was represented by a previous study (Everest, 2006)

Figure 5-4. EFDC Model Grid System and bathymetry for Los Angeles-Long Beach Harbor and San Pedro Bay.

Boundary conditions for velocity and water elevations were specified for every grid cell in the model region. Salinity and temperature open boundary conditions were specified as spatially constant and temporally varying along the open boundary. The hydrodynamic and transport model was configured for a four-year historical simulation period from January 2002 through December 2005, since this period encompasses the greatest amount of observational data for model calibration and overlaps with the available watershed model output (see Appendix I for more details).

5.2.2 Sediment and Contaminant Transport Model

Sediment and Contaminant Transport Model Parameters

The EFDC model simulates transport and fate in both the water column and sediment bed. Both fine, cohesive behaving sediment and noncohesive sand were simulated. Particulate organic material was assumed to be associated with the fine sediment class. Contaminants modeled included three metals; copper, lead, and zinc and three organics; DDT, PAH, and PCB. See Appendix I for more EFDC details). Two-phase equilibrium partitioning was used to represent for the Los Angeles and Long Beach Harbor adsorption of the metals and organics to the fine sediment class.

Water column transport included advection, diffusion, and settling for sediment and sediment adsorbed contaminates. The sediment bed was represented by multiple layers with internal transport of contaminants by pore water advection and diffusion. Sediment and water was exchanged between the water column and bed by deposition and erosion, with corresponding exchange of adsorbed and dissolved contaminants. Dissolved phase contaminants were also exchanged by diffusion between bed pore water and the overlying water column.

Initial water column conditions, based on available monitoring results were integrated into the model. However it is important to note that aqueous pollutant concentrations often wash out or rapidly respond to external sources and open boundary conditions. In contrast, initial bed sediment conditions are persistent and contamination levels change more slowly at annual scales and longer. Parameters used for hydrodynamic model development included salinity and bathymetry to reproduce observed water elevation and velocity patterns and magnitudes.

Equilibrium partition coefficients for three metals based on the 2006 POLA-POLB sediment and overlying water data are listed in Table 5-4. Both sets of values are within the literature range summarized by USEPA (2005). Water column partition coefficients for metal adsorption to dilute sediment (concentrations in the 1 to 100’s mg/L) are typically larger than bed values.

Table 5-4. Sediment Bed and Water Column Equilibrium Partition Coefficients and Particulate to Dissolved Concentration Ratios for Metals.

Contaminant	Average Bed Partition Coefficient Based on Total Solids (L/mg)[1]	Visual Best Fit Bed Partition Coefficient Based on Total Solids (L/mg)[1]	Water Column Particulate to Dissolved Concentration Ratio[2]	Estimated Water Column Partition Coefficient, 5 Times Column 3 (L/mg)[3]
Copper	0.09	0.05	0.51	0.25
Lead	0.54	0.25	7.12	1.25
Zinc	0.02	0.01	0.20	0.05

[1] Based on POLA/POLB 2006 sediment bed and overlying water data.

[2] Based on POLA 2005 and 2006 mid-water data.

[3] Calculated based on POLA/POLB 2006 sediment bed and overlying water data.

Sediment initial conditions influence both sediment transport dynamics and the phase distribution and mobility of contaminants in the bed. Physical parameters for setting sediment initial conditions included: porosity, density, and grain size from numerous studies in the greater Los Angeles and Long Beach Harbor waters (Bight 98, WEMAP 99, Bight 03 and various POLA and POLB sediment analysis post-1997, n= 200). Available sediment bed grain size data suggested that a mean sand diameter between 0.125 and 0.250 mm would be appropriate. Sediment contaminant concentrations as well as particulate or total organic carbon (POC or TOC) data were interpolated into the model based on post 2000 available sediment chemistry results. See Appendix III.3 for monitoring results used to set up EFDC model initial conditions.

Equilibrium partition coefficients based on the 2006 POLA-POLB data for DDT, PAH, and PCB, as a function of bed sediment concentration and bed total organic carbon concentration. Since no functional dependence of the partition coefficients on sediment concentration and organic carbon is observed, average values were estimated for use in the modeling. Table 5-5 summarizes the estimated average equilibrium partition coefficients for the three organic contaminants based on the data.

Table 5-5. Sediment Bed Equilibrium Partition Coefficients for Organics.

Contaminant	Bed Solids Based (L/mg)[1]	Bed TOC Based (L/mg)[1]	TOC Based Low Range (L/mg)[2]	TOC Based High Range (L/mg)[2]
DDT	0.0002	0.02	0.0002	0.2
PAH	0.0004	0.04	0.01	2.0
PCB	0.0002	0.02	0.005	0.5

[1] Based on POLA-POLB 2006 sediment bed and overlying water data.

[2] Based on Chapra, 1997.

5.3 EFDC Model Calibration

5.3.1 Calibration of the Hydrodynamic Model

After the model was set-up or configured, model calibration was performed. This is generally a two-phase process, with hydrodynamic calibration completed before repeating the process for water quality. Upon completion of the calibration at selected locations, a calibrated dataset containing parameter values (salinity, etc.) was developed.

Hydrodynamics was the first model calibration component because simulation of water quality loading relies heavily on flow prediction. The hydrodynamic calibration involves a comparison of model results to water elevation and velocity observations at selected locations. After comparing the results, key hydrodynamic parameters were adjusted and additional model simulations were performed. This iterative process was repeated until the simulated results closely represented the system and reproduced observed water elevation and velocity patterns and magnitudes.

The parameters that need to be calibrated for tidal elevation and velocity were the amplitude and phase of the incoming tidal constituent waves along the open boundary. The amplitude and phase along the three open boundaries were determined using a proprietary optimization procedure to minimize the difference between the observed and predicted complex amplitudes (cosine and sine amplitudes). Figure 5-5 shows a visual comparison of tidal frequency water surface elevation at the NOAA Gauge. As shown in this figure, agreement between observed and predicted tidal water surface elevations is reasonably good for the NOAA tide gauge station (note: additional details are provided in Appendix I).

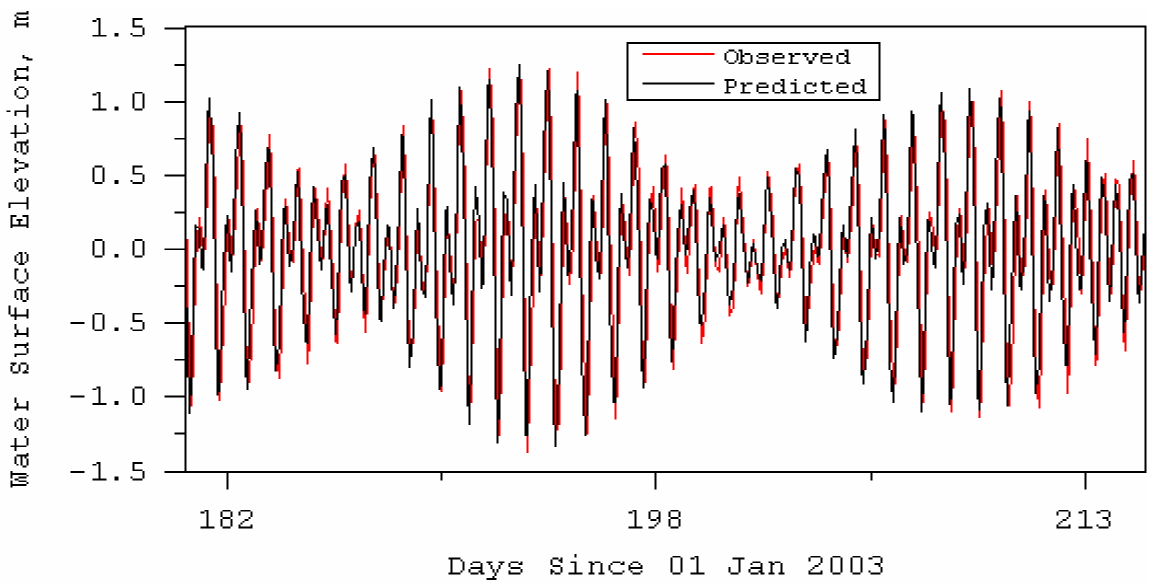


Figure 5-5. Tidal water surface elevation comparison at NOAA tide gauge in Los Angeles Harbor

Figure 5-6 shows a scatter plot comparing predicted and observed data for the 20 station locations for four sampling times from December 2004 to March 2005. The surface and bottom notation corresponds to averages over the upper and lower halves of the water column. Predicted salinities over the lower half of the water column agree reasonably well with observations although there are clusters of over and under prediction. Predicted salinities for the upper half of the water column agree reasonably well at most stations although the model tends to under predict surface salinity which the exception of a number of stations having over prediction. The solid lines represent linear regression fits. The lower range of variability of the bottom values yields a slope that is overly influenced by extreme values. The fit for the surface values yields a near unity slope.

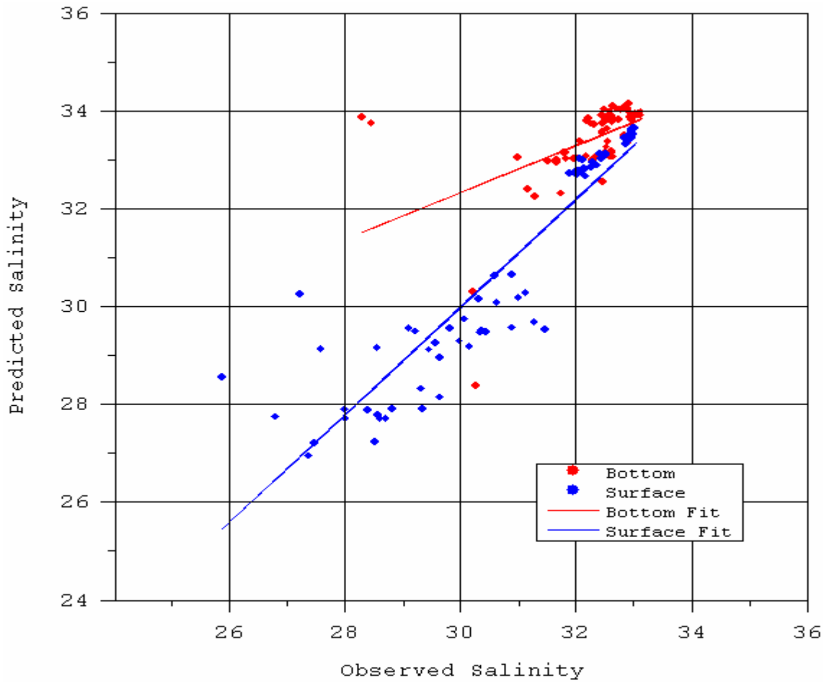


Figure 5-6. Comparison of EFDC predicted and observed salinity at 20 stations for four sampling times during the December 2004 to March 2005 period using NOAA Port wind fields

As can be seen from the comparisons indicated in the above figures, the hydrodynamic model provides a good foundation for the simulation of sediment and contaminant transport modeling in the greater harbor water system (see Appendix I for more details, especially Appendix A embedded within Appendix I, which presents time series plots of the modeled and observed salinity illustrating the model's response to high freshwater inflows).

5.3.2 Calibration of the Sediment and Contaminant Transport Model

The observational data available for sediment and contaminant transport model calibration and validation is sparse. Due to these data limitations, only a calibration effort was undertaken, as an independent set of data was not available to perform model validation. As mentioned in the preceding section, observational data defining conditions in the sediment bed were used for model initialization and are not appropriate for use in calibration. The calibration approach taken in this study was to use observational data in the water column for model calibration. Observational data in the water column included sediment and contaminant concentrations measured near the bottom of the water column during fall 2006.

The degree of calibration of the sediment and contaminant transport model is evaluated using sediment and contaminant concentrations at the 60 fall 2006 overlying water sites and the 2005 and fall 2006 mid-water column sites. As previously noted, the mid-water column sites only have data for the three metals. Overlying water sites failed to provide detectable concentrations of PCB, resulting in no calibration results being presented for PCB other than confirmation that the model predicted water column PCB levels were below detection limits. As was done for the sediment comparison, contaminant concentrations were averaged over the six-month dry season period from May to October 2005 for comparison with instantaneous observations taken during dry fall conditions (mostly in 2006). Results for copper simulations are shown as an example (Figure 5-7). Appendix I provides additional details and calibrations results associated with the EFDC model.

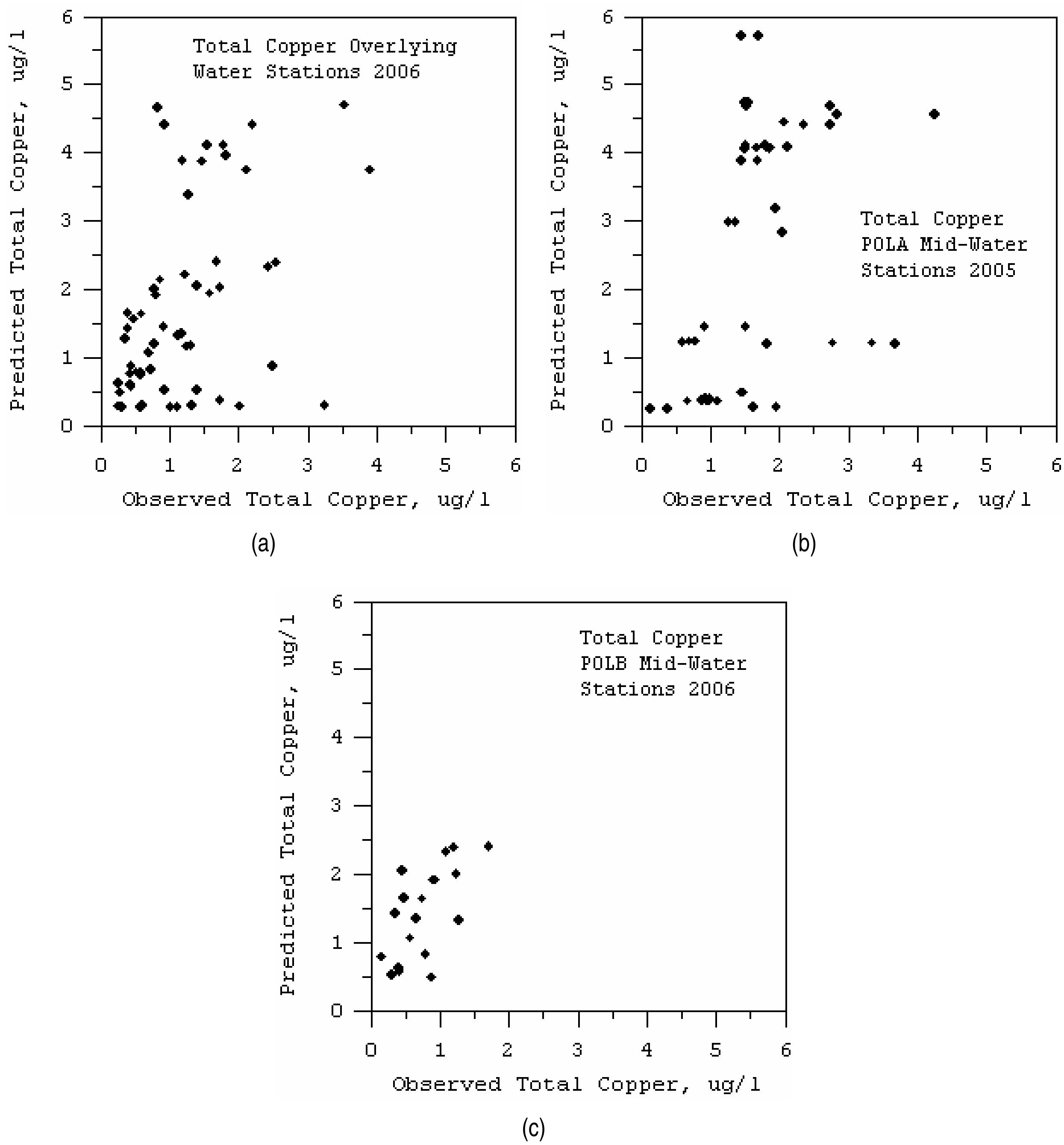


Figure 5-7. Comparison of model predicted and observed copper concentration at the overlying water and mid-water column sites (Appendix I, Figure 43)

Overall, there were extremely limited data available for model calibration and the best available data and information were incorporated into the models. While the model results did not always match the observed values, it generally captured the range of observations using the data and information available at the time of model development. Appendix I provides extensive detail on the model calibration efforts and results.

5.4 Summary of Linkage Analysis

The LSPC model was developed and applied to TSS and pollutant loads from freshwaters, including Dominguez Channel, Los Angeles River, San Gabriel River and nearshore areas. Comparison of LSPC model output based on 1995-2005 simulation period, shows the Los Angeles River contains the highest pollutant load of any of the four fresh watersheds. Output (2002-2005) from these watersheds was integrated into the EFDC receiving water model. Figure 5-8 below illustrates the TMDL zones simulated by EFDC as well as the nearshore watersheds draining to those zones.

