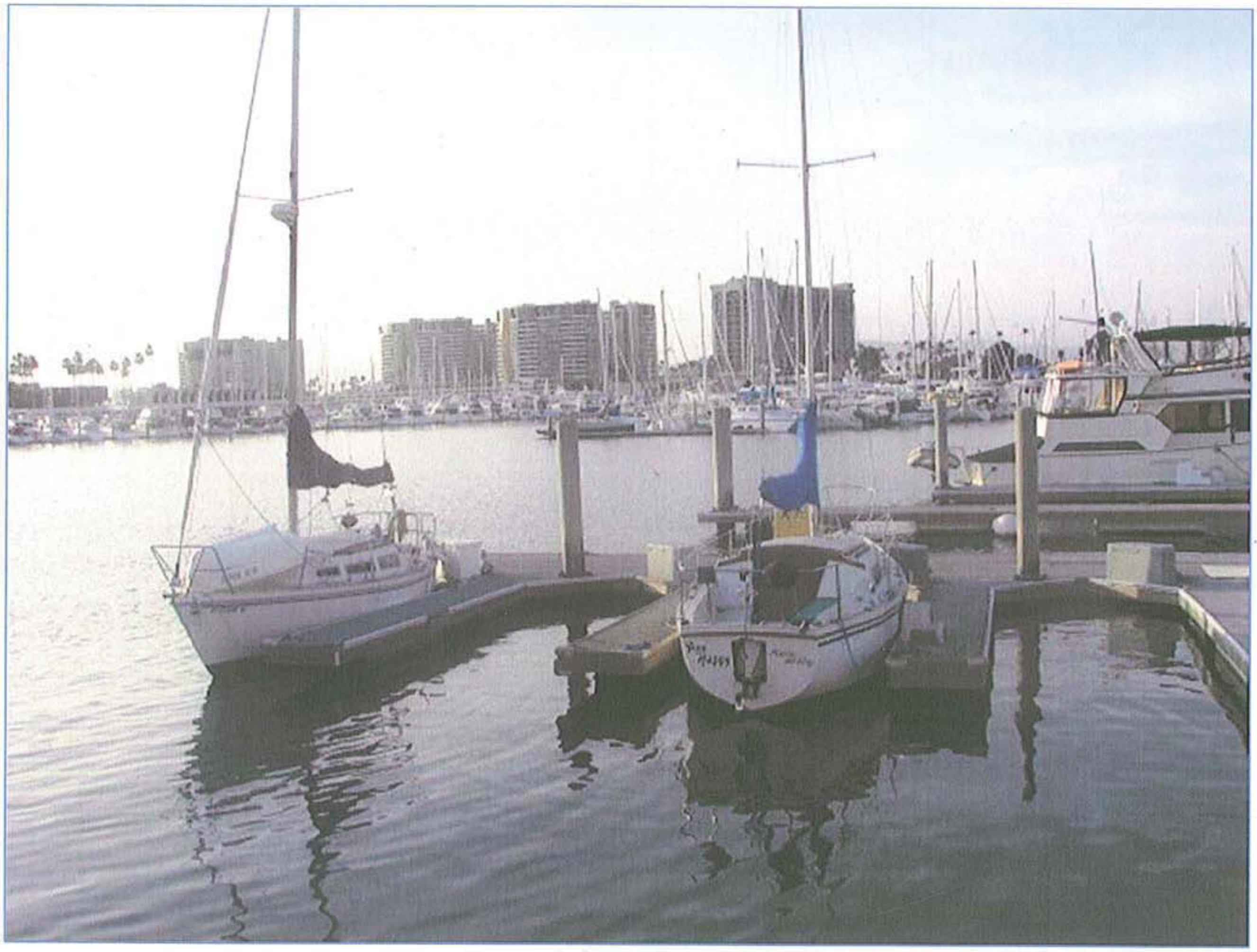
Marina Del Rey Harbor Toxic PollutantsTMDL Implementation Plan



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Executive Summary

ES.1 Introduction

The Marina del Rey Harbor Toxic Pollutants TMDL Implementation Plan (Implementation Plan) defines the approaches that the cities of Los Angeles (lead agency for developing this Implementation Plan) and Culver City and the California Department of Transportation (Caltrans), (collectively the Marina del Rey Watershed Agencies), propose to comply with the implementation requirements of the *Marina del Rey Harbor Toxic Pollutants TMDL* (Toxics TMDL). This TMDL limits the discharge of specific pollutants to the three Back Basins of Marina del Rey Harbor – Basins D, E and F (**Figure ES-1**). The County of Angeles, the designated lead agency for the Toxics TMDL, elected to develop its own implementation plan to comply with the implementation requirements of the Toxics TMDL.