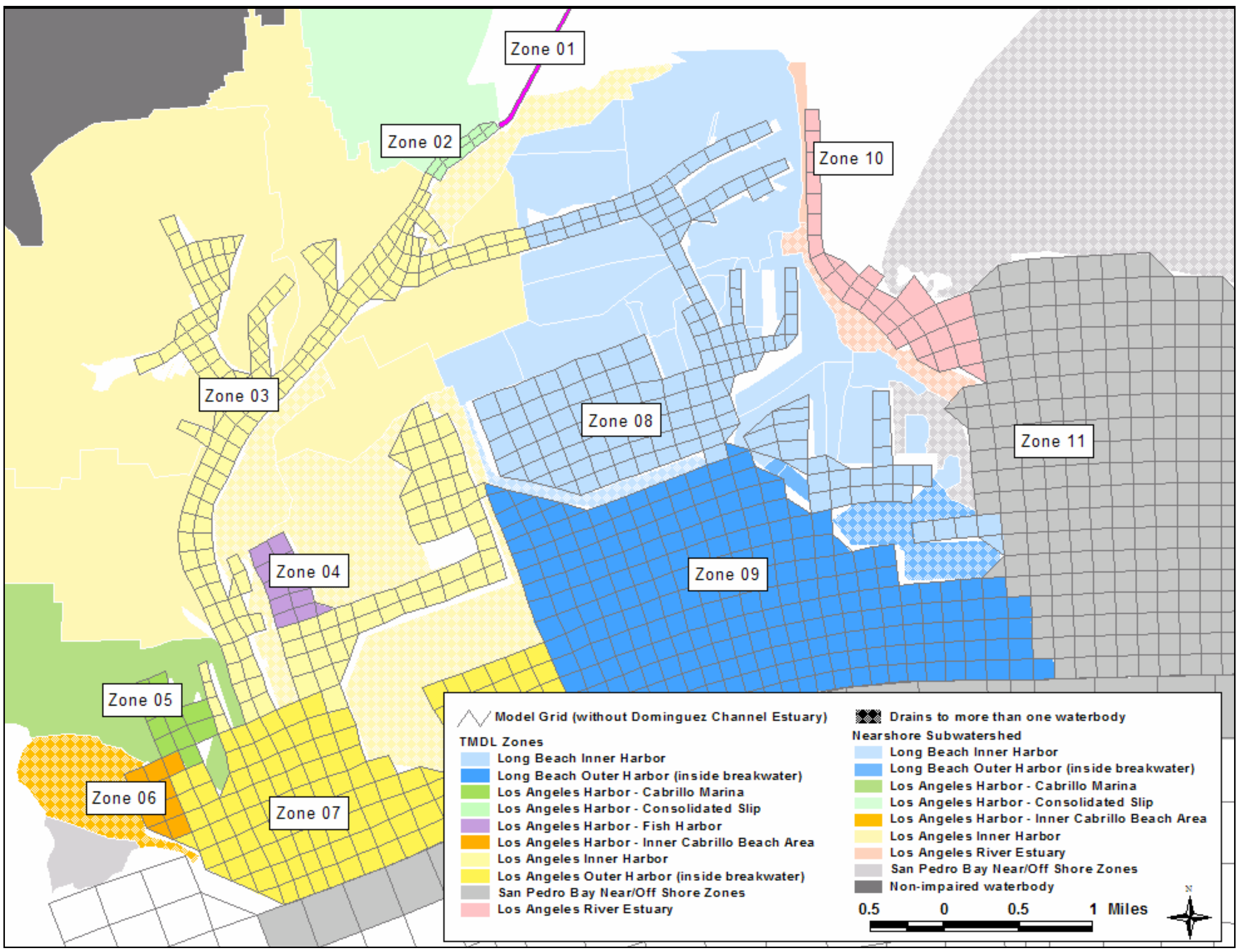


Figure 5-8. Nearshore subwatersheds (LSPC model) associated with TMDL (EFDC) model zones

The EFDC based hydrodynamic, sediment transport, and contaminant transport and fate model for the greater Los Angeles and Long Beach Harbors and adjacent region of San Pedro Bay has been calibrated and demonstrated to be suitable for use in TMDL development.

The EFDC model was used to generate a baseline as well as several other management scenarios and to evaluate relative contributions from various inputs to support water quality management decisions in these waters. The baseline scenario started with the initial conditions and then simulated four years ahead to determine average water and sediment conditions if no implementation occurs (see Appendix III, section 8) to characterize existing contaminant loads. Pollutant load reduction scenarios were performed to support allocation analyses and implementation alternatives. Appendix III, Part 8 provides details on all of these scenarios. The "no upland sources" scenario, which simulates conditions assuming no upland (watershed) contaminant loads, was used to support allocation of the TMDL loads.

Results of the "no upland sources" scenario were compared with results from the baseline scenario to quantify the relative contributions from the watersheds. Specifically, the model was run for 2002-2005 for these two scenarios and the resulting average sediment bed concentrations in each waterbody were quantified. The waterbody-specific values from each scenario were compared and the difference between them was represented as a percentage. This percentage was interpreted as the waterbody-specific percent contribution of the contaminant to the bed sediments from the upstream watersheds. These percentages were ultimately applied to both the TMDLs and the existing conditions to determine the wasteload allocation and existing load, respectively, associated with watershed inputs. The resulting WLAs were further distributed among MS4 permits based on the area draining to each waterbody (see Appendix III, Part 1).

Preliminary results for these two scenarios indicate that reducing freshwater input loads may not be sufficient to achieve target concentrations in water and sediments; thus decreasing contaminated pollutant levels in bed sediments may be required.

6 TMDLs and Allocations

This section explains the development of the loading capacities (i.e., TMDLs) and allocations for toxicants in the Dominguez Channel watershed and greater Harbor waters. EPA regulations require that a TMDL include waste load allocations (WLAs), which identify the portion of the loading capacity allocated to existing and future point sources (40 CFR 130.2(h)) and load allocations (LAs), which identify the portion of the loading capacity allocated to nonpoint sources (40 CFR 130.2(g)). As appropriate waste load allocations are assigned to point sources, such as wastewater treatment plants, storm water discharges, power generating stations, and other NPDES discharges. Load allocations are assigned to existing sediments and atmospheric deposition. As discussed in previous sections, the flows, sources, and the relative magnitude of inputs vary between pollutant types as well as seasonal conditions. Separate TMDLs have been developed for freshwaters in Dominguez Channel and Torrance Lateral; these apply during wet weather conditions only. TMDLs for impaired sediment chemistry, sediment quality conditions (benthic communities) and bioaccumulation (elevated fish tissue levels) apply year-round in Dominguez Channel Estuary and all other greater Harbor waterbodies.

Interim WLA and LA are to not allow any decrease in current facility performance. Interim allocations shall be met upon the effective date of the TMDL. As allocation-specific data are collected, interim targets for other pollutants and waterbodies may be identified.

6.1 Freshwater toxicity TMDLs in Dominguez Channel

The Basin Plan narrative toxicity objective does not allow acute or chronic toxicity in any receiving waters. To meet the narrative toxicity objective, a numeric toxicity target of 1 chronic toxicity unit (1 TUc) is established. Equation 1 describes the calculation of a TUc.

TUc – Toxicity Unit Chronic = 100/NOEC (no observable effects concentration) (Eq. 1)

To calculate the TUc: TUc = 100% divided by the sample concentration, derived using hypothesis testing, to cause no observable effect, with the sample concentration expressed as a percentage. For example, if the NOEC is estimated to 25% using hypothesis testing, then the TUc equals 100/25 = 4 toxic units.

An updated Toxicity Policy is now in development by the State Water Resources Control Board and may establish new toxicity criteria. Targets that are based on new criteria that achieve the narrative objective of Chapter 3 of the Basin Plan may substitute for the TUc of 1, when those new criteria are adopted and in effect.

As discussed in the Problem Statement section, whereas toxicity results are re-occurring (6 of 14 over 7 years), diazinon does not appear to be elevated and thus is probably not the causative agent. Recent City of Los Angeles monitoring data show diazinon exceedences from 2002-2005, but none from 2006-2010 (zero of 34 samples). This timing is consistent with the EPA ban on urban use of diazinon, effective Dec. 31, 2005. Based on available monitoring results, no diazinon TMDLs have been developed at this time. The Regional Board may revisit the potential for diazinon TMDLs in the future or if the data record continues to show no exceedences the Board may pursue delisting this pollutant in future 303(d) Listing cycles.

6.1.1 Toxicity Allocations – Wasteload and Load Allocation

To address toxicity occurring in freshwaters of Dominguez Channel, the allocations will equal the numeric target and loading capacity. Therefore the allocation of 1 TUc applies to each source, including all point sources and non-point sources (Table 6-1). Similar toxicity allocations have been applied to other freshwater TMDLs including Calleguas Creek Watershed Toxicity TMDL. The fresh water interim allocation shall be implemented as a trigger for initiation of the TRE/TIE process as outlined in USEPA's "Understanding and Accounting for Method Variability in Whole Effluent Toxicity Applications Under the National Pollutant Discharge Elimination System Program" (2000) and current NPDES permits. The fresh water interim allocation shall be implemented in accordance with US EPA, State Board and Regional Board resolutions, guidance and policy at the time of permit issuance, modification or renewal.

Table 6-1. Wasteload and Load Allocations for dischargers into Dominguez Channel freshwaters.

Allocations	Interim*	Final
Waste load Allocations		
MS4 – LA County	2 TUc	1 TUc
CalTrans	2 TUc	1 TUc
Other permittees**	2 TUc	1 TUc
Load Allocations		
non-point sources	2 TUc	1 TUc

* LACDPW results are currently <2 TUc so this interim should be easily achieved.
** 'Other permittees' includes General Construction and General Industrial permittees as well as minor permittees with irregular discharges during wet weather.

6.1.2 Freshwater Toxicity – Margin of Safety

An implicit margin of safety is included in these toxicity TMDLs. Chronic Toxicity unit allocations will be protective of both acute and chronic exposures. No explicit margin of safety is required as meeting the final allocation will attain the applicable narrative objective; i.e., "no toxics in toxic amounts."

6.2 **Freshwater wet weather metals TMDLs in Dominguez Channel**

Freshwater metals TMDLs within Dominguez Channel are based on repeated exceedences of CTR criteria for dissolved copper, lead and zinc in wet weather. No exceedence has been observed in dry weather; therefore no dry weather metals TMDLs are required for this waterbody. These freshwater metal TMDLs utilize a similar approach to other Regional Board metals TMDLs; that it, the targets are set for acute conditions, hardness dependent, and expressed in total metals concentrations. See Table 3-2 to review total metal targets.

Mass-based WLAs have been developed for combined stormwater sources, that is, MS4, Caltrans sources, and flow data will rely on approximate daily storm volume.

Concentration-based WLAs have been developed for General Construction and General Industrial; (and) non-stormwater discharges; e.g., minor, general and future minor NPDES permits.

6.2.1 Wet Weather TMDLs

Wet-weather TMDLs apply when the maximum daily flow in the Dominguez Channel is equal to or greater than 63 cfs as measured at LACDPW flow gauge S-28. This gauge is located in Dominguez Channel at Vermont Ave. and represents only freshwater flows.

During wet weather, the allowable load is a function of the volume of water in the Channel and the total metal target concentration. See Equation 2. Given the variability in wet-weather flows, the concept of a single critical flow is not justified. Instead, a load duration curve approach was used to establish the wet-weather loading capacity. In brief, a load duration curve is developed by multiplying the wet-weather flows by the in-stream numeric target. The result is a curve, which identifies the allowable load for any given flow. The wet-weather loading capacity applies to any day when the maximum daily flow measured at a location within the Dominguez Channel is equal to or greater than 62.7 cfs, which is the 90th percentile of annual flow rates from the estimated modeled flow rates. The wet-weather freshwater metals TMDLs were defined by these load-duration curves and are presented in Table 6-2.

TMDL (g/day) = loading capacity = daily storm volume (liters) X numeric target (µg/L) / 1,000,000 (Eq. 2)

Table 6-2. Wet-weather loading capacities (TMDLs) for metals (total recoverable metals).

Reach	Copper (kg/day)	Lead (kg/day)	Zinc (kg/day)
Dominguez Channel (freshwater)	Daily storm volume x 9.7 µg/L	Daily storm volume x 42.7 µg/L	Daily storm volume x 69.7 µg/L

The daily storm volume is equal to the total daily flow in Dominguez Channel measured at site S28.
Metal specific values are hardness dependent (50 mg/L) and site-specific conversion factors are applied.

The LSPC model was used to simulate flows and metals concentrations in Dominguez Channel from 1995-2005, providing daily flow volume and estimates of existing metals loads during wet days. By including all storm flows over the 1995-2005 period (an eleven-year period), analysis of critical conditions was included. Allowable loads were calculated by multiplying the daily flow volume (when Dominguez Channel maximum streamflow rate is greater than or equal to 62.7 cfs) by the appropriate numeric water quality target.

Based on modeling of the average annual loading capacity for each metal during only wet weather days, Table 6-3 compares the annual predicted existing load to the allowable load determined using the numeric targets. (Source: Tetra Tech spreadsheet, April 2011). The loads presented in Table 6-3 are based the load duration curves; therefore, the numbers used in these calculations are from the bars in the load duration curves presented for each metal or the total loads under the loading capacity curves (Appendix III, Figures III.2-2 to III.2-4).

Specifically, for the existing loads, the loads associated with all bars in the load duration curves are summed, but for the average annual allowable loads, the total possible loads below the loading capacity curve are summed. These total existing loads or total allowable loads (which are based solely on wet days over the eleven-year modeling period) were divided by eleven to yield average annual wet weather loads. It is important to note that these “annual” loads are only based on the wet days. If they are converted to average daily loads for comparison with the TMDL loads in Table 6-4, they should be divided by an average of 28 wet days per year (in the eleven-year simulation period, there were a total of 307 wet days). The percent reductions in Table 6-3 are estimates to provide readers with an approximate level of pollutant reductions during wet weather on daily basis.

Table 6-3. Dominguez Channel freshwater model-predicted average annual loads (kg) and percent reduction required.

Metal[1]	Allowable load (kg)	Existing load (kg)	Percent reduction required
Total Copper[2]	245	776	72.0%
Total Lead[3]	1080	440	3.1%
Total Zinc[2]	1763	6747	76.4%

[1] The numeric targets presented in Table 3-2 (based on CTR) were used to determine allowable loads for all three metals in the watershed model.
[2] Copper and zinc average annual and daily existing loads were consistently above the allowable load (based on wet days in the eleven-year modeling period), requiring 72% and 76% reductions, respectively.
[3] Although the average annual existing load of Pb is below the average annual allowable load (based on wet days in the eleven-year modeling period), there are a few exceedances of the allowable daily load in the modeled Load Duration Curve, thus a small percent reduction is required.

Wet-weather load-duration curves for each metal, along with the 1995-2005 wet weather modeled existing loads are presented in Appendix III, Part - 2. For practical purposes of comparing stormwater data to the TMDLs, the wet-weather load for a day is calculated based on the stormwater event mean concentration (EMC) from a flow-weighted composite.

Model results for lead are different from results for copper and zinc since the average annual existing lead loads are less than the average annual allowable load (based on wet days in the eleven-year modeling period). Given that this is an average condition; some daily loads are expected to be above this load, while others will fall below, as illustrated by the lead load duration curves in Appendix III.2 (Figure III.2-3). When comparing the sum of the daily exceedance loads with the sum of the total lead existing loads in the load duration curves, a 3.1 percent load reduction is required to achieve the loading capacity.

6.2.2 <u>Wet-weather Allocations</u>

Wet-weather allocations are assigned to all upstream reaches and tributaries of Dominguez Channel (above Vermont Avenue) because they potentially drain to these impaired freshwater reaches during wet weather. Allocations are assigned to both point (WLA) and nonpoint sources (LA). A mass-based LA has been developed for direct atmospheric deposition. A mass-based waste load allocation (WLA) is divided between the MS4 permittees and Caltrans under its NPDES stormwater permit by subtracting the other stormwater or NPDES waste load allocations, air deposition and the margin of safety from the total loading capacity. Individual MS4 waste load allocations are further defined for Los Angeles County MS4 Permittees and Caltrans based on land use percentages within the Dominguez Channel watershed. Concentration-based WLAs are assigned for the other point sources including but not limited to General Construction, General Industrial, Power Generating stations, minor permits and irregular dischargers, and other NPDES dischargers.

6.2.2.1 Wet-Weather Load Allocations

An estimate of direct atmospheric deposition is developed based on the percent area of surface water in the watershed. Approximately 0.3% of the watershed area draining to the freshwater portion of Dominguez Channel is comprised of surface water. The load allocation (LA) for atmospheric deposition is calculated by multiplying this percentage by the difference of total loading capacity (TMDL) and margin of safety (MOS), according to the following equation:

$$LA_{\text{Direct Atmospheric Deposition}} = 0.03 \times (TMDL - MOS)$$

6.2.2.2 Wet-Weather Waste Load Allocation for Stormwater

Wet-weather waste load allocations for the LA County and CalTrans stormwater permittees are calculated in the same manner as other metals TMDLs in Los Angeles region. Since the direct atmospheric deposition is calculated as a percentage of the TMDL, the equation becomes:

$$WLA_{\text{Stormwater permittees}} = TMDL - MOS - LA_{\text{Direct Atmospheric Deposition}}$$

Wet weather mass-based allocations for direct air deposition and stormwater permittees are presented in Table 6-4.

6.2.2.3 Wet-Weather Waste Load Allocation for other NPDES Permits

Concentration-based waste load allocations are established for General Construction and General Industrial stormwater and other minor NPDES permittees that discharge to Dominguez Channel to ensure that these point sources do not contribute to exceedances of the CTR criteria. The concentration-based waste load allocations are equal to the wet-weather numeric targets for each total recoverable metal expressed as an average daily concentration, identified as "other stormwater/NPDES" in Table 6-4. Any future minor NPDES permits or enrollees under a general non-stormwater NPDES permit will also be subject to the concentration-based waste load allocations.

Table 6-4. Wet-weather TMDLs and Allocations for copper, lead and zinc (g/d) in Dominguez Channel. Allocation values presented here are based on daily volume associated with stream flow rate = 62.7 cfs at monitoring station S28.

Dominguez Channel	Percent area	Total Copper	Total Lead	Total Zinc
TMDL	100%	1485.1	6548.8	10,685.5
Waste Load Allocations				
Municipal Stormwater	97.3%	1300.3	5733.7	9355.5
CalTrans Stormwater	2.4%	32.3	142.6	232.6
Other stormwater/NPDES	N/A	[9.7 µg/L]	[42.7 µg/L]	[69.7 µg/L]
Load Allocations				
Air Deposition	0.3%	4.0	17.7	28.9
Margin of Safety				
MOS (10%)	N/A	148.5	654.9	1069.6

Mass-based stormwater values were based on total recoverable metal targets, a hardness of 50 mg/L and a flow of 62.7 cfs (daily volume = 1.5 x 10^8 liters).

Recalculated mass-based allocations using ambient hardness and flow rate at the time of sampling are considered consistent with the assumptions and requirements of these waste load allocations. In addition, samples collected during flow conditions less than the 90^{th} percentile of annual flow rates must demonstrate that the acute and chronic hardness dependent water quality criteria provided in the CTR are achieved. Other Stormwater/NPDES allocations are shown in total recoverable concentration.

Interim water allocations are assigned to stormwater dischargers, (MS4, general construction and general industrial stormwater dischargers) and other NPDES dischargers. Interim water allocations listed in Table 6-5 are based on the 95th percentile of total metals concentrations collected from January 2006 to January 2010 using a log-normal distribution. The use of 95th percentile values to develop interim allocations is consistent with NPDES permitting methodology. Regardless of the interim allocations below, permitted dischargers shall ensure that effluent concentrations and mass discharges do not exceed levels that can be attained by performance of the facility's treatment technologies existing at the time of permit issuance, reissuance or modification.

Table 6-5. Wet-weather Concentration-based Dominguez Channel and Torrance Lateral freshwater interim metal allocations (ug/L)

Allocation	Copper	Lead	Zinc
Interim water allocation	207.5	122.9	898.9

Based on hardness of 50 mg/L.
Recalculated concentration-based allocations using ambient hardness at the time of sampling are considered consistent with the assumptions and requirements of these waste load allocations. In addition, samples collected during flow conditions less than the 90th percentile of annual flow rates must demonstrate that the acute and chronic hardness dependent water quality criteria provided in the CTR are achieved.

6.2.3 *Margin of Safety-Dominguez Channel freshwater*

The federal statute and regulations require that TMDLs include a margin of safety (MOS) to account for any lack of knowledge concerning the relationships between effluent limitations and water quality. To account for any additional uncertainty in the wet-weather freshwater TMDLs, an explicit MOS equal to 10% of the loading capacity or existing load available for wet-weather allocations has been included. The 10% MOS was subtracted from the loading capacity or existing load, whichever is smaller. Applying an explicit margin of safety is reasonable because a number of uncertain estimates are offset by the explicit margin of safety. While the observed dissolved-to-total metals ratios are not similar to CTR default conversion values, there appears to be very poor correlation between the fraction of particulate metals and TSS. Also, there is added uncertainty of stream flow rates during wet weather conditions, when the highest metal loads occur, thus an explicit margin of safety is justified.

6.3 Freshwater wet weather metals TMDLs in Torrance Lateral

Torrance Lateral is a sub-watershed within the larger Dominguez Channel watershed that flows directly into Dominguez Channel Estuary (approx. 2 miles below S28). Torrance Lateral refers to waters upstream of confluence with Dominguez Channel Estuary, consistent with LAC DPW sampling site TS19. Currently there is no flow gauge associated with stream flows within Torrance Lateral, thus the daily storm volume or load duration approach can not be applied.

6.3.1 *Wet weather metals TMDLs in Torrance Lateral*

Recent monitoring results provide only 10 wet weather samples and no flow data within Torrance Lateral, thus the TMDL approach has been modified from that taken for freshwater metals in Dominguez Channel. For Torrance Lateral freshwaters, concentration-based TMDLs and allocations for the water column were developed; these are consistent with total metal targets identified for Dominguez Channel freshwaters. To address impaired sediments, sediment waste load allocations are assigned to all other dischargers to Torrance Lateral equal to the concentration-based sediment targets.

6.3.2 Wet-weather Allocations

Until more robust results exist for waters sampled within the Torrance Lateral sub-watershed, the water column allocations are set equal to total metal concentration-based targets provided for Dominguez Channel. See Table 6-6. These allocations apply during all wet weather conditions; i.e., no base flow level has been identified. If future studies within Torrance Lateral provide sufficient flow data, then water column allocations maybe refined to apply above a designated stream flow rate.

These allocations apply to Los Angeles County MS4 Permittees. Non-point sources do not exist within this sub-watershed. Sediment concentration-based allocations are included here.

Table 6-6. Water and Sediment Allocations for Torrance Lateral sub-watershed.

Media	Copper	Lead	Zinc
Water (unfiltered)	9.7 µg/L	42.7 µg/L	69.7 µg/L
Sediment (TECs)	31.6 mg/kg dry	35.8 mg/kg dry	121 mg/kg dry

Hardness = 50 mg/L based on Dominguez Channel monitoring site S28.
Recalculated concentration-based allocations using ambient hardness at the time of sampling are considered consistent with the assumptions and requirements of these waste load allocations. In addition, samples collected during flow conditions less than the 90^{th} percentile of annual flow rates must demonstrate that the acute and chronic hardness dependent water quality criteria provided in the CTR are achieved. Other Stormwater/NPDES allocations are shown in total recoverable concentration.

6.3.2.1 Wet weather wasteload allocations for ExxonMobil Refinery

Exxon Mobil retains stormwater for its facility and part of the City of Torrance. Typically this stormwater is retained on-site and then preferentially diverted to a local wastewater treatment system; however there are rare times when the facility must discharge stormwater into Torrance Lateral. ExxonMobil has provided monitoring results and flow data, from 2000-2010, for two discharge events during this timeframe, both occurred during water year 2005 (very large rainfall year). These allocations assume that Refinery stormwater discharges will continue to be rare in the future; that is, these facilities will continue to maximize storage and divert large stormwater volumes into POTWs prior to discharging into Torrance Lateral or Dominguez Channel Estuary. ExxonMobil anticipates discharging stormwater once every seven years on average (ExxonMobil 2007). If, due to an increase in discharge frequency or volumes, it appears that the allocations are not supportive of the TMDL, these allocations may be revised. Based on this information as well as the total recoverable metals targets, the mass-based allocations for copper, lead and zinc for stormwater discharges from this NPDES permittee are shown in Table 6-7. No explicit allocations for PAHs are identified for ExxonMobil; however, discharges should not exceed existing water quality criteria for these individual compounds and continued monitoring should occur.

Table 6-7. Waste Load Allocations for ExxonMobil refinery into Torrance Lateral.

Media	Copper	Lead	Zinc
Water (unfiltered)	1.36 kg/yr	5.98 kg/yr	9.75 kg/yr

Values are based on Q = 3.7 MGD for 7 days/year and total metal targets; assumes discharge events are irregular; e.g., once every seven years on average.

Compliance with the freshwater metals allocations for Dominguez Channel and Torrance Lateral may be demonstrated via any one of three different means:

a. Final allocations are met.
b. CTR total metals criteria are met instream.
c. CTR total metals criteria are met in the discharge.

6.3.3 Margin of Safety-Torrance Lateral

An implicit margin of safety exists in the final wasteload allocations. The implicit margin of safety is based on multiple targets (for water and sediment). Currently no explicit margin of safety is applied to these TMDLs to address impaired conditions within the sediments; however, if any chemical-specific freshwater sediment quality value(s) is revised or updated contingent on future sediment quality studies, then an explicit margin of safety may be considered and may be applied.

6.4 **Impaired Sediment Quality Objective – Direct Effects TMDLs in Dominguez Channel Estuary and Greater Harbor waters**

Based on monitoring studies with sediment triad results, impaired sediment conditions exist and TMDLs are required for the following waterbodies: Dominguez Channel Estuary, Consolidated Slip, Inner, Outer and Fish Harbors, Los Angeles River estuary, eastern San Pedro Bay and Cabrillo Marina. The goal is to restore the beneficial uses of aquatic life within sediments of these waterbodies.

The categories designated in the State Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality (SQO Part 1) as Unimpacted and Likely Unimpacted by the interpretation of multiple lines of evidence shall be considered as the protective narrative objective. Evaluation of achieving these desired categories relies on multiple lines of evidence, integrating sediment chemistry, sediment toxicity and benthic community index results. Numeric TMDLs and allocations are presented below and are expected to attain the narrative objective.

6.4.1 Interim Allocations for Sediment

Interim sediment allocations are assigned to stormwater dischargers, (MS4, general construction and general industrial stormwater dischargers) and other NPDES dischargers. Interim sediment allocations are based on the 95th percentile of sediment data collected from 1998-2006 (Table 6-8). The use of 95th percentile values to develop interim allocations is consistent with NPDES permitting methodology. For waterbodies where the 95th percentile value has been equal to, or lower than, the numeric target, then the interim allocation is set equal to the final allocation. Regardless of the allocation, permitted dischargers shall ensure that effluent concentrations and mass discharges do not exceed levels that can be attained by performance of the facility's treatment technologies existing at the time of permit issuance, reissuance or modification.

Compliance with the interim concentration-based sediment allocations may be demonstrated via any one of three different means:

1. Demonstrate that the sediment quality condition of **Unimpacted** or **Likely Unimpacted** via the interpretation and integration of multiple lines of evidence as defined in the SQO Part 1, is met; or
2. Meet the interim allocations in bed sediment over a three-year averaging period; or
3. Meet the interim allocations in the discharge over a three-year averaging period.

Table 6-8. Sediment, Interim Concentration-based Allocations

Waterbody	Pollutant (mg/kg sediment)					
	Copper	Lead	Zinc	DDT	PAHs	PCBs
Dominguez Channel Estuary	220.0	510.0	789.0	1.727	31.60	1.490
Long Beach Inner Harbor	142.3	50.4	240.6	0.070	4.58	0.060
Los Angeles Inner Harbor	154.1	145.5	362.0	0.341	90.30	2.107
Long Beach Outer Harbor (inside breakwater)	67.3	**46.7**	**150**	0.075	**4.022**	0.248
Los Angeles Outer Harbor (inside breakwater)	104.1	**46.7**	**150**	0.097	**4.022**	0.310
Los Angeles River Estuary	53.0	**46.7**	183.5	0.254	4.36	0.683
San Pedro Bay Near/Off Shore Zones	76.9	66.6	263.1	0.057	**4.022**	0.193
Los Angeles Harbor - Cabrillo Marina	367.6	72.6	281.8	0.186	36.12	0.199
Los Angeles Harbor - Consolidated Slip	1470.0	1100.0	1705.0	1.724	386.00	1.920
Los Angeles Harbor - Inner Cabrillo Beach Area	129.7	**46.7**	163.1	0.145	**4.022**	0.033
Fish Harbor	558.6	116.5	430.5	40.5	2102.7	36.6

Numbers in **bold** are also the final allocation.

6.4.2 TMDL – Direct Effects

The narrative objective provides two qualitative conditions that satisfy the support of aquatic life in sediments. These two qualitative conditions are either 'unimpacted' or 'likely unimpacted' which must be interpreted via evaluation multiple lines of evidence as described above. For these TMDLs, an alternative, quantitative expression, defined as meeting the sediment quality value (SQV) for each chemical[1] identified within the applicable Sediment Quality Plan, Part I – Direct Effects is included. The SQV for each chemical is initially set equal to the chemical-specific ERL values. However, the SQV may be modified or replaced based on future sediment quality studies, such as site-specific (toxicity or benthic impact) studies or stressor identification studies. Such special sediment studies may test for sediment toxicity (survival and sub-lethal effects) as well as benthic community response index. Also, plans for sediment special studies will be reviewed by the Regional Board and EPA in order to provide the basis for replacing an ERL as the SQV.

Attainment of the narrative sediment quality objective may occur either through demonstrating the waterbody has achieved the desired qualitative condition [clearly unimpacted or likely unimpacted] or the quantitative condition; i.e., if the ambient sediment chemistry levels within a waterbody are equal to or below the sediment quality values.

The direct effects TMDLs were calculated using annual average sediment deposition rates (Table 5-3) from the EFDC model output for each TMDL zone. These deposition rates were multiplied by the applicable numeric targets and a conversion factor to determine the loading capacities for each pollutant in each TMDL waterbody. See Appendix III, Part 1 for more information on the TMDL calculations. The loading capacities are presented in Table 6-10. This table also includes estimates of existing loads, which are consistent with the values presented in Table 4-6 and are based on the total deposition rate multiplied by the applicable existing sediment concentration and a conversion factor (the existing sediment concentrations are based on the average simulated sediment concentration from 2002-2005 in the top 5 cm of sediment).

6.4.3 Allocations – Direct Effects

These allocations apply to pollutant sources discharging into the waterbody as well as to existing sediments within each waterbody. To comply with Federal Regulations, wasteload and load allocations must be express in numeric form within TMDLs. See 40 C.F.R. § 130.2(h) & (i). For these TMDLs, the allocations are based on chemical specific sediment quality value (SQV), referring to the chemical concentration in the bulk sediments. The initial SQV value is equal to the ERL value. As described below, mass-based allocations were defined for some sources where sufficient data was available, whereas concentration-based allocations were identified for others.

6.4.3.1 Waste Load Allocations – Direct Effects

Wasteload Allocations are provided by waterbody and source-type in Table 6-9 and 6-10. Mass-based WLAs are identified for TIWRP and other point sources that have provided discharge flow data. (Refineries which have provided discharge flow data along with monitoring results receive mass-based allocations, whereas other refineries receive concentration-based allocations because no discharge flow data has been provided to Regional Board staff.) Stormwater sources,

[1] Sediment Quality Plan, Part I identifies the following specific contaminants of concern: Cu, Pb, Hg, Zn, PAHs (18 compounds), Dieldrin, Chlordane (3 isomers), DDT (6 isomers), total PCBs (18 congeners), TOC, % fines. Here the approach is simplified by developing TMDLs for total PAHs, total Chlordane, total DDT and total PCBs.

including Los Angeles County MS4 Permittees, City of Long Beach and Caltrans, have received individual, mass-based allocations by permit within each watershed. Stormwater discharges from the Port of Los Angeles (POLA) and Port of Long Beach (POLB) are grouped with the MS4 dischargers. Mass-based WLAs are applied as annual limits. Individual mass-based WLAs for an individual MS4 Permittee will be calculated based on its share, on an area basis, of the mass-based WLA or other approved approach available at the time final mass-based WLAs are in effect and incorporated into the permit.

As described above in Section 5.3, the relative difference between the baseline and "no upland sources" scenarios were interpreted as the waterbody-specific percent contribution of the contaminant to the bed sediments from the upstream watersheds. These percentages were applied to the TMDLs to determine the mass-based WLAs for the stormwater sources. These overall WLAs were further divided to individual, mass-based allocations by permit based on the percent area draining to each waterbody (see Appendix III, Part 1).

Concentration-based WLAs are identified for other sources, such as General Construction, General Industrial, Power Generating stations, minor permits and irregular dischargers into Dominguez Channel Estuary. Any future minor NPDES permits or enrollees under a general non-stormwater NPDES permit will also be subject to the concentration-based waste load allocations. Concentration-based limits are applied as daily limits.

Non-MS4 point sources such as General Construction, General Industrial, individual industrial permittees, including power generating stations, minor permits and irregular dischargers into Dominguez Channel Estuary and greater Harbor waters are assigned concentration-based allocations. Any future minor NPDES permits or enrollees under a general NPDES permit are also assigned the concentration-based waste load allocations. The allocations are set equal to the saltwater targets for metals and equal to the human health targets for the organic compounds in CTR. The averaging period for the concentration-based WLAs shall be consistent with that specified in the regulation establishing the criterion or objective or relevant implementation guidance published by the establishing agency.

Table 6-9. Receiving (salt) Water Column Concentration-Based Waste Load Allocations

Constituents	Copper* (µg/L)	Lead* (µg/L)	Zinc* (µg/L)	PAHs (µg/L)	Chlordane (µg/L)	4,4'-DDT (µg/L)	Dieldrin (µg/L)	Total PCBs (µg/L)
Dominguez Channel Estuary	3.73	8.52	85.6	0.049**	0.00059	0.00059	0.00014	0.00017
Inner Harbor	3.73	8.52	85.6			0.00059		0.00017

* Total Concentration-based WLAs for metals are converted from saltwater dissolved CTR criteria using CTR saltwater default translators.

** CTR human health criteria were not established for total PAHs. Therefore, the CTR criteria for individual PAHs of 0.049 µg/L are applied individually to benzo[a]anthracene, benzo[a]pyrene, and chrysene. The CTR criterion for pyrene of 11,000 µg/L is assigned as an individual WLA. Other PAHs compounds in the CTR shall be screened as part of the TMDL monitoring.

Calculations for the allocations shown here include MS4 discharges from the Seal Beach area (Orange County) to San Pedro Bay. The Orange County MS4 is issued by the Santa Ana Regional Board. Allocations for the Orange County MS4 will not be assigned in the Basin Plan

Amendment. If later monitoring demonstrates that the Seal Beach MS4 discharges do not support the goals of the TMDL, a revision to this TMDL in conjunction with the Sana Ana Region may be developed.

TIWRP discharges into Outer Harbor. Effluent flow from 1988 to 2009 showed the following range of average annual discharge rates – 21.0 to 16.0 MGD, with general declining trend. The target pollutant concentrations multiplied by 15.6 MGD (annual average flow rate in 2009) was used to calculate mass-based allocations for this point source. This yields allocation quantities for metals and bioaccumulatives that exceed the loading capacity. A reduction in the flow from TIWRP is planned and may allow for a revision of the WLA in future TMDL re-considerations.

6.4.3.2 Load Allocations – Direct Effects

Load Allocations apply to non-point sources; e.g., existing sediments and direct air deposition, and are also presented in Table 6-10. Direct air deposition allocations are included for Cu, Zn and PAHs based on estimates of current atmospheric loading rates presented in Source Analysis section, Table 4-6 based on monitoring results cited by Sabin & Schiff (2007) or Sabin et al., (2010). Future changes to Cu, Zn and PAH air quality criteria, other regulation such as brake pad requirements, or other improvement in air quality may allow for re-calculations of air deposition allocations in future revisions to the TMDL. Mass-based LAs are applied as annual limits.

For Lead (Pb), the direct air deposition allocation was calculated using information from EPA's revision to the National Ambient Air Quality Standard (EPA, 2008) as well as recent rule making by South Coast Air Quality Management District (SCAQMD, 2010). SCAQMD will be implementing EPA's Pb ambient air standard (0.15 ug/m^3) in forthcoming years. The load allocation for direct deposition of Pb onto surface waters is based on this revised air quality standard and the surface area of each waterbody, converted to mass/year. These mass-based direct air deposition allocations apply as annual limits.

Air deposition allocations for copper and zinc are based on existing loads; assuming no direct deposition reductions this consumes or partially consumes the available loading capacity. Copper and zinc load allocations for bed sediments are negative values, in Inner and Outer Harbor, indicating that copper and zinc loads must be reduced. (Each negative copper and zinc bed sediment allocation may alternatively be interpreted as zero, or not adversely affecting benthic organisms.) The amount of copper and zinc load reduction may be revised based on future monitoring results. For example, if future air deposition studies show lower existing air deposition copper and zinc loads or, if future copper and zinc sediment characterization studies show lower existing bed sediment copper and zinc loads, then copper and zinc allocations may be adjusted (presumably higher).

If, at some point in the future, a non-point source is considered subject to NPDES or WDR regulations, then the corresponding load allocation (numeric value) may switch to wasteload allocation columns.