Following the principles of the Water Quality Compliance Master Plan for Urban Runoff and City of Los Angeles Integrated Resources Plan (City of Los Angeles, 2004), this Implementation Plan uses the following guiding principles:

- ***Watershed-Wide Approach***: Characterize the watershed as a whole and identify and select projects independent of jurisdictional boundaries in order to develop the most beneficial plan for the watershed.
- ***Integrated Plan***: Identify urban runoff management projects that have multiple benefits and treat multiple pollutants.
- ***Green Solutions***: Wherever possible, implement solutions that are "green," sustainable, and work with the existing natural environment.
- ***Build on Existing Programs:*** Review existing urban runoff programs and identify opportunities to improve current water quality programs.
- ***Adaptive Management***: Develop a plan that can be refined based on the information gathered over time through lessons learned from the implementation of both successful and unsuccessful programs and projects.

The Implementation Plan was first submitted as a draft to the Los Angeles Regional Water Quality Control Board (LARWQCB) in March 2011. This revised Implementation Plan was submitted to the LARWQCB in December 2012 and addresses the comments that were received in September 2012. The major changes in this revised Implementation Plan include the following:

- **Sections 2.3.2 and 2.3.3** provide a summary of recent monitoring data that were obtained after submittal of the Draft Implementation Plan in March 2011.
- **Section 4** provides a discussion of the implications of new monitoring data on the proposed strategy of the Draft Implementation Plan and recommends that the implementation strategy be revised with the identification of additional green infrastructure BMPs to ensure compliance with the Toxics TMDL.