6.4.3.3 Allocations for other sediment pollutants

Consolidated Slip and Fish Harbor are impaired for mercury in sediments and the average sediment concentration (1.1 mg/kg dry) is significantly higher than the target concentration (0.15 mg/kg dry). Consolidated Slip is also impaired for cadmium and chromium in sediments. Dominguez Channel Estuary is impaired for cadmium in sediments. While mercury is a compound that often bioaccumulates, there are no associated tissue listings for mercury in these waters, so it does not appear to be bioaccumulating to excessive levels and no fish tissue-supporting sediment target or allocation is assigned. See Table 6-11 for applicable WLAs.

6.4.4 Margin of Safety – Direct Effects

An implicit margin of safety exists in the final allocations. Implicit margin of safety is based on the selection of multiple numeric targets, including targets for water, fish tissue and sediment. Currently no explicit margin of safety is applied to these TMDLs to address impaired conditions within the sediments; however, an explicit margin of safety must be considered and may be applied if any chemical-specific sediment quality value is revised or updated contingent on future sediment quality studies.

Table 6-10. TMDLs and Allocations (kg/yr) – Metals and PAHs Compounds by waterbody/source. Sediment values are based on active sediment layer = 5cm depth.

Waterbody/source	*Total Cu*	*Total Pb*	*Total Zn*	*PAHs total*
DomCh Estuary - TMDL	84	115.4	370.5	9.94
WLAs				
MS4- LA County et al.	22.4	54.2	271.8	0.134
MS4- City of Long Beach	0.6	1.52	7.6	0.0038
MS4- CalTrans	0.384	0.93	4.7	0.0023
LAs				
Air deposition	4.6	0.031	33.2	0.051
Bed sediments	56.0	58.7	53.3	9.7
Current Load (Table 4-6)	327.6	457.9	1799.0	28.1
Overall reduction	74%	75%	79%	65%
Consolidated Slip - TMDL	12.1	16.6	53.3	1.43
WLAs				
MS4- LA County et al	2.73	3.63	28.7	0.0058
MS4 CalTrans	0.043	0.058	0.5	0.00009
LAs				
Air deposition	1.2	0.008	8.6	0.013
Bed sediments	8.13	12.9	15.57	1.41
Current Load (Table 4-6)	92.1	127.3	398.9	11.5
Overall reduction	***87%***	***87%***	***87%***	***88%***
Inner Harbor - TMDL	76.7	105.3	338.3	9.1
WLAs				
MS4- LA County et al	1.7	34.0	115.9	0.088

Waterbody/source	***Total Cu***	***Total Pb***	***Total Zn***	***PAHs total***
MS4 City of Long Beach	0.463	9.31	31.71	0.024
MS4 CalTrans	0.032	0.641	2.18	0.0017
LAs				
Air deposition ***Bed sediments***	97.6 (23.1)	0.67 60.7	710 (521.3)	1.08 7.88
Current Load (Table 4-6)	178.4	105.9	542.1	3.524
Overall reduction	57%	1%	38%	0%
Outer Harbor - TMDL	81.6	112.1	360.1	9.7
WLAs				
MS4- LA County et al	0.91	26.1	81.5	0.105
MS4 City of Long Beach	0.63	18.1	56.4	0.073
MS4 CalTrans	0.0018	0.052	0.162	0.00021
TIWRP = POTW (CTR & MGD)***	80.4	183.6	1845	1.056
LAs				
Air deposition ***Bed sediments***	17.9 (18.2)	0.9 (116)	108.1 (1731)	1.5 6.964
Current Load (Table 4-6)	119.0	66.7	403.4	0.626
Overall reduction	31%	0%	11%	0%
Fish Harbor - TMDL	1.04	1.43	4.59	0.123
WLAs				
MS4- LA County et al (POLA)	0.00017	0.54	1.62	0.007
MS4 CalTrans	0.0000005	0.00175	0.0053	0.000021
LAs				
Air deposition ***Bed sediments***	0.4 0.636	0.02 0.87	2.4 0.5	0.033 0.084
Current Load (Table 4-6)	1.43	0.60	4.2	0.003
Overall reduction	27%	0%	0%	0%
Cabrillo Marina -TMDL	1.32	1.81	5.8	0.156
WLAs				
MS4- LA County et al (POLA)	0.0196	0.289	0.74	0.00016
MS4 CalTrans	0.00019	0.0028	0.007	0.0000016
LAs				
Air deposition ***Bed sediments***	0.34 1.0	0.017 1.506	2.05 3.03	0.028 0.1285
Current Load (Table 4-6)	9.2	2.3	9.14	0.236
Overall reduction	86%	21%	36%	34%
San Pedro Bay - TMDL	648	890	2858	76.6
WLAs				

Waterbody/source	Total Cu	Total Pb	Total Zn	PAHs total
MS4- LA County et al	20.3	54.7	213.1	1.76
MS4 City of Long Beach	137.9	372.2	1449.7	12.0
MS4 CalTrans	0.88	2.39	9.29	0.077
MS4 Orange County**	*9.8*	*26.4*	*102.9*	*0.85*
LAs				
Air deposition ***Bed sediments***	36 442.9	1.8 432	219 865	2.9 59.0
Current Load (Table 4-6)	1251	1737	8167	3.63
Overall reduction	48%	49%	65%	0%
LA River Estuary - TMDL	735	1009	3242	86.9
WLAs				
LAR Estuary dischargers*	[Cu SQV]	[Pb SQV]	[Zn SQV]	[PAH SQV]
MS4- LA County et al	35.3	65.7	242.0	2.31
MS4 City of Long Beach	375.8	698.9	2572.7	24.56
MS4 CalTrans	5.1	9.5	34.8	0.333
LAs				
Air deposition ***Bed sediments***	6.7 311.8	0.046 235.0	48.9 343.0	0.075 59.6
Current Load (Table 4-6)	1612	2641	20096	8.72
Overall reduction	54%	62%	84%	0%

Note: Cu, Zn & PAHs air dep allocation = existing load, no reductions anticipated. MS4 and bed sediments are expected to reduce loads. Negative values for bed sediments indicates loads are expected to be reduced – the amount of reduction may be revised with additional monitoring results. See discussion in Section 6.4.3.2.
Individual MS4 permits based on land percentage within that individual watershed.
Pb air dep allocation = reduction based on new SCAQMD ambient air standard proposed November 2010.
*SQV values are currently set at ERLs as discussed in section 6.4.1.
**Orange County MS4 permit is issued by the Santa Ana Regional Board. The allocations included, here, for the Seal Beach nearshore area, are for TMDL calculation purposes only, and an allocation is not assigned in the Basin Plan Amendment.
***For TIWRP, the discharge volume at the time of permit modification or reissuance shall be used to calculate the mass-based effluent limitations consistent with the assumptions and requirements of these WLAs. Studies may be conducted to determine the portion of the discharged pollutants that is deposited on bedded sediment. The results of any such Executive Officer approved studies shall be evaluated at the TMDL reconsideration to modify these WLAs as appropriate.

Table 6-11. Final Concentration-Based Sediment WLAs for metals.

Concentration-based Sediment WLAs (mg/kg dry sediment)		
Cadmium	**Chromium**	**Mercury**
1.2	81	0.15

Mercury applies to both Consolidated Slip and Fish Harbor; Cd applies to Dominguez Estuary and Consolidated Slip; Cr applies to Consolidated Slip only.

6.4.5 Compliance with TMDL – Direct Effects

These TMDLs are designed to protect the benthic organisms in sediments of these waterbodies. Attainment of these Direct Effects TMDLs may be achieved any one of three different means:

- Meet final sediment allocations in Table 6-10, are met.
- The qualitative sediment condition of Unimpacted or Likely Unimpacted via the interpretation and integration of multiple lines of evidence as defined in the SQO Part 1 is met, with exception of Cr which is not included in SQO Part 1.
- Sediment numeric targets are met in bed sediments over a three-year averaging period.

Compliance with mass-based limits will be measured at designated discharge points. Compliance with concentration-based WLA for existing sediment shall be determined by pollutant concentrations in ambient sediment in each waterbody. The average ambient bulk sediment level within a waterbody at or below the sediment quality value is considered attainment with these TMDLs. Implementation Section 7.5 provides more details on compliance for these Direct Effects TMDLs.

Interim WLAs are based on the 95th percentile of sediment data collected from 1998-2006. The use of 95th percentile values to develop interim limits is consistent with NPDES permitting methodology. If the 95th percentile is equal to or lower than the numeric target, then the interim limit is equal to the final WLA. Interim and final WLAs will be included in MS4 permits in accordance with NPDES regulations and guidance (40 CFR 144.22(d)(1)(vii)(B); US EPA Memorandum "Revisions to the November 22, 2002 Memorandum 'Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Storm Water Sources and NPDES Permit Requirements Based on Those WLAs'" (November 12, 2010)).

The allocations were designed to achieve the following specific goals:

1 Reduction of sediment toxicity (as measured by both lethal and sub-lethal tests),
2 Improvement of benthic organism communities,
3 Minimization of the negative impact of sediment chemicals,
4 Reduction of pollutant loads.

Whereas certain chemicals are identified in these TMDLs as pollutants of concern, future site specific studies may yield results that point to other toxicants as causative agents. The SQO – Direct Effects Policy provides for sediment stressor ID studies, which may be pursued as long as stakeholders/responsible parties are concurrently pursuing activities supporting these TMDLs and the goals defined above. Demonstrable improvement in the SQO lines of evidence must be provided along with progress in stressor ID studies. Progress solely in stressor ID studies is not an acceptable substitute; thus sediment quality improvements must be concurrent.

6.5 Bioaccumulative/Organochlorine compounds TMDLs in Dominguez Channel Estuary and greater Harbor waters

6.5.1 TMDL – Bioaccumulatives[2]

[2] Total DDT, total PCBs, total chlordane, dieldrin, and toxaphene.

Fish tissue levels of certain bioaccumulative compounds are above desired numeric targets (OEHHA Fish Contaminant Goals). DDT and PCBs (total) apply to all estuarine and marine waters in greater Harbor area, including Cabrillo Beach Inner, Los Angeles River estuary and eastern San Pedro Bay. Chlordane TMDLs apply to Dominguez Channel estuary, Consolidated Slip, Fish Harbors, Los Angeles River estuary and eastern San Pedro Bay. Dieldrin applies to Dominguez Channel estuary and Consolidated Slip. Toxaphene applies to Consolidated Slip only.

To address these impairments, the TMDLs have been designed to reduce contaminated sediment levels which will result in lower corresponding pollutant levels in fish tissue. This approach has been utilized in other Los Angeles Region TMDLs. (Ballona Estuary TMDLs, 2007, Calleguas Creek Organochlorine Compounds TMDLs, 2005). Here, the active sediment layer approach to quantify the mass of allowable sediment-bound loads has been used. More specifically, the average mass of total sediment (fine and coarse particles) deposited in each waterbody annually based on average EFDC model output (using water years 2002-2005) was approximated. This value is the average annual (clean) sediment deposition rate per waterbody (Table 5-3). Then the more protective sediment quality value of either ERLs or biota-sediment accumulation factor (BSAF) was selected to determine desired sediment concentrations to attain specific fish tissue levels. The loading capacity of contaminated sediments within each waterbody was calculated from multiplying the sediment quality target by the average annual sediment deposition rate (Equation 3; See also Appendix III, Part 1).

TMDL = total sediment deposition rate x SQV or BSAF; (Eq. 3)

where sediment deposition rate = average annual mass of sediment deposited per waterbody

The loading capacities are presented in Table 6-12. This table also includes estimates of existing loads, which are consistent with the values presented in Table 4-6 and are based on the total deposition rate multiplied by the applicable existing sediment concentration and a conversion factor (the existing sediment concentrations are based on the average simulated sediment concentration from 2002-2005 in the top 5 cm of sediment).

The biota-sediment accumulation factor (BSAF) accounts for the sediment concentration, the associated food web and the desired fish tissue level to protect wildlife or human health consumption. The Basin Plan does not contain BSAFs, nor has State Board have approved any; however, the current development of Sediment Quality Plan,Part 2 – Indirect Effects is using a foodweb spreadsheet model to determine sediment concentrations (BSAFs) that correspond to specific fish tissue levels. As described above the more protective value between BSAF or ERL was used for determining TMDLs for bioaccumulative compounds. For chlordane and dieldrin, the ERL value is lower and more protective than BSAF values. The DDT sediment values are nearly equal (ERL = 1.58, BSAF = 1.9); the more stringent one was used for calculation. The PCBs sediment value associated with fish tissue is more stringent than the ERL sediment value for PCBs (3.2 vs. 22.7).

The active sediment layer is a generic term for the depth of contaminated sediments that benthic infauna consume or mix up via their physical movements. The sediment volume is approximately equal to the product of waterbody surface area and active sediment layer or depth. The issue of active sediment layer is contingent on the burrowing depth of benthic organisms within the bioaccumulation foodweb. Studies of benthic infauna in sediment show that 95% of benthic organisms exist within top 5 cm, yet some benthic organisms (such as ghost shrimp) burrow deeper down (~ 20 cm) and are also contained within the bioaccumulative foodweb. Here the active sediment layer is defined as 5 cm depth[3].

Chlordane, Dieldrin and Toxaphene TMDLs and allocations are concentration-based for all sources. Available monitoring data for these particular bioaccumulative pollutants does not provide sufficient detection levels to adequately estimate the current loads. Some detections of chlordane has been reported for a few waterbodies, however it is highly erratic and less frequent for Dieldrin and Toxaphene. To simplify, allocations for these pollutants within the impaired waters are concentration-based.

6.5.2 Allocations – Bioaccumulatives

6.5.2.1 Wasteload Allocations – Bioaccumulatives

Wasteload Allocations are provided by waterbody and source-type in Table 6-9 or 6-12. Mass-based WLAs were developed for TIWRP and other point sources that have provided discharge flow data. (Refineries that have provided discharge flow data along with monitoring results receive mass-based allocations, where as other refineries receive concentration-based allocations because no discharge flow data has been provided to Regional Board staff.) Stormwater sources, including Los Angeles County MS4 Permittees, City of Long Beach and Caltrans, have received individual mass-based allocations, by permitted land area. Mass-based WLAs are applied as annual limits. Individual mass-based WLAs for an individual MS4 Permittee will be calculated based on its share, on an area basis, of the mass based WLA or other approved approach available at the time final mass-based WLAs are in effect and incorporated into the permit.

As described above in Section 5.3, the relative difference between the baseline and "no upland sources" scenarios were interpreted as the waterbody-specific percent contribution of the contaminant to the bed sediments from the upstream watersheds. These percentages were applied to the TMDLs to determine the mass-based WLAs for the stormwater sources. These overall WLAs were further divided to individual, mass-based allocations by permit based on the percent area draining to each waterbody (see Appendix III, Part 1).

Concentration-based WLAs are identified for other sources, such as General Construction, General Industrial, Power Generating stations, minor permits and irregular dischargers into Dominguez Channel Estuary. Any future minor NPDES permits or enrollees under a general non-stormwater NPDES permit will also be subject to the concentration-based waste load allocations. Concentration-based limits are applied as daily limits.

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[3] The Sediment Quality Plan – Direct Effects describes 5 cm for monitoring purposes however it does not intend to constrain or limit the sediment depth of applicability (person. commun., C. Beegan, SWRCB). Sediment Quality Plan –Indirect Effects is still in development and has not indicated a definite number for active sediment layer.

The calculations for the allocations shown here included MS4 discharges from the Seal Beach area (Orange County) to San Pedro Bay. The Orange County MS4 is issued by the Santa Ana Regional Board. Allocations for the Orange County MS4 will not be assigned in the Basin Plan Amendment. If later monitoring demonstrates that the Seal Beach MS4 discharges do not support the goals of the TMDL, a revision to this TMDL in conjunction with the Sana Ana Region may be developed.

6.5.2.2 Load Allocations – Bioaccumulatives

Load Allocations are provided by waterbody and source-type in Table 6-12. Mass-based LAs are identified for non-point sources, existing sediments and direct air deposition. Direct air deposition allocations are included for total DDT based on atmospheric monitoring results collected close to Los Angeles/Long Beach Harbor at SCAQMD Wilmington station in 2006 (SCCWRP presentation, 2007). Chemical-specific air deposition values (DDT = 29 $ng/m^2/day$) were multiplied by the surface area of each waterbody to produce direct deposition allocations. Direct deposition allocations for PCBs are not included since air deposition (air to water) has been measured to be less than water to air fluxes. Chlordane and dieldrin were not measured in the 2006 air deposition study. Mass-based WLAs will be applied as annual limits.

Air deposition allocations for DDT are based on existing loads; with no reductions anticipated this consumes the available loading capacity. DDT load allocations for bed sediments are negative values, with exception of those for the Los Angeles River Estuary, indicating that DDT loads must be reduced. (Each negative DDT bed sediment allocation may alternatively be interpreted as zero, or interpreted as minimal bioaccumulation into the food web.) The amount of DDT load reduction may be revised based on future monitoring results. For example, if future air deposition studies show lower existing air deposition DDT loads or, if future DDT sediment characterization studies show lower existing bed sediment DDT loads, then DDT allocations may be adjusted.

Note: If, at some point in the future, a non-point source is considered subject to NPDES or WDR regulations, then the corresponding load allocation (numeric value) may switch to wasteload allocation columns.

Table 6-12. TMDLs and Allocations (g/yr) – Bioaccumulative Compounds by waterbody/source. Sediment values are based on active sediment layer = 5cm depth.

Waterbody/source	*DDT total*	*PCBs total*
DomCh Estuary – TMDL	3.90	7.90
WLAs		
MS4- LA County et al	0.250	0.207
MS4 City of Long Beach	0.007	0.006
MS4 CalTrans	0.004	0.004
LAs		
Air deposition	6.01	n/a
Bed sediments	(2.4)	7.7

Waterbody/source	***DDT total***	***PCBs total***
Current Load (Table 4-6)	54.0	57.5
Overall reduction	93%	86%
Consolidated Slip - TMDL	0.56	1.14
WLAs		
MS4- LA County et al	0.009	0.004
MS4 CalTrans	0.00014	0.00006
LAs		
Air deposition ***Bed sediments***	1.56 (1.00)	n/a 1.13
Current Load (Table 4-6)	49.0	83.9
Overall reduction	99%	99%
Inner Harbor - TMDL	3.56	7.22
WLAs		
MS4- LA County et al	0.051	0.059
MS4 City of Long Beach	0.014	0.016
MS4 CalTrans	0.0010	0.0011
LAs		
Air deposition ***Bed sediments***	129 (125)	n/a 7.14
Current Load (Table 4-6)	21.67	29.51
Overall reduction	84%	76%
Outer Harbor - TMDL	3.79	7.68
WLAs		
MS4- LA County et al	0.005	0.020
MS4 City of Long Beach	0.004	0.014
MS4 CalTrans	0.000010	0.00004
TIWRP = POTW ***(CTR & MGD***)***	12.7	0.37
LAs		
Air deposition ***Bed sediments***	173 (182)	n/a 7.28
Current Load (Table 4-6)	30.8	34.7
Overall reduction	88%	78%
Fish Harbor - TMDL	0.048	0.098
WLAs		
MS4- LA County et al	0.0003	0.0019
MS4 CalTrans	0.0000010	0.000006
LAs		
Air deposition	3.9	n/a

Waterbody/source	***DDT total***	***PCBs total***
Bed sediments	(3.85)	0.10
Current Load (Table 4-6)	0.168	0.075
Overall reduction	71%	0%
Cabrillo Marina -TMDL	0.061	0.124
WLAs		
MS4 LAC DPW	0.000028	0.000025
MS4 CalTrans	0.00000028	0.00000024
LAs		
Air deposition ***Bed sediments***	3.3 (3.22)	n/a 0.12
Current Load (Table 4-6)	1.66	1.06
Overall reduction	96%	88%
Inner Cabrillo Beach - TMDL	0.04	0.09
WLAs		
MS4- LA County et al	0.0001	0.0003
LAs		
Air deposition ***Bed sediments***	3.5 (3.5)	n/a 0.09
Current Load (Table 4-6)	0.98	0.31
Overall reduction	96%	72%
San Pedro Bay - TMDL	30.1	61.0
WLAs		
MS4- LA County et al	0.049	0.44
MS4 City of Long Beach	0.333	3.01
MS4 CalTrans	0.002	0.019
MS4 Orange County*	0.024	0.213
LAs		
Air deposition ***Bed sediments***	350 (320)	n/a 57.3
Current Load (Table 4-6)	205.2	110.7
Overall reduction	85%	45%
LA River Estuary - TMDL	34.1	69.2
WLAs		
MS4- LA County et al	0.100	0.324
MS4 City of Long Beach	1.067	3.441
MS4 CalTrans	0.014	0.047
LAR Estuary dischargers*	[DDT SQV]	[PCB SQV]
LAs		

Waterbody/source	*DDT total*	*PCBs total*
Air deposition	8.9	n/a
Bed sediments	24.09	65.3
Current Load (Table 4-6)	231.6	402.2
Overall reduction	85%	83%

Note: DDT air dep allocation = existing load, no reductions anticipated. Negative values for bed sediments indicate DDT loads are expected to be reduced-the amount of reduction may be revised with additional monitoring results. See discussion in Section 6.5.2.2.
Individual MS4's based on land percentage within that individual watershed.
PCBs air dep value n/a since monitoring results show flux from water to air.
*SQV values are currently set at the more protective of ERLs or BSAFs as discussed in section 6.5.1.
**Orange County MS4 is issued by the Santa Ana Regional Board. The allocations included, here, for the Seal Beach nearshore area, are for TMDL calculation purposes, only and an allocation is not assigned in Basin Plan Amendment.
***For TIWRP, the discharge volume at the time of permit modification or reissuance shall be used to calculate the mass-based effluent limitations consistent with the assumptions and requirements of these WLAs. Studies may be conducted to determine the portion of the discharged pollutants that is deposited on bedded sediment. The results of any such Executive Officer approved studies shall be evaluated at the TMDL reconsideration to modify these WLAs as appropriate.

Bed sediment concentration-based allocations are assigned for chlordane in Dominguez Channel Estuary, Consolidated Slip, Fish Harbor, Los Angeles River Estuary and Eastern San Pedro Bay. Bed sediment concentration-based allocations are also assigned for dieldrin in Dominguez Channel Estuary and Consolidated Slip. Bed sediment concentration allocations are also assigned for toxaphene in Consolidated Slip. The TMDLs and allocations are set at target sediment concentrations; see Table 6-13.

Table 6-13. Final Concentration-Based Sediment WLAs for other bioaccumulative compounds.

Concentration-based Sediment WLAs (µg/kg dry sediment)		
Chlordane	**Dieldrin**	**Toxaphene**
0.5	0.02	0.10

6.5.3 MOS – Bioaccumulatives

An implicit margin of safety exists in the final allocations to Dominguez Channel estuary and greater Harbor waters. The implicit margin of safety is based on the selection of multiple numeric targets, including targets for water, fish tissue and sediment among other conservative assumptions. An explicit margin of safety must be considered and may be applied if any chemical-specific sediment quality value is revised or updated contingent on future sediment quality studies. That is, there may be uncertainty associated with revised sediment quality values that may warrant including an explicit margin of safety.

6.5.4 Compliance with TMDL – Bioaccumulatives

Compliance with these bioaccumulative TMDLs may be achieved via any of four different means:

- Fish tissue targets are met in species resident to the TMDL waterbodies[4].
- Final sediment allocations, presented in Table 6-12, are met.
- Sediment numeric targets to protect fish tissue are met in bed sediment over a three-year averaging period.
- Demonstrate that the sediment quality objective protective of fish tissue is achieved per the Statewide Enclosed Bays and Estuaries Plan, as amended to address contaminants in finfish and wildlife.

Implementation Section 7.5 provides more details on compliance for these bioaccumulative TMDLs.

6.6 **Summary of TMDLs**

The freshwater TMDLs within Dominguez Channel are based on water column pollutants. The loading capacity is based on meeting CTR criteria for metals in freshwaters for both Dominguez Channel and Torrance Lateral. For downstream saline receiving waters – Dominguez Estuary and greater Harbor waters, the loading capacity for metals, organochlorine and PAH TMDLs are based on an estimate of annual pollutant loads that can be delivered to sediments and still meet the sediment targets. These TMDLs acknowledge that pollutant load reductions are required by watershed (stormwater) sources as well as existing bed sediments to attain the allowable loading capacity. Water column concentration-based allocations are also included for receiving waters; these allocations are equal to existing CTR criteria for protection of aquatic life or human health. Reductions in air deposition are expected only for Pb, otherwise load allocations for the other pollutants are equal to current estimates of direct deposition. As a general rule of thumb, reductions necessary to meet target Cu levels will also attain Pb, Zn and PAHs allocations. Necessary copper reductions range from 25 – 87%. Likewise, necessary reductions to meet DDT or PCB levels, up to 99%, will also attain the other bioaccumulative compound allocations.

Direct Effects targets are presented in flexible manner; that is, future stressor identification site-specific studies may yield different sediment quality values that correlate with desired sediment toxicity and benthic community goals. These TMDLs will need to be revisited and modified if toxic pollutants outside the scope of these TMDLs are identified as causative agents. Bioaccumulative compound TMDLs are designed to achieve fish tissue targets through contaminated sediment reductions and meeting saltwater column criteria.

6.7 **Critical Condition**

TMDLs must include consideration of critical conditions and seasonal factors. Pesticides, PCBs, PAHs, and metals are a concern in Dominguez Channel Estuary and Greater Harbor waters due to long-term loading and bioaccumulation effects. Wet weather events are likely to transport sediments and therefore produce extensive sediment redistribution into the harbors. In concert with aqueous pollutant transfer and contaminant diffusion properties the CTR-based water column targets are protective of this condition. This would be considered the critical condition

[4] A site-specific study to determine resident species shall be submitted to the Executive Officer for approval.

for loading. The effects of pollutants in sediment and fish tissue are manifested over long time periods. As an example, the half-life of PCBs in some sediment is estimated to be 20 years, whereas the PCBs half-life in fish is closer to 100 days, according to Gobas & Arnot (2010) and references therein. For this reason, short term variations (e.g., annual wet and dry seasons) in pollutant loadings are not likely to cause significant variations in impairment in fish tissue or sediments. In addition, no correlation with flow or seasonality (wet vs. dry season) was found to exist in sediment or tissue data. Given that allocations for this TMDL are expressed in terms of pesticides, PCBs, PAHs, and metals levels in sediment, a critical condition is not identified based upon flow or seasonality.

7 IMPLEMENTATION

California Water Code section 13360 precludes the Regional Board from specifying the method of compliance with waste discharge requirements; however California Water Code section 13242 requires that the Basin Plan include an implementation plan to describe the nature of actions to be taken to achieve water quality objectives and a time schedule for action. This section describes the proposed implementation plan to meet numeric targets for toxic pollutants in the Dominguez Channel and greater Los Angeles and Long Beach Harbor Waters.

Compliance with the TMDL for metals and PAHs is based on achieving the load and waste load allocations and/or demonstrating attainment of the sediment quality objectives (SQO Part 1) as multiple lines of evidence. Compliance with the TMDLs for bioaccumulative compounds shall be based on achieving the assigned loads and waste load allocations or, alternatively, by meeting fish tissue targets. Compliance will require the elimination of toxic pollutants being loaded into Dominguez Channel and the harbors, and clean up of contaminated sediments lying at the bottom of greater Los Angeles and Long Beach Harbors. Dischargers and responsible parties may implement structural and or non-structural BMPs and work collaboratively to achieve the numeric targets and allocations.

As discussed in the source analysis and allocations section of this TMDL, in most areas of the harbors, contaminant concentrations in sediment are above numeric targets for sediment. WLAs and LAs may not be attainable without reducing loadings from storm water discharges, near-shore and on water discharges, and river influences, and removal of contaminated sediment within hotspots of the Dominguez Channel Estuary and the Los Angeles and Long Beach Harbors. SWRCB (1999b, 2003) has prioritized hotspots in these waters, including: Consolidated Slip, and areas of Inner and Outer Harbors. This implementation section includes discussion of implementation actions to address these TMDLs. The implementation section describes the following implementation processes.

1. Implement (and evaluate effectiveness of) best management practices (BMPs) and source control in conjunction with the remediation actions to remove contaminated sediment as necessary;
2. Evaluate effectiveness of controlling sediment loading from Los Angeles River, San Gabriel River, and Machado Lake through implementation of effective TMDLs.
3. Conduct monitoring to evaluate compliance with targets during implementation and after

implementation actions are in place.
4. Determine if reductions in loadings from controllable sources from Los Angeles River and San Gabriel River will be required and addressed through revision of the TMDL.
5. Re-evaluate the WLAs and LAs, if necessary.

This implementation section also includes a schedule for conducting the activities listed above, a discussion of monitoring activities, and consideration of an economic analysis.

7.1 **Regulation by the Regional Board**

The Porter-Cologne Water Quality Control Act provides that "All discharges of waste into the waters of the State are privileges, not rights." Furthermore, all discharges are subject to regulation under the Porter-Cologne Act including both point and nonpoint source discharges.[5] In obligating the State Board and Regional Boards to address all discharges of waste that can affect water quality, the legislature provided the State Board and Regional Boards with authority in the form of administrative tools (waste discharge requirements (WDRs), waivers of WDRs, and Basin Plan waste discharge prohibitions) to address ongoing and proposed waste discharges. Hence, all current and proposed discharges must be regulated under WDRs, waivers of WDRs, a prohibition, or some combination of these or other administrative tools (e.g. Statewide Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program). Since the USEPA delegated responsibility to the State and Regional Boards for implementation of the National Pollutant Discharge Elimination System (NPDES) program, WDRs for discharges to surface waters also serve as NPDES permits

The regulatory mechanisms to implement the TMDL include, but are not limited to, general NPDES permits, individual NPDES permits, MS4 Permits covering jurisdictions and flood control districts within these waters, the Statewide Industrial Storm Water General Permit, the Statewide Construction Activity Storm Water General Permit, the Statewide Stormwater Permit for Caltrans Activities, and the authority contained in Sections 13263, 13267 and 13383 of the Cal. Water Code. For each discharger assigned a WLA, the appropriate Regional Board Order shall be reopened or amended when the order is reissued, in accordance with applicable laws, to incorporate the applicable WLA(s) as a permit requirement consistent with federal regulation and related guidance (40 CFR 144.22(d)(1)(vii)(B); US EPA Memorandum "Revisions to the November 22, 2002 Memorandum 'Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Storm Water Sources and NPDES Permit Requirements Based on Those WLAs'" (November 12, 2010)).

The MS4 Permits, Caltrans Storm Water Permit, general NPDES permits, general industrial storm water permits, general construction storm water permits, and minor NPDES permits shall be allowed a phased implementation schedule to achieve the waste load allocations. A phased implementation approach, using a combination of non-structural and structural BMPs could be

[5] See CWC sections 13260 and 13376.

used to achieve compliance with the waste load allocations. The administrative record and the fact sheets for the permits must provide reasonable assurance that the BMPs selected will be sufficient to implement the WLAs in the TMDL.

MS4 permittees, Caltrans, and other NPDES dischargers will be required to meet the WLAs at the designated compliance locations as defined in the TMDL monitoring plan. To achieve the necessary reductions to meet the allowable waste load allocations, permittees could balance short-term capital investments directed to addressing this and other TMDLs in the Dominguez Channel watershed and greater Los Angeles and Long Beach Harbor waters with long-term planning activities for stormwater management in the region as a whole. It should be emphasized that the potential implementation strategies discussed below may contribute to the implementation of other TMDL for Dominguez Channel watershed and greater Los Angeles and Long Beach Harbor waters. Likewise, implementation of other TMDLs in the watershed may contribute to the implementation of this TMDL.

Implementation by assigned responsible parties is required in three waterbody areas:

1. Dominguez Channel, Torrance Lateral, and Dominguez Channel Estuary
2. Greater Los Angeles and Long Beach Harbor waters (including Consolidated Slip)
3. Los Angeles River and San Gabriel River

The sediment targets are not intended to be used as ~~necessarily~~ 'clean-up standards' for navigational, capital or maintenance or dredging or capping activities; rather they are long-term sediment concentrations that should be attained after reduction of external loads, targeted actions addressing internal reservoirs of contaminants, and environmental decay of contaminants in sediment. Sediment remediation or dredging activities are reviewed in different regulatory processes (e.g., CWA Section 404; Marine Protection, Research, and Sanctuaries Act; Rivers and Harbors Act) and often take into account numerous factors, including yet not limited to: depth and volume of dredge materials, cost, disposal options, navigation and potential redistribution.

7.2 Responsible Parties and Potential Implementation Strategy

TMDL implementation will be carried out by responsible parties including, but not limited to:

1. Dominguez Channel Responsible Parties
- Dominguez Channel, Torrance Lateral, and Dominguez Channel Estuary MS4 Permittees
  - Los Angeles County
  - Los Angeles County Flood Control District
  - Caltrans
  - City of Carson
  - City of Compton
  - City of El Segundo
  - City of Gardena
  - City of Hawthorne
  - City of Inglewood
  - City of Lawndale
  - ~~City of Lomita~~

- City of Long Beach
- City of Los Angeles
- City of Manhattan Beach
- City of Redondo Beach
- City of Torrance

- Individual and General Stormwater Permit Enrollees
- Other Non-stormwater Permittees
- Dominguez Channel Estuary Subgroup for bed sediment and fish:
  - Los Angeles County
  - Los Angeles County Flood Control District
  - Caltrans
  - City of Carson
  - City of Compton
  - City of Gardena
  - City of Los Angeles
  - City of Long Beach
  - City of Torrance

2. Greater Los Angeles and Long Beach Harbors Waters Responsible Parties

- Greater Los Angeles and Long Beach Harbor Waters MS4 Permittees
  - Los Angeles County
  - Los Angeles County Flood Control District
  - Caltrans
  - City of Bellflower
  - City of Lakewood
  - City of Long Beach
  - City of Los Angeles
  - City of Paramount
  - City of Signal Hill
  - City of Rolling Hills
  - City of Rolling Hills Estates
  - City of Rancho Palos Verdes
- City of Los Angeles (including the Port of Los Angeles)
- City of Long Beach (including the Port of Long Beach)
- State Lands Commission
- Individual and General Stormwater Permit Enrollees
- Other Non-stormwater Permittees, including City of Los Angeles (TIWRP)
- <u>Los Angeles River Estuary Subgroup for bed sediment and fish:</u>
  - Los Angeles County
  - Los Angeles County Flood Control District
  - City of Long Beach
  - City of Los Angeles
  - City of Signal Hill
  - Caltrans
- Consolidated Slip Responsible Parties subgroup
  - Consolidated Slip MS4 Permittees[6]

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[6] US EPA is the regulatory oversight agency pursuant to CERCLA with respect to the Superfund site within the Dominguez Channel Estuary and Consolidated Slip subarea, but is not identified as a Responsible Party under the TMDL. As the regulatory oversight agency, US EPA is

- Los Angeles County
- Los Angeles County Flood Control District
- City of Los Angeles

3. Los Angeles River and San Gabriel River Watershed TMDLs Responsible Parties
   - Los Angeles River and San Gabriel River metals TMDLs responsible parties

7.3 Phased Implementation by Waterbody Area

The implementation actions described in this implementation section represent a range of activities that could be conducted to achieve final allocations. The specific actions taken to achieve the final allocations may vary to some degree from the elements presented here based on this evaluation and future analyses of the most cost effective and beneficial mechanisms for achieving the final allocations. To the extent possible, all ideas being considered as mechanisms for implementing the TMDL have been included in this implementation plan. Future considerations may result in other actions being implemented rather than the options presented.

Reductions to be achieved by each BMP will be documented and sufficient monitoring will be put in place to verify that the required reductions are achieved. When permits for responsible parties are revised, the permits should provide mechanisms to make adjustments to the required BMPs as necessary to ensure their adequate performance. If proposed structural and non-structural BMPs adequately implement the waste load allocations then additional controls will not be necessary. Alternatively, if the proposed structural and non-structural BMPs selected prove to be inadequate then additional structural and non-structural BMPs or additional controls may be required.

Implementation actions to achieve WLA and LA will be implemented via an iterative process, whereby information from each phase being used to inform the implementation of the next phase. The project will be adjusted as necessary based on information gained during each implementation phase.

Phase I Implementation includes elements to reduce the amount of sediment transport from point sources that directly or indirectly discharge to Dominguez Channel and the harbors. An important component of Phase I will be to secure the relationships and agreements between cooperating parties and to develop a detailed scope of work with priorities.