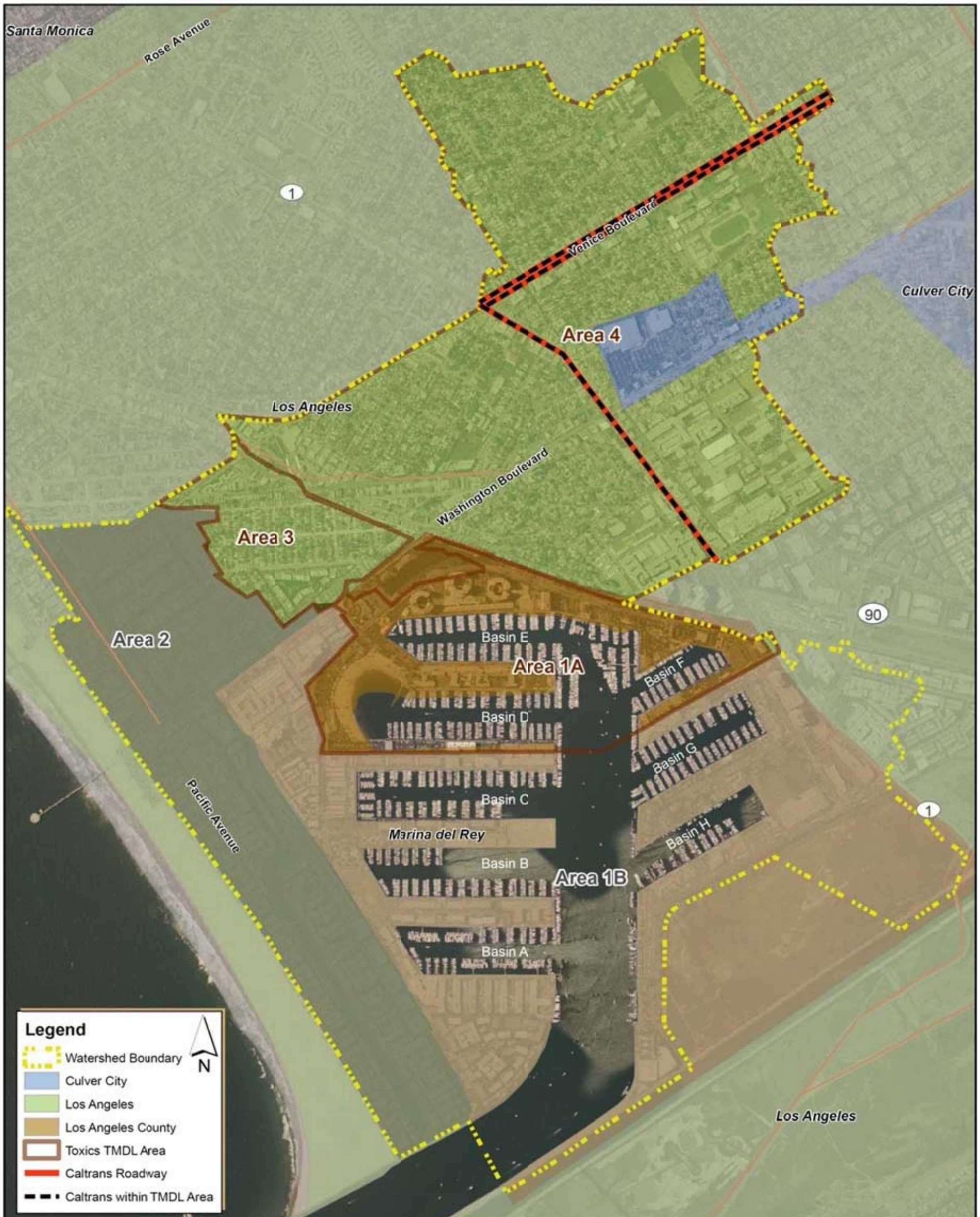


Figure ES-1 Watershed Layout

ES.2 Regulatory and Permitting Requirements

The Marina del Rey Back Basins are on a regulatory list of impaired waterbodies in the Los Angeles region, referred to as the 303(d) list. The Los Angeles Regional Water Quality Control Board (LARWQCB) biennially prepares the 303(d) list which identifies the impaired waterbody and the specific pollutant(s) for which it is impaired. All waterbodies on the 303(d) list are subject to the development of a Total Maximum Daily Load (TMDL). A TMDL establishes the maximum amount of a pollutant that a waterbody can receive and still meet the applicable water quality standards for that pollutant. Depending on the nature of the pollutant, TMDL implementation may require a cap on pollutant contributions from point sources (e.g., centralized pipe outfall discharges into the Back Basins from wastewater treatment plants), nonpoint sources (e.g., dispersed urban runoff from the storm drainage system), or both.

Adoption of the Marina del Rey Harbor Toxics TMDL required an amendment to the regional water quality regulations (Basin Plan) and the LARWQCB adopted the Toxics TMDL October 6, 2005. Subsequent approvals were by the State Board on January 13, 2006, the State Office of Administrative Law approved the TMDL on March 13, 2006, and EPA Region 9 on March 16, 2006. The Toxics TMDL became effective on March 22, 2006.

ES.3 Toxics TMDL Numeric Limits

Table ES-1 summarizes the Toxics TMDL numeric targets which are based on the sediment quality guidelines compiled by the National Oceanic and Atmospheric Administration and the corresponding waste load allocations (WLA). Throughout this Implementation Plan, the term "toxic pollutants" refers to the constituents that are listed in the Toxics TMDL (e.g., both metals and organics).

The Toxics TMDL numeric targets include concentrations of toxic pollutants in the Back Basins of the harbor, i.e., Basins D, E and F (**Figure ES-1**). The WLA are for the maximum amount of each of these constituents that can be transported from the Marina del Rey Watershed to the Back Basins. A majority of these constituents are bound to sediment and transported as storm-borne sediment during wet weather runoff events.

Table ES-1
Marina del Rey Harbor Numeric Targets and Waste Load Allocations

Metals	Numeric Target (mg/kg)	WLA (kg/yr)
Copper	34	2.06
Lead	46.7	2.83
Zinc	150	9.11
Organics	**Numeric Target (μg/kg)**	**TMDL (g/yr)**
Chlordane	0.5	0.03
Total PCBs	22.7	1.38

Source: Attachment A to Resolution No. 2005-012, Basin Plan Amendment.

ES.4 Toxics TMDL Compliance Milestones

The Toxics TMDL defines milestones for achieving compliance as follows:

- By **March 22, 2011**, Municipal Separate Storm Sewer (MS4) and Caltrans stormwater NPDES permittees shall provide a written draft report to the LARWQCB outlining how they will achieve the WLA for sediment in the Marina del Rey Harbor.
- By **September 22, 2011**, MS4 and Caltrans stormwater NPDES permittees shall provide a written final report to the Regional Board outlining how they will achieve the WLA for sediment in the Marina del Rey Harbor.
- By **March 22, 2012**, the Regional Board shall reconsider this TMDL to re-evaluate the waste load allocations and the implementation schedule.
- By **March 22, 2013**, demonstrate that 25 % of the total drainage area is effectively meeting the waste load allocation for sediment.
- By **March 22, 2015,** demonstrate that 50 % of the total drainage area is effectively meeting the waste load allocation for sediment.
- By **March 22, 2017,** demonstrate that 75 % of the total drainage area is effectively meeting the waste load allocation for sediment.
- By **March 22, 2021,** demonstrate that 100 % of the total drainage area is effectively meeting the waste load allocation for sediment.

ES.5 Coordinated Monitoring Plan (CMP) Requirements

The Toxics TMDL requires that the responsible jurisdictions (County of Los Angeles, cities of Los Angeles and Culver City, Caltrans) submit and implementa CMP. A draft CMP was submitted to the LARWQCB on March 22, 2007. The revised CMP was submitted on March 31, 2008, which was subsequently approved by the LARWQCB. On August 31, 2009, the responsible jurisdictions submitted an addendum with additional monitoring locations and procedures for sampling in the watershed areas that are under tidal influence (LARWQCB approval received on October 28, 2009).

The CMP includes both ambient and TMDL effectiveness monitoring locations in the Front Basins, Back Basins, and the watershed that drains to the Back Basins. The CMP includes monitoring of the water column, sediment and fish species in the Harbor, and stormwater monitoring in the watershed. Implementation of the CMP was initiated in August 2010 upon execution of an agreement for cost sharing by the responsible jurisdictions.

ES.6 Marina del Rey Watershed Characteristics

The Marina del Rey Watershed is approximately 1,855 acres (2.9 square miles) in size (**Figure ES-1**) and lies within the jurisdictions of the City of Los Angeles (53%), County of Los Angeles (44%), City of Culver City (2%), and Caltrans (1%). The watershed is bordered by the Santa Monica Bay Watershed and the Ballona Creek Watershed. Marina del Rey Harbor is open to Santa Monica Bay through the Main Channel and it shares a common breakwater with Ballona Creek. The Harbor consists of the Main Channel and eight basins (A-H). **Figure ES-1** shows that there are five subwatersheds (or Areas) within the Marina del Rey Watershed. Subwatersheds 1A, 3 and 4 are tributary directly to the Back Basins (Basins D, E and F). Subwatershed Area 1B drains to the other basins of the Harbor. Subwatershed Area 2 does not drain to the Harbor but to Ballona Lagoon.

The land area under the jurisdictions of the City of Los Angeles, City of Culver City and Caltrans is almost exclusively in Subwatersheds Areas 3 and 4, therefore, this Implementation Plan only addresses those two subwatersheds.

ES.7 Draft Implementation Plan (March 2011)

ES.7.1 Sediment Quality

At the time of developing the Draft Implementation Plan, only limited data were available to support the development of the implementation strategy. The available sediment quality data from the bottom of the harbor are not directly applicable to estimate the baseline pollutant loadings in storm-borne sediment from Areas 3 and 4 for comparison to the WLAs. Sediment samples taken from the Harbor bottom not only reflect discharges of storm-borne sediment from the upper watershed, but also the discharges from Harbor activities and from the areas adjacent to the basins. These dischargesfrom the Harbor and adjacent area could be significant, as is recognized in the TMDL Staff Report to be sources of pollutants, thereby overestimating the actual baseline pollutant loadings from Areas 3 and 4. A more accurate estimation of the baseline pollutant loading would require the analysis of storm-borne sediment collected from stormwater in Areas 3 and 4, but these data will only become available as CMP implementation progresses over the upcoming years.