Phase I includes the following elements:

- Incorporate interim limits into WDRs and NPDES permits
- Implementation of Structural and Non-Structural BMPs throughout Dominguez Watershed and nearshore areas of greater LA/LB Harbor waters
- Implementation of effective TMDLs in Los Angeles River, San Gabriel River, and Machado Lake

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responsible for choosing an appropriate remedy for these sites. Furthermore, under CERCLA, US EPA is responsible for assuring that the CERCLA PRPs clean up the site in compliance with CERCLA and applicable or relevant and appropriate requirements (ARARs) (CERCLA section 121(d))

- o Develop and initiate monitoring program

Phase II will include the implementation of site-specific cleanup actions for areas identified as high-priority in Phase I according to prioritization assessment completed by responsible parties and approved by the Regional Board in Phase I. Phase II will also include implementation of additional BMPs and site remedial actions upstream and in the Los Angeles and Long Beach Harbors, as determined to be effective based on the success of upstream source control, TMDL monitoring data evaluations, and WRAP and Sediment Management Plan-directed activities implemented during Phase I. Responsible parties will develop, prioritize, and implement Phase II elements based on data from the TMDL monitoring program and other information from special studies. Possible actions include additional structural and non-structural BMPs throughout the watershed by municipalities, counties, Caltrans, and others. It is expected that Phase II will include the majority of any necessary sediment removal activities.

Phase II should be designed by responsible parties to achieve all allocations by the end of Phase II. Phase III is provided to allow for any necessary follow-on activities due to the scope and complexity of the TMDL goals.

Phase III will includes implementation of secondary and addition remediation actions as necessary to be incompliance with final load allocations by end of implementation period.

7.3.1 Dominguez Channel, Torrance Lateral, and Dominguez Channel Estuary

Responsible parties can implement a variety of implementation strategies to meet the required WLAs and LAs, such as non-structural and structural BMPs, diversion and treatment to reduce sediment transport from the watershed to Dominguez Channel and Greater Harbor waters, and sediment removal activities.

Nonpoint source elements include legacy sediments and air deposition across Dominguez Channel and Harbor waters. The sediment load allocations for the contaminated bed sediments are assigned to the Cities of Long Beach and Los Angeles and the State Lands Commission, which have responsibility for remediation of the contaminated sediments.

- Phase I

  The purpose of the Phase I implementation is to reduce the amount of sediment transport from point sources that directly or indirectly discharge to Dominguez Channel and the Harbor waters. Phase I should include watershed-wide implementation actions. Important components of Phase I should be to secure the relationships and agreements between cooperating parties and to develop a detailed scope of work with priorities.

  Potential watershed-wide non-structural BMPs include more frequent and appropriately timed storm drain catch basin cleaning, improved street cleaning by upgrading to vacuum type sweepers, and educating residents and industries about good housekeeping practices. Structural BMPs may include the placement of stormwater treatment devices designed to reduce sediment loading, such as infiltration trenches, vegetated swales, and/or filter strips at critical points in the watershed. Structural BMPs may also include diversion and treatment facilities to divert runoff directly, or provide capture and storage of runoff and then diversion to a location for treatment. Treatment options to reduce sediment could include sand or media filters.

The Los Angeles County Flood Control District (District) owns and operates Dominguez Channel; therefore, the District and the cities that discharge to Dominguez Channel shall each be responsible for conducting implementation actions to address contaminated sediments in Dominguez Channel. Responsible parties in Dominguez Channel shall develop a Sediment Management Plan to address contaminated sediment in Dominguez Channel and Dominguez Channel Estuary.

Sediment conditions shall be evaluated through the Sediment Quality Objective (SQO) process detailed in the SQO Part 1. If chemicals within sediments are contributing to an impaired benthic community or toxicity, then causative agent(s) shall be determined using SQO recommended procedures, SQO Part 1 (VII.F.). Impacted sediments shall be included in the list of sites to be managed.

- Phase II

Phase II should include the implementation of additional BMPs and site remedial actions, as determined to be effective based on the success of upstream source control, evaluation of TMDL monitoring data collected during Phase I, and targeted source reduction activities as identified in Phase I. Regional responsible parties should develop, prioritize, and implement Phase II elements based on data from the TMDL monitoring program and other available information from special studies. Possible actions include implementation of additional structural and non-structural BMPs throughout the watershed by municipalities, LA County, Caltrans, and others. Phase II should include the implementation of site-specific cleanup actions for areas identified as high priority in the Dominguez Channel Estuary and in accordance with the Sediment Management Plan.

- As management actions are planned for a contaminated site, site-specific cleanup criteria should be determined following protocols that are consistent with state and national guidance. The site improvements should be confirmed through a sediment monitoring program.
- There are two Superfund sites located within Dominguez Channel Watershed: the Montrose Superfund Site and the Del Amo Superfund Site. The US EPA has not yet reached a final remedial decision with respect to certain of the Montrose Superfund Site Operable Units (OUs) that remain contaminated with DDT, including the on- and near-property soils (OU1), the current storm water pathway (OU2), and the "Neighborhood Areas" (OU4 and OU6). The TMDL, its waste load and load allocations, and other regulatory provisions of this TMDL may be applicable or relevant and appropriate requirements (ARARs) as set forth in Section 121(d) of the Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C. §§ 9621(d)) for those OUs. The TMDL for DDT should be taken into account in the course of the remedial decision-making process. The City of Los Angeles and/or Los Angeles County, should they decide to take action that impacts

one of the OUs, shall consult with US EPA's Superfund Division in advance of such action.

Detection of DDT compounds in water or sediment samples collected within Torrance Lateral shall trigger additional monitoring, by parties to be determined by the Executive Officer, in coordination with EPA, to evaluate potential contribution from contaminated soils related to upstream Montrose operable units discharging via the Kenwood storm drain. Upon reconsideration of the TMDL, all monitoring results for DDT compounds collected by responsible parties or other entities shall be considered as part of source analysis and to determine potential future allocation(s) that may be necessary to minimize impacts to downstream waters and restore beneficial uses in TMDL waterbodies.

- Phase III

Phase III should include implementation of secondary and additional remediation actions as necessary to be in compliance with final allocations by the end of the implementation period. TMDLs to allocate additional contaminant loads between dischargers in the Dominguez Channel, Torrance Lateral and Dominguez Channel Estuary subwatersheds may also be developed, if necessary.

7.3.2 Greater Los Angeles and Long Beach Harbor Waters (including Consolidated Slip)

Responsible parties can implement a variety of implementation strategies to meet the required WLAs, such as non-structural and structural BMPs, and/or diversion and treatment to reduce sediment transport from the nearshore watershed to the Greater Harbor waters.

- Phase I

The purpose of Phase I implementation is to reduce the amount of sediment transport from point sources that directly or indirectly discharge to the Harbor waters. Phase I should include actions to be implemented throughout the nearshore watershed and specific implementation actions at the Ports. Important components of Phase I should be to secure the relationships and agreements between cooperating parties and to develop a detailed scope of work with priorities.

Potential watershed-wide non-structural BMPs include more frequent and appropriately timed storm drain catch basin cleaning, improved street cleaning by upgrading to vacuum type sweepers, and educating residents and industries about good housekeeping practices. Structural BMPs may include the placement of stormwater treatment devices designed to reduce sediment loading, such as infiltration trenches, vegetated swales, and/or filter strips at critical points in the watershed. Structural BMPs may also include diversion and treatment facilities to divert runoff directly, or provide capture and storage of runoff and then diversion to a location for treatment. Treatment options to reduce sediment could include sand or media filters.

Implementation actions at the Ports should be developed to address different sources that contribute loading to the Harbors such as Port-wide activities and associated control measures for water and sediment, control measures to reduce the discharges from various land uses in the Harbors, nearshore discharges, and on-water discharges. The implementation actions described in the *Water Resources Action Plan* (WRAP) adopted by the Port of Los Angeles and the Port of Long Beach represent a range of activities that could be conducted to control discharges of polluted stormwater and contaminated sediments to the Harbors.

To meet necessary reductions in sediment bed loads, a Sediment Management Plan shall be developed by the dischargers assigned a sediment bed load LA, the Cities of Los Angeles and Long Beach and the State Lands Commission. Phase I implementation elements for the improvement of the Harbors' sediment quality should be conducted through the continuation of source reduction, source control, and sediment management. Below are proposed implementations actions that may be implemented in Phase I or Phase II to improve sediment quality at the ports:

- *Removal of Contaminated Sediment within Areas of Known Concern*. Planned removal programs are in place for IR Site 7 (former Navy facility in the Port of Long Beach) and Berth 240 (former Southwest Marine facility in the Port of Los Angeles). Contaminated sediment will be removed by Port of Long Beach and Port of Los Angeles.

- *Sediment Management Plan, Prioritization Assessment for Contaminated Sediment Management.* Sediment will be evaluated through the Sediment Quality Objective (SQO) process detailed in the Enclosed Bays and Estuaries Plan (i.e., SQO Part 1 as amended). If chemicals within sediments are contributing to an impaired benthic community or toxicity or fish tissue, then causative agent(s) will be determined using SQO recommended procedures, including SQO Part I (VII. F.). Impacted sediments will be included in the list of sites to be managed. The sites to be managed by the responsible parties will be prioritized for management and coupled with other planned projects when feasible. Prioritized sites shall include known hot spots, including but not limited to Consolidated Slip and Fish Harbor. For these prioritized sites, the sediment management plan shall include concrete actions and milestones, including numeric estimate of load reductions or removal, to remediate the priority areas and shall demonstrate the atcitons to address prioritized hot spots will be initiated and completed as early as possible during the 20-year TMDL implementation period. This process will prioritize management efforts on sites that have the greatest impact to the overall health of the benthic community and fish tissue and allow sites with lower risks to be addressed in later phases when opportunities can be coupled to capital projects. As management actions are planned for a contaminated site, site-specific cleanup criteria will be determined following established protocols that are consistent with state and national policy and guidance. The site will then be managed and the improvements confirmed through a sediment monitoring program. A flow chart showing a potential sediment monitoring and priority assessment program is included in Figure 7-1.

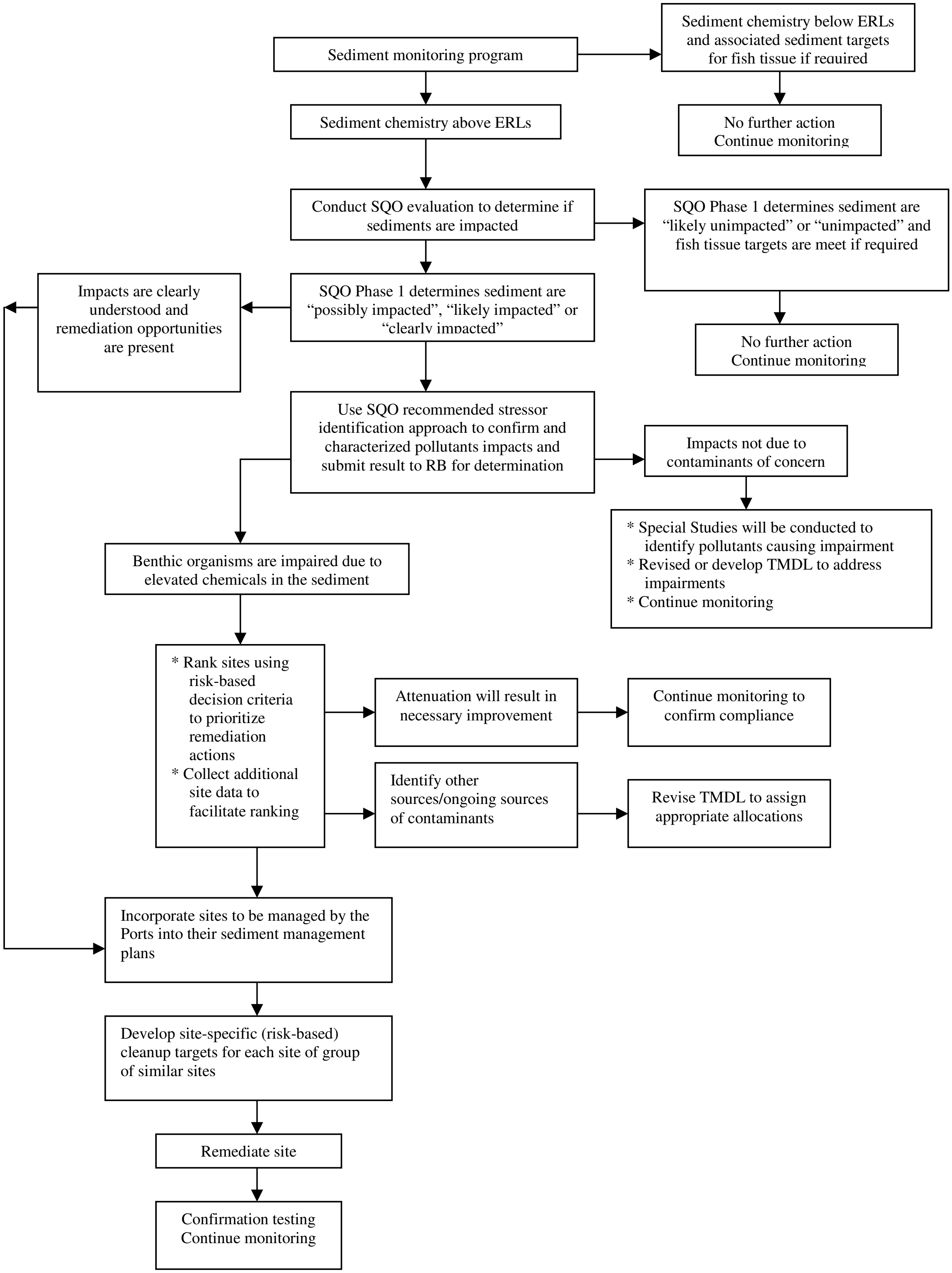

Figure 7-1. Proposed Sediment Monitoring Program and Priority Assessment Flowchart.

- *Superfund Sites.* Two Superfund sites are located in Dominguez Channel Watershed: the Montrose Superfund Site (DDT) and the Del Amo Superfund Site (benzene). Montrose Superfund Site includes multiple operable units (OUs), which are identified as investigation areas potentially containing site-related contamination. These Superfund Sites are located in a community known as Harbor Gateway, which is situated mostly in the City of Los Angeles and partially in unincorporated land in Los Angeles County. Harbor Gateway lies within the Kenwood Drain subwatershed, which discharges stormwater into Torrance Lateral which flows downstream into saline waters of Dominguez Channel Estuary and Consolidated Slip. The Torrance Lateral, Dominguez Channel Estuary and Consolidated Slip (OU2) contain sediments contaminated with multiple pollutants including DDT (potentially from various sources). The US Environmental Protection Agency (US EPA) has been working with other government agencies and local agencies including the City of Los Angeles and Los Angeles County to ensure the protection of both the environment and public health in the areas surrounding these Superfund sites.

  The US EPA has not yet reached a final remedial decision with respect to certain of the Montrose Superfund Site Operable Units (OUs) that remain contaminated with DDT, including the on- and near-property soils (OU1), the current storm water pathway (OU2), and the "Neighborhood Areas" (OU4 and OU6). The TMDL, its waste load and load allocations, and other regulatory provisions of this TMDL may be applicable or relevant and appropriate requirements (ARARs) as set forth in Section 121(d) of the Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C. §§ 9621(d)) for those OUs. The TMDL for DDT should be taken into account in the course of the remedial decision-making process.

  In August 1999, USEPA and the State of California, which includes the Regional Board, entered into a consent decree concerning the Montrose Superfund site in a case entitled *United States of America and State of California v. Montrose Chemical Corporation of California, et al*., United States District Court Central District of California, Case No. CV 90-3122-AAH (JRx)."

  Also, US EPA Superfund does not need to make a remedial decision prior to individual or collective action (by City of LA and/or County of LA) to clean up sediments within the OU2 stormwater pathway. The City of Los Angeles and/or Los Angeles County, should they decide to take action that impacts one of the OUs, shall consult with US EPA's Superfund Division in advance of such action. The goal of consultation is to ensure the proposed sediment cleanup will not aggravate the situation or further interfere with the site. The Montrose surrounding area is shown in Figure 7-2.

  Detection of DDT compounds in water or sediment samples collected within Torrance Lateral shall trigger additional monitoring, by parties to be determined by the Executive Officer, in coordination with EPA, to evaluate potential contribution from contaminated soils related to upstream Montrose operable units discharging via the Kenwood storm drain. Upon reconsideration of the TMDL, all monitoring results for DDT compounds collected by responsible parties or other entities shall be considered as part of source analysis and to determine potential future allocation(s) that may be necessary to minimize impacts to downstream waters and restore beneficial uses in TMDL waterbodies.

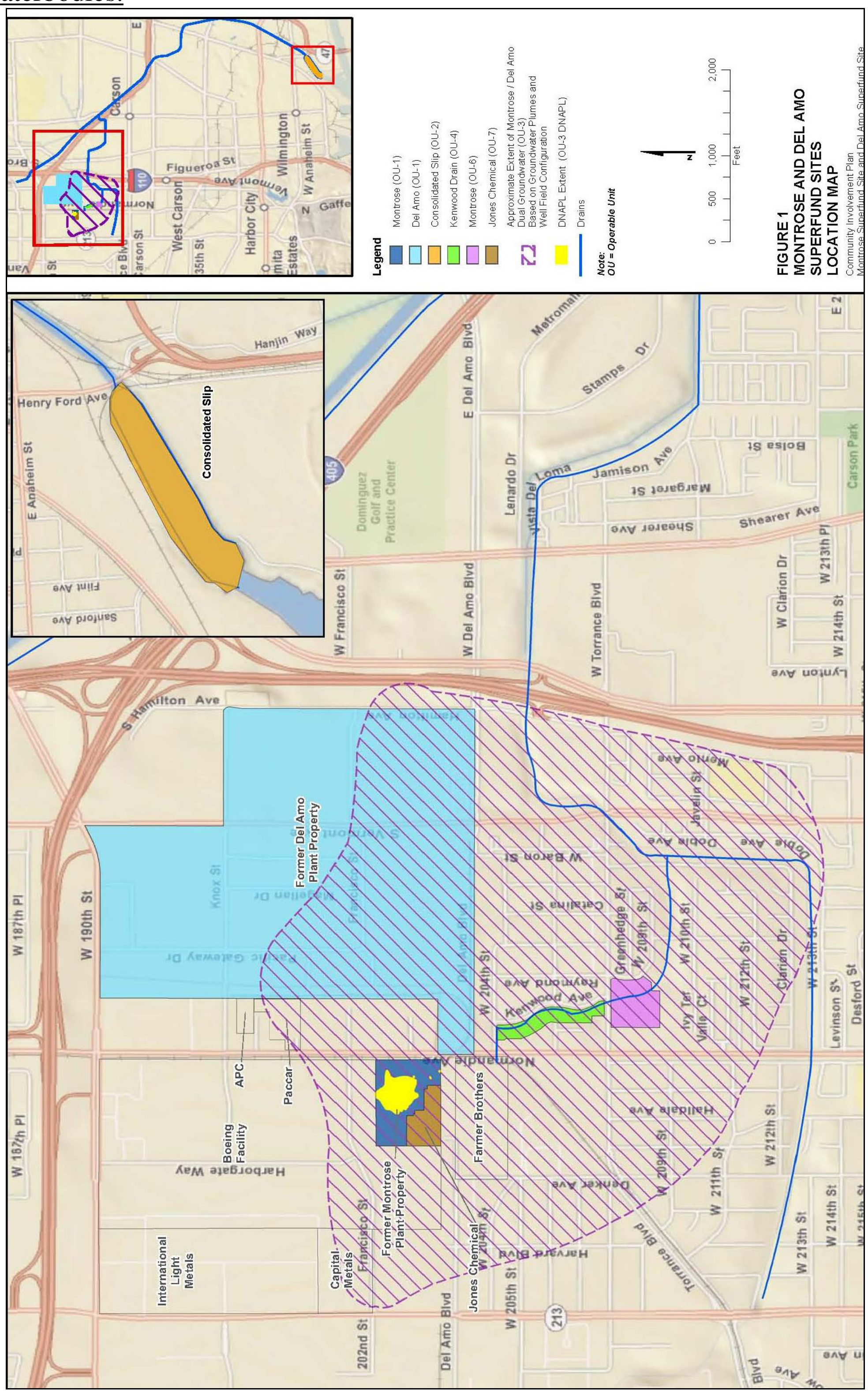

Figure 7-2 Montrose Superfund Site and the Del Amo Superfund Site Area Map

- Phase II

Phase II should include the implementation of additional BMPs and site remedial actions including sediment removal in the nearshore watershed and in the Harbors, as determined to be effective based on the success of upstream source control, TMDL monitoring data evaluations, WRAP activities implemented during Phase I, and targeted source reduction activities as identified in Phase I. Responsible parties should develop, prioritize, and implement Phase II elements based on data from the TMDL monitoring program and other available information from special studies. Possible actions include additional structural and non-structural BMPs throughout the watershed.

Phase II should include the implementation of site-specific cleanup actions for areas identified as high priority in the Harbor waters and per the Sediment Management Plan.

- Phase III

The purpose of Phase III is to implement secondary and additional remediation actions as necessary to be in compliance with final waste load and load allocations by the end of the TMDL implementation period.

7.3.3 Los Angeles River and San Gabriel River

Responsible parties in these watersheds are implementing other TMDLs, which will directly or indirectly support the goals of this TMDL.

- Phase I

Responsible parties for each watershed shall submit a Report of Implementation to describe how current activities support the downstream TMDL.

- Phases II and III

Implementation actions may be developed and required in Phases II and III as necessary to meet the targets in the Greater Harbor waters. TMDLs to allocate contaminant loads between dischargers in the Los Angeles and San Gabriel Rivers watersheds may also be developed, if necessary.

7.4 **Special Studies and Reconsiderations**

Special studies may be used to refine source assessments, assign appropriate allocation based on updated information from the results of implementation actions and monitoring program, and help focus implementation efforts. Regional Board staff also recognize that the TMDL targets, allocations, and proposed implementation actions to reach those targets and allocations will change due to changes in policies anticipated SQO Part II. In addition, improved air deposition studies may be used to refine air deposition allocations. The results of special studies submitted to the Regional Board's EO will be considered during subsequent TMDL reopeners. In addition, it may be necessary to make adjustments to the TMDL to be responsive to new State policies including, but not limited to, SQO Part II; toxicity policy; possible changes to air quality criteria and other regulations affecting air quality.

If appropriate, the TMDL will be reconsidered by the Regional Board at the end of Phase I to consider completed special studies or policy changes. As allocation-specific data are collected, interim targets for the end of Phase II may be identified.

Below is list of potential optional special studies that may be conducted by responsible parties:

- **Optional Special Study - Stressor Identification Studies**
  Outlined in the Phase I SQOs is a stressor identification (stressor ID) process that is intended to be completed in order to identify the specific constituents causing sediment quality impairments. Given the recent adoption of the Phase I SQOs, stressor IDs have not been completed within the waterbodies addressed by the Harbors TMDLs. As a stressor ID process has not been completed, no individual constituent has been identified as directly causing or contributing to impairment in a manner consistent with the State's sediment quality objectives.

  A stressor ID study consists of the development and implementation of a work plan to: (1) confirm and characterize pollutant-related impacts; (2) identify specific pollutants; and (3) identify pollutant sources. The stressor ID process outlined in Section VII.F of the Phase I SQOs and the NPDES receiving water and effluent limit process outlined in Section VI.B of the Phase I SQOs provide the scientific basis and an approved regulatory process for identifying and addressing specific constituents causing sediment quality impairments. Work plans consistent with the Phase I SQOs stressor ID study approach must be submitted for Regional Board EO approval. The results of this special studies will submitted to the Regional Board and maybe used to revised the targets and allocation if determine by the Regional Board to be sufficient and appropriate.

- **Optional Special Study – Further characterization of direct air deposition loadings for heavy metals and legacy pesticides**
  Allocations of certain pollutants in certain waterbodies are confounded by preliminary estimates of pollutant loading via direct deposition onto waterbody surface area. Additional monitoring of these pollutants at air sampling sites more closely resembling the respective waterbody will help characterize these loadings. Limited data exist for dry deposition so this could be extended over longer timeframes. Measurements of wet deposition for each pollutant may also be appropriate to estimate air deposition more completely. Results could provide data to reconsider pollutant-specific allocations in this TMDL.

  Detection of DDT compounds in water or sediment samples collected within Torrance Lateral shall trigger additional monitoring, by parties to be determined by the Executive Officer, in coordination with EPA, to evaluate potential contribution from contaminated soils related to upstream Montrose operable units discharging via the Kenwood storm drain. Upon reconsideration of the TMDL, all monitoring results for DDT compounds collected by responsible parties or other entities shall be considered as part of source analysis and to determine potential future allocation(s) that may be necessary to minimize impacts to downstream waters and restore beneficial uses in TMDL waterbodies.

- **Optional Special Study - Evaluation of Los Angeles River and San Gabriel River Loadings to the Harbors**
  This special study will evaluate whether or not the loading from Los Angeles River and San Gabriel have the potential to re-contaminate the Harbors and the results from this study will be used to determine if reductions in loadings from controllable sources from Los Angeles River and San Gabriel River will be required and addressed through revision of the TMDL.

- **Optional Special Study - Sediment and Fish Tissue Linkage Studies**
  A relationship between sediment pollutant concentrations, depth of sediment contamination and fish tissue pollutant concentrations exists; however, the quantification of that relationship (i.e., what concentrations in sediment lead to levels of concern in fish) is not well understood in the waterbodies addressed in the Harbors TMDLs. Performing special studies to develop a more comprehensive understanding of the link between sediment constituent concentrations and fish constituent concentrations may affect allocations associated with bioaccumulative pollutants addressed in the TMDL. Additionally, determining the range and habitat of specific fish populations within the receiving waterbodies can help guide implementation actions and the attainment of targets. That is, if a specific fish populations' range and habitats are known, then the fish tissue quality can be compared to the sediment quality for areas within the fish populations' range and habitats. These investigations may also be based on applying Phase II SQOs (currently being developed) for an understanding of the continuing level of impairment.

  Completion of studies linking sediment pollutant concentrations with fish tissue pollutant concentrations and evaluating the range and habitat of specific fish populations may be used to evaluate the attainment of targets, guide future implementation actions, and may lead to changes in TMDL targets, WLAs and LAs. Work plans to complete such studies must be submitted for Regional Board EO approval.

- **Optional Special Study – Additional monitoring results within Dominguez Channel and greater Harbor waters**
  Any additional monitoring data or information may be used to refine the existing watershed and/or receiving water models relevant to the TMDL.

7.5 Compliance with Allocations and Attainment of Numeric Targets

The goal of the TMDL is to restore all of the beneficial uses of Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters through attainment of water and sediment quality objectives.

Compliance with the TMDL shall be determined through water, sediment, and fish tissue monitoring and comparison with the TMDL waste load and load allocations and numeric targets. Compliance with the sediment TMDL for metals and PAH compounds shall be based on achieving the loads and waste load allocations or, alternatively, demonstrating attainment of the SQO Part 1 through the sediment triad/multiple lines of evidence approach outlined therein. Compliance with the TMDLs for bioaccumulative compounds shall be based on achieving the assigned loads and waste load allocations in water and sediment or, alternatively, by meeting fish tissue targets. If at any point during the implementation plan, monitoring data or special studies indicate that WLAs or LAs will be attained but fish tissue targets may not be achieved, the Regional Board shall reconsider the TMDL to modify WLAs and LAs to ensure that the fish tissue targets are attained.

The compliance point for the stormwater WLAs shall be at the storm drain outfall of the permittee's drainage area. Alternatively, if stormwater dischargers select a coordinated compliance monitoring option, the compliance point for the stormwater WLA may be at storm drain outfalls or at a point in the receiving water, which suitably represents the combined discharge of cooperating parties discharging to Dominguez Channel and Greater Los Angeles and Long Beach Harbor waters. Depending on potential BMPs implemented, alternative stormwater compliance points may be proposed by responsible parties subject to approval by the Regional Board Executive Officer. The compliance point(s) for responsible parties receiving load allocations shall be in the receiving waters or the bed sediments of the Dominguez Channel and the Greater Los Angeles and Long Beach waters.

7.6 **Monitoring**

Monitoring is required to measure the progress of pollutant load reductions and improvements in water and sediment quality and fish tissue. The information presented in this section is intended to be a brief overview of the goals of the monitoring. Special studies may be planned to improve understanding of key aspects related to achievement of WLAs and LAs, restore the beneficial uses, and to assist in the modification of structural and non-structural BMPs if necessary. The goals of monitoring include:

- To determine compliance with the assigned waste load and load allocations.
- To monitor the effect of implementation actions proposed by responsible parties to improve water and sediment quality including proposed structural and non-structural BMP to reduce storm water run-off and sediment loading, and remediation actions to remove contaminated sediment.
- To monitor contaminated sediment level in the harbors and determine if additional implementation action should be required.
- To implement the monitoring in a manner consistent with other TMDL implementation plans and regulatory actions within the Dominguez Channel watershed.

Monitoring by assigned responsible parties is required in three waterbody areas:

1. Dominguez Channel, Torrance Lateral, and Dominguez Channel Estuary
2. Greater Los Angeles and Long Beach Harbor Waters (including Consolidated Slip)

3. Los Angeles River and San Gabriel River

Monitoring shall be conducted under technically appropriate Monitoring and Reporting Plans (MRPs) and Quality Assurance Project Plans (QAPPs). The MRPs shall include a requirement that the responsible parties report compliance and non-compliance with waste load and load allocations as part of annual reports submitted to the Regional Board. The QAPPs shall include protocols for sample collection, standard analytical procedures, and laboratory certification. All samples shall be collected in accordance with SWAMP protocols. Monitoring Plans shall be submitted twenty (20) months after the effective date of the TMDL for public review and, subsequently, Executive Officer approval.

Monitoring shall begin six months after the monitoring plan is approved by the Executive Officer. Responsible parties assigned both WLAs and LAs may submit one document that addresses the monitoring requirements (as described below) and implementation activities for both WLAs and LAs. Responsible parties shall submit annual monitoring reports.

The Regional Board Executive Officer may reduce, increase, or modify monitoring and reporting requirements, as necessary, based on the results of the TMDL monitoring program. Currently, several of the constituents of concern have numeric targets that are lower than the readily available detection limits. As analytical methods and detection limits continue to improve (i.e., development of lower detection limits) and become more environmentally relevant, responsible parties shall incorporate new method detection limits in the MRP and QAPP.

7.6.1 Dominguez Channel Freshwater, Torrance Lateral, and Dominguez Channel Estuary Compliance Monitoring Program

For Dominguez Channel, Dominguez Channel Estuary, and Torrance Lateral, water and total suspended solids samples shall be collected at the outlet of the storm drains discharging to the channel and the estuary. Fish tissue samples shall be collected in receiving waters of the Dominguez Channel Estuary. Sediment samples shall be collected in the estuary.

Responsible parties listed above for Dominguez Channel, Torrance Lateral, and Dominguez Channel Estuary are each responsible for conducting water, sediment, and fish tissue monitoring. However, they are encouraged to collaborate or coordinate their efforts to avoid duplication and reduce associated costs. Stormwater dischargers may coordinate compliance with the TMDL. Compliance with the TMDL may be based on a coordinated MRP. Dischargers interested in coordinated compliance shall submit a coordinated MRP that identifies stormwater BMPs and monitoring to be implemented by the responsible parties. Under the coordinated compliance option, the compliance point for the stormwater WLAs shall be storm drain outfalls which suitably represent the combined discharge of cooperating parties.

Water samples and total suspended solids samples will be collected during two wet weather and one dry weather events each year. The first large storm event of the season shall be included as one of the wet weather monitoring events. Water samples and total suspended solid samples will be analyzed for metals, DDT, PCBs, Benzo[a]anthrancene, Benzo[a]pyrene, Chrysene, Phenanthrene, and Pyrene. Sampling shall be designed to collected sufficient volumes of suspended solids to allow for analysis of the listed pollutants in the bulk sediment.

In addition to TMDL constituents, general water chemistry (temperature, dissolved oxygen, pH, and electrical conductivity) and a flow measurement will be required at each sampling event. General chemistry measurements may be taken in the laboratory immediately following sample collection, if auto samplers are used for sample collection or if weather conditions are unsuitable for field measurements.

Sediment monitoring program shall be developed in agreement with the selected method for compliance and all samples shall be collected in accordance with SWAMP protocols.

a) If ERLs compliance method is selected, sediment chemistry samples will be collected every two years for analysis of general sediment quality constituent and full chemical suite as specified in SQO Part 1. In addition, benthic community effects shall be assessed in the Dominguez Channel estuary.

b) If SQO compliance method is selected, sediment chemistry samples shall also be collected every five years (in addition to, and in between, the sediment triad sampling events as described below), beginning after the first sediment triad event to evaluate trends in general sediment quality constituents and listed constituents relative to sediment quality targets. Chemistry data without accompanying sediment triad data shall be used to assess sediment chemistry trends and shall not be used to determine compliance.

Sediment quality objective evaluation as detailed in the SQO Part 1 (sediment triad sampling) shall be performed every five years in coordination with the Biological Baseline and Bight regional monitoring programs, if possible. Sampling and analysis for the full chemical suite, two toxicity tests and four benthic indices as specified in SQO Part 1 shall be conducted and evaluated. If moderate toxicity as defined in the SQO Part 1 is observed, results shall be highlighted in annual reports and further analysis and evaluation to determine causes and remedies shall be required in accordance with the EO approved monitoring plan. Locations for sediment triad assessment and the methodology for combining result from sampling locations to determine sediment conditions shall be specified in the MRP to be approved by the Executive Officer. The sampling design shall be in compliance with the SQO Part 1 Sediment Monitoring section (VII.E.).

Fish tissue samples will be collected every two years and analyzed for chlordane, dieldrin, toxaphene, DDT, and PCBs. The target species in the Dominguez Channel estuary shall be selected based on the local abundance and fish size at the time of field collection. Tissues analyzed will be based on most common preparation for the selected fish species.

7.6.2 Greater Harbor Waters Compliance Monitoring Program

Responsible parties listed above for Greater Harbor Waters, Eastern San Pedro Bay are jointly responsible for implementing the monitoring program. At a minimum, monitoring shall be conducted at the locations and constituents listed in Table 7-1 for water column, total suspended solid, and sediment. The exact location of monitoring sites shall be specified in the monitoring plan to be approved by the Executive Officer. During aspects of the remedial action(s) for the Montrose Superfund Site that may mobilize sediments and associated pollutants from the on- or near-property soils or "Neighborhood Areas", it is recommended that US EPA, as the regulatory oversight agency, require that Potentially Responsible Parties (PRP) implement monitoring to evaluate pollutant loads and concentrations leaving the site and surrounding area, as well as pollutant concentrations in the bed sediments of Dominguez Channel Estuary and Consolidated Slip and coordinate such monitoring with other TMDL compliance monitoring.

Sediment quality objective evaluation as detailed in the SQO Part 1 (sediment triad sampling) will be performed every five years for compliance; concurrently with the Biological Baseline and Bight programs. Full chemical suite, two toxicity tests and four benthic indices will be conducted and evaluated. If moderate toxicity as defined in the SQO Part 1 is observed, results shall be highlighted in annual reports and further analysis and evaluation to determine causes and remedies shall be required in accordance with the EO approved monitoring plan. Locations for sediment triad assessment and the methodology for combining results from sampling locations to determine sediment conditions in the waterbody shall be specified in the MRP to be approved by the EO. The sampling design shall be in compliance with the SQO Part I Sediment Monitoring section (VII.E).

Sediment chemistry samples will also be collected in between every five year of the sediment quality objective evaluation for analysis of general sediment quality constituents (GSQC) and listed constituents in Table 7-1. The chemistry analysis shall be used to assess sediment chemistry trend and will not be used to determine compliance. All samples will be collected in accordance with SWAMP protocols.

Water samples and total suspended solids samples will be collected during two wet weather and one dry weather event each year. The first large storm event of the season shall be included as one of the wet weather monitoring events. General water chemistry (temperature, dissolved oxygen, pH, and electrical conductivity), flow measurement, and listed constituent in Table 7-1 will be required at each sampling event.

Table 7-1. List of Constituents for Analysis and Required Monitoring Sites and for Water Column and Sediment Chemistry

Water Body Name	Station Id	Station Location	Sample Media	
			WATER/TSS	SEDIMENT
Consolidated Slip	01	Center of Consolidated Slip	Metals, PCBs, DDT	Metals, Chlordane, DDT PCBs, Benzo[a]anthracene, Benzo[a]pyrene, Chrysene, Phenanthrene, Pyrene, 2-methylnaphthalene
Los Angeles Inner Harbor	02	East Turning Basin	Metals, PCBs, DDT	
	03	Center of the POLA West Basin	Metals, PCBs, DDT	Metals, Toxicity, Benthic Community Effect
	04	Main Turning Basin north of Vincent Thomas Bridge	Metals, PCBs, DDT	
	05	Between Pier 300 and Pier 400	Metals, PCBs, DDT	Metals, Toxicity, Benthic Community Effect

Water Body Name	Station Id	Station Location	Sample Media	
			WATER/TSS	SEDIMENT
	06	Main Channel south of Port O'Call	Metals, PCBs, DDT	Metals, Toxicity, Benthic Community Effect
Fish Harbor	07	Center of inner portion of Fish Harbor	Metals, PCBs, DDT	Metals, Toxicity, PCBs, DDT, Chlordane, Benzo[a]anthracene, Benzo[a]pyrene, Chrysene, Dibenz[a,h]anthracene, Phenanthrene, Pyrene
Los Angeles Outer Harbor	08	Los Angeles Outer Harbor between Pier 400 and middle breakwater	Metals, PCBs, DDT	Toxicity
	09	Los Angeles Outer Harbor between the southern end of the reservation point and the San Pedro breakwater	Metals, PCBs, DDT	Toxicity
Cabrillo Marina	10	Center of west Channel	Metals, PCBs, DDT	
Inner Cabrillo Beach	11	Center of Inner Cabrillo Beach	Metals, PCBs, DDT	Metals
Long Beach Inner Harbor	12	Cerritos Channel between the Heim Bridge and the Turning Basin	Metals, PCBs, DDT	Metals, Toxicity, Benthic Community Effect
	13	Back Channel between Turning Basin and West Basin	Metals, PCBs, DDT	Metals, Toxicity, Benthic Community Effect
	14	Center of West Basin	Metals, PCBs, DDT	Metals, Toxicity, Benthic Community Effect
	15	Center of Southeast Basin	Metals, PCBs, DDT	Metals, Toxicity, Benthic Community Effect
Long Beach Outer Harbor	16	Center of Long Beach Outer Harbor	Metals, PCBs, DDT	Toxicity
	17	Between the southern end of Pier J and the Queens Gate	Metals, PCBs, DDT	Toxicity
San Pedro Bay	18	Northwest of San Pedro Bay near Los Angeles River Estuary	Metals, PCBs, DDT	Metals, Chlordane, PAHs, Toxicity
	19	East of San Pedro Bay	Metals, PCBs, DDT	Metals, Chlordane, PAHs, Toxicity
	20	South of San Pedro Bay inside breakwater	Metals, PCBs, DDT	Metals, Chlordane, PAHs, Toxicity
Los Angeles River Estuary	21	Los Angeles River Estuary Queensway	Metals, PCBs, DDT	Metals, Chlordane, DDT, PCBs

Water Body Name	Station Id	Station Location	Sample Media	
			WATER/TSS	SEDIMENT
		Bay		
	22	Los Angeles River Estuary	Metals, PCBs, DDT	Metals, Chlordane, DDT, PCBs

Fish tissue samples will be collected annually in San Pedro Bay, Los Angeles Harbor, and Long Beach Harbor, and analyzed for Chlordane, Dieldrin, Toxaphene, DDT, PCBs. Fish targeted to evaluate potential impacts to human health will be limited to species more commonly consumed by humans. White croaker, a sport fish, and a prey fish shall be collected and analyze to capture contaminant concentrations in species that pose the biggest risk to human health if consumed.

7.7 Implementation Schedule

The TMDL Implementation Schedule (Table 7-2) is designed to provide responsible parties flexibility to implement BMPs and management strategies to address toxicity pollutant impairments in Dominguez Channel and Greater Harbor waters. Implementation consists of development of monitoring/management plans by responsible parties, implementation of BMPs to address contaminant loading to the Dominguez Channel and Greater Harbor waters, and the ports management activities to remediate the sediment contamination and protect aquatic life.

Table 7-2. Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants TMDL: Implementation Schedule

Task Number	Task	Responsible Party	Deadline
1	Interim allocations are met.	All Responsible Parties	Effective date of the TMDL
2	Submit a Monitoring Plan to the Los Angeles Regional Board for Executive Officer approval.	Dominguez Channel Responsible parties; Greater Harbors Responsible Parties; Consolidated Slip Responsible Parties subgroup; Los Angeles and San Gabriel River Responsible Parties	20 months after effective date of the TMDL
3	Implement Monitoring Plan	Dominguez Channel Responsible parties; Greater Harbors Responsible Parties; Consolidated Slip Responsible Parties subgroup; Los Angeles and San Gabriel River Responsible Parties	6 months after monitoring plan approved by Executive Officer.
4	Submit annual monitoring reports to the Los Angeles Regional Board.	All Responsible parties	15 months after monitoring starts and annually thereafter
5	Submit an Implementation Plan and Contaminated Sediment Management Plan (CSMP). The Implementation Plan and CSMP shall be circulated for public review for 30 days. The CSMP shall include concrete milestones with numeric estimates of load reductions or removal, including milestones for remediating hot spots, including but no limited to Dominguez Channel Estuary, Consolidated Slip and Fish Harbor, for Executive Officer approval. The Executive Officer shall consider the consent decree for the Montrose Superfund site in determining whether to approve the CSMPs.	Dominguez Channel Responsible parties; Greater Harbors Responsible Parties; Consolidated Slip Responsible Parties subgroup	2 years after effective date of the TMDL
6	Submit Report of Implementation to the Los Angeles Regional Board for Executive Officer approval.	Los Angeles and San Gabriel River Responsible Parties	2 years after effective date of the TMDL
7	Submit annual implementation reports to the Los Angeles Regional Board. Report on implementation progress and demonstrate progress toward meeting the assigned LAs and WLAs.	All Responsible parties	3 years after effective date of the TMDL and annually thereafter
8	Complete Phase I of TMDL Implementation Plan and Sediment Management Plan.	Dominguez Channel Responsible parties; Greater Harbors Responsible Parties; Consolidated Slip Responsible Parties subgroup	5 years after effective date of the TMDL
9	Submit updated Implementation Plan and	Dominguez Channel	5 years after

Task Number	Task	Responsible Party	Deadline
	Contaminated Sediment Management Plan.	Responsible parties; Greater Harbors Responsible Parties; Consolidated Slip Responsible Parties subgroup	effective date of the TMDL
10	Regional Board will reconsider targets, WLAs, and LAs based on new policies, data or special studies. Regional Board will consider requirements for additional implementation or TMDLs for Los Angeles and San Gabriel Rivers and interim targets and allocations for the end of Phase II.	Regional Board	6 years after the effective date of the TMDL
11	Report on status of implementation and scope and schedule of remaining Phase II implementation actions to Regional Board	All responsible parties	10 years after the effective date of the TMDL.
12	Complete Phase II of TMDL Implementation Plan and Sediment Management Plan.	Dominguez Channel Responsible parties; Greater Harbors Responsible Parties; Consolidated Slip Responsible Parties subgroup	15 years after effective date of the TMDL
13	Complete Phase III of TMDL Implementation Plan and Sediment Management Plan.	Dominguez Channel Responsible parties; Greater Harbors Responsible Parties; Consolidated Slip Responsible Parties subgroup	20 years after effective date of the TMDL
14	~~Final LAs and WLAs are achieved~~. Demonstrate attainment of WLAs and LAs using the mean identified under WLAs and LAs in Table 7-40.1 in the Basin Plan.	All Responsible parties	20 years after effective date of the TMDL

7.8 Cost Consideration

Porter-Cologne Section 13241(d) requires staff to consider costs associated with the establishment of water quality objectives. This TMDL does not establish water quality objectives, but is merely a plan for achieving existing water quality objectives. Therefore, cost considerations required in Section 13241 are not required for this TMDL.

The purpose of this cost analysis is to provide the Regional Board with information concerning the potential cost of implementing this TMDL, and to address concerns about costs that may be raised by responsible parties. An evaluation of the costs of implementing this toxic pollutant TMDL amounts to evaluating the costs of remediating toxic pollutant levels in the Dominguez Channel and Los Angeles and Long Beach Harbors and preventing toxic pollutant loading to these waters from stormwater discharge. This section provides an overview of the costs associated with the typical toxic pollutant cleanup and toxic pollutant reduction implementation methods.

7.8.1 Cost of Implementing Toxic Pollutant TMDL

The cost of implementing this TMDL will range widely, depending on methods that the responsible parties select to meet the Waste Load and Load Allocations. Based on the implementation measures discussed previously, approaches can be categorized as Harbor management and stormwater treatment prior to discharging into Harbor. Harbor management strategies may be relatively more effective in reducing toxic pollutant concentrations in harbors, since some methods can remove the long accumulated sediment, which is a large source of toxic pollutants. Attainment of the WLA and LA in Harbor by only treating incoming stormwater would require more time. However, stakeholders may determine the compliance approach by considering the possible time needed in conjunction with the expense.

7.8.1.1 Harbor Management Implementation Options

Sediment Removal/Dredging

The depth of Harbor ranges from 30 to 60 feet (10-20 meters) with shallower bottom near outlet of Dominguez Channel and inner side of Pier 300 at Port of Los Angeles (< 20 feet), and deeper water at the entrance to Port of Long Beach (> 60 feet). Both Los Angeles and Long Beach Harbors are dredged periodically for navigation purposes. Staff finds it may be feasible to dredge Harbors for contaminated sediment removal as part of the existing practices.

Factors that possibly influence the dredging cost include dredging methodology, depth to the bottom of harbor, distance from shoreline, composition (silt, clay, sands with different grain sizes) of the sediments, transport of dredged materials, disposal methods and locations, and subaqueous capping for off-shore disposal. Based on a feasibility study conducted in 1998 for sediment contamination mitigation at the mouth of Ballona Creek and Marina del Rey, the dredging cost ranges from $10.95 per cubic yard ($yd^3$) to $74.4 per cubic yard (Moffatt & Nichol Engineers, 1998). The less expensive estimate was the results of choosing off-shore disposal, and economic capping. Since most of cost driving factors are undetermined, the average of estimates is used to predict the most probable dredging unit cost of $42.68 per cubic yard (1998 dollars). Assuming an inflation rate of 3% each year, the unit cost adjusted to the current value (year 2010) becomes $60.84 per cubic yard. This cost includes delivery of equipment, setup, operating equipment, pumping, dewatering process or sludge/sediment management, cleaning, labor associated with the above activities, and transporting waste.

Based on the draft memorandum to Regional Board staff on December 10, 2010, prepared by Ports of Long Beach and Los Angeles, and its associated discussion, areas where dredging activities may be necessary to remove contaminated sediment to fulfill requirements of Effect Range Low (ERL) or Sediment Quality Objective (SQO) were analyzed. Multiple literatures including Southern California Bight Monitoring (1998, 2003 and 2008) and the Ports Biobaseline Monitoring in 2008, indicated that the sediments at five primary locations which are Fish Harbor, Cabrillo Marina, Consolidated Slip, and Inner Cabrillo Beach of Los Angeles Harbor, Inner and Outer Harbors of Los Angeles/Long Beach have concentrations exceeding ERLs, and may have caused or contributed to benthic community impairment.

In accordance with the SQO procedure, multiple lines of evidences for sediment chemistry, toxicity, and benthic community may be used to determine the levels of impact which indirectly may interpolate the areas and depth of necessary dredging activities. Approximately 1889 acres where classified either possible, likely or clearly impacted, with varying depths with a range of 2-8 feet may be dredged. Table 7-3 summarizes the total volume of dredged materials that may fulfill requirements of SQO and ERLs.

Table 7-3. Estimated volume of dredged materials with respect to SQO and ERL, prepared by Anchor QEA for Port of Los Angeles and Long Beach December 2010.

	Estimated Volume of Dredged materials Cubic Yard (yd^3)	
Waterbody	**SQO**	**ERL**
Fish Harbor	1,120	1,111,701
Los Angeles Harbor Cabrillo Marina	1,156,131	1,159,768
Los Angeles Harbor Consolidated Slip	475,910	478,294
Los Angeles Harbor Inner Cabrillo Beach Area	196,560	238,138
Los Angeles Harbor Beach Inner Harbor	6,692,551	21,864,948
Los Angeles Harbor Beach Outer Harbor	2,645,954	10,669,544
San Pedro Bay outside Harbors Outlet of Los Angeles River*	4,840*	4,840*
Total	11,173,066	35,527,233

*Additional estimate provided by Regional Board Staff.

The memo referenced above did not address any areas outside of Los Angeles and Long Beach Harbors. Based on a study conducted by Southern California Coast Water Research Project (SCCWRP) in 2008 and Regional Board staff's analysis, several locations with total area of 73 acres were identified as impacted. By the typical protocol of dredging, the minimal dredging depths are in a range of 2-3 feet. Therefore, the total volume to be dredged per SQO is approximately 11,173,066 cubic yards.

The total cost to dredging at Harbors is estimated $679.8 million dollars. Given a compliance schedule of 20 years, and the annual interest rate of 6%, the amortized cost for each year would be $59.3 million dollars (Table 7-4).

Table 7-4. Summary of estimated cost for dredging

	Volume (cubic yards)	Unit Cost	Total Cost
Dredging	11,173,066	$60.84/cubic yard	$679,788,860
Amortized over 20 years (6% interest rate)			$59,277,589 per year

(Wastewater Engineering Treatment, disposal and Reuse, 3rd edition, Chap 12, Metcalf & Eddy).

7.8.1.2 Stormwater Treatment Implementation Options

Sand/Organic Filters

A typical sand/organic filter system contains two or more chambers. The first is the sedimentation chamber for removing floatables and heavy sediments. The second is the filtration chamber, which removes additional pollutants by filtering the runoff through a sand bed. Properly designed sand/organic filters are effective methods to remove suspended solids, biochemical oxygen demand (BOD), total phosphorus, fecal coliform bacteria, metals and toxic pollutants from stormwater. The effectiveness of a sand/organic filter system is greatly influenced by the pollutant loadings, and the characteristics of the drainage areas.

The construction cost of a sand/organic filter system depends on the drainage areas, expected efficiency and other design parameters. Case studies conducted in 1997 indicate cost ranges from $2,360 dollars/acre for areas greater than 30 acres to $18,500 dollars per acre (EPA, 1999). With considerations of inflation rate of 3% to bring the monetary value to current, and the vast areas, the unit price of constructing filter system is assumed $3,000 dollars per acre. The Dominguez Channel subwatershed is approximately 75,144 acres, which results in the overall cost of $ 225 million dollars for sand/organic filter system construction (Table 7-5). Amortized with interest rate of 6% annually and into 20 years based on the implementation schedule, and with the average annual maintenance rate of 5%, the total cost is 20.64 million dollars.

Table 7-5. Summary of estimated cost for stormwater treatment filters

Items	Unit Price	Total Cost
Construction cost	$3,000/acre of drainage area Total 75,144 acres in the Dominguez Channel Subwatershed.	$225,432,000 $19.6 million annually if amortized with an interest rate of 6% for 20 years.
Maintenance	5% of the construction cost, annually	$982,884 annually
Total Cost		$20,640,554 annually

Vegetated Swales

Vegetated swales are constructed along drainage ways where stormwater runoff conveyed. Vegetation in swales and strips allows for the filtering of pollutants, and infiltration of runoff into groundwater. Densely vegetated swales can be designed to add visual interest to a site or to screen unsightly views. They reduce runoff velocities, which allow sediment and other pollutants to settle out.

The effectiveness of vegetated swales depends on slopes of swales, soil permeability, grass cover density, contact time of stormwater runoff and intensity of storm events. Vegetated swales, based on case studies, are capable of managing runoff from small drainage areas with approximate sizes of 10 acres.

Construction of swales begins with site clearing, grubbing, excavation, leveling and tilling, thereafter followed with seeding and vegetation planting. The cost of developing a swale unit is estimated in the range of $6,000 to $17,000 (CASQA, 2003). Routine maintenance activities include keeping up the hydraulic and removal efficiency of the channel, periodic mowing, weed control, watering, reseeding and clearing of debris and blockages for a dense, healthy grass cover.

With considerations of inflation rate of 3% to bring the monetary value to current, and the vast areas, the unit price of constructing a vegetated swale is assumed to be $7,200 dollars each. Acreage of the Dominguez Channel subwatershed requires approximately 7,514 units of vegetated swales, which results in the overall cost of $54.1 million dollars (Table 7-6). Amortized with interest rate of 6% annually and into 20 years based on the implementation schedule, and with the average annual maintenance rate of 5%, the total cost is $4.95 million dollars.

Table 7-6. Summary of estimated cost for vegetative swales

Items	Unit Cost	Total cost
Construction	$7,200 per unit swale for each 10-acre drainage area	$54,103,680 $4.7 million annually if amortized with an interest rate of 6% for 20 years.
Maintenance	5% of construction cost annually	$235,892 annually
Total Cost		$4,953,733 annually

7.8.1.3 Cost Comparison

Water quality improvement at the Harbors can be achieved through harbor management which mitigates the toxic pollutant problem in harbors water and by reducing toxic pollutant loading from stormwater discharge. The following table summarizes the estimated total costs as results of implementing this TMDL (Table 7-7). The overall project costs arising from dredging the contaminated sediment in harbors and pollutant loading reduction in stormwater could be in a range of 733 million dollars to 905 million dollars. With consideration of the maintenance cost to structural BMPs such as infiltration system and vegetated swales, this overall cost may amortized, at a interest rate of 6%, to become as low as 64 million dollars per year during implementation of this TMDL.

Both the Port of Los Angeles and Port of Long Beach dredge the harbors and channels periodically or upon request to maintain proper navigation. The quantity of dredged materials for purposes other than removing contaminated sediment was not accounted, and may further reduce the cost for implementing this TMDL.

Table 7-7. Cost summary for stormwater treatment implementation alternatives

Implementation Alternatives	Harbor Dredging and Sand/Organic Filters	Harbor Dredging and Vegetated Swale
Total Project Cost (current value)	$905,220,860	$733,892,540
Amortized annual Cost (Interest rate 6% over 20 years)	$79,918,143	$64,231,322

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