Due to the lack of appropriate data, the Draft Implementation Plan relied on data developed from the Toxicity Identification Evaluation (TIE) study recently completed in the adjacent Ballona Creek Estuary. These data are an appropriate surrogate for the following reasons:

- The upstream watershed areas of the Marina del Rey and Ballona Creek watersheds are in close proximity and have very similar in land use characteristics.
- Sediment in Ballona Creek Estuary is not impacted by harbor activities or boat discharges as Ballona Creek and its Estuary are not navigated by any vessels.

Accordingly, the TIE data were considered more representative of pollutant concentrations in storm-borne sediment from Areas 3 and 4 than the Harbor sediment data.

ES.7.2 Recommended BMP Implementation

The Draft Implementation Planrelies on a combination of measures designed to decrease introduction and transport of sediment bound toxics, as well as other pollutants such as bacteria and organics, by (1) reducing the introduction of pollutants, (2) reducing the amount of dry weather and wet weather anthropogenic/urban runoff, and (3) providing localized BMPs to reduce pollutant loads.

Recommended BMPs for implementation and BMPs already in place and contributing to reducing pollutants include:

- **Vehicle Brake Pad Product Replacement**. The purpose of this BMP is to reduce a significant source of metals and other toxic pollutants in the environment by developing safe alternative products. This BMP applies specifically to reducing copper loading by modifying the copper content in vehicle brake pads. California Senate Bill (SB) 346 was signed by former Governor Arnold Schwarzenegger in 2010, thereby requiring that brake pads contain no more than 5 % copper by 2021 and no more than 0.5 % copper by 2025;

- **Enhanced Street Sweeping**. Metals released to the urban environment during dry weather conditions are likely to adsorb on street sediments, which provides a transport mechanism for metals to reach downstream waterbodies. Street sweeping removes sediment, debris, and other pollutants from road and parking lot surfaces. This Implementation Plan proposes to increase sediment removal by 15%through enhancements to the existing street sweeping program;

- **Education and outreach**. The Marina del Rey Watershed Agencies conduct education and outreach programs for residents and businesses which could include information about water quality impacts from controllable sources of metals. Outreach mechanisms include brochures, posters, websites, event attendance, utility bill inserts, and surveys;

- **Catch basin cleaning**. Continuation of catch basin cleaning programs will contribute to removal of sediments prior to entering the storm drains;

- **Downspout disconnection**. The City of Los Angeles currently has a pilot program in place for downspout retrofit of single family residential roofs. Pending the results of the pilot program, the City of Los Angeles may expand the program citywide, including watersheds draining to Marina del Rey;

- **SUSMP implementation**. The SUSMP requirements of the existing MS4 permit apply to new development and significant redevelopment projects. The BMPs installed on-site must be able to infiltrate, capture and reuse, or treat all of the runoff from an 85th percentile storm, which is approximately a 3/4-inch, 24-hour storm in the Marina del Rey Watershed. Implementation of the recently adopted LID ordinance by the City of Los Angeles will provide additional water quality benefits. It is anticipated that approximately 100 acres within Areas 3 and 4 of the Marina del Rey watershed will have BMPs installed by 2021 to treat or capture stormwater runoff to meet the SUSMP and LID requirements;

- **Trash TMDL implementation**. To meet the requirements of the various Trash TMDLs throughout the waterbodies in the region, the City of Los Angeles will be installing 100 opening screen coverswhich will capture trash and debris as well as sediments, with completion estimated to be June 30, 2011; and

- BMPs already installed to meet other TMDL requirements in the area are expected to reduce the discharge of the metals and organics to Marina del Rey. These BMPs include: three Low Flow Diversions (LFDs) (owned and operated by the County) and five tree wells (owned and operated by the County).

ES.7.3 Quantification of Water Quality Benefits

Table ES-2 estimates the pollutant baseline loadings from the upper watershed based on the results of the 2007-09 TIE study for Ballona Estuary. **Table ES-3** presents the load reductions expected from the implementation of institutional BMPs as recommended in the Draft Implementation Plan**. Table ES-3** shows that lead and PCB concentrations already meet the TMDL WLAs and that implementation of the vehicle brake pad product replacement program and enhanced street sweeping will result in compliance with the WLAs for the remaining constituents (copper and zinc), except chlordane.

Table ES-2
Baseline Load

Constituent	Average of Measured Concentrations in BC Estuary[1]	Area 1A, 3 and 4 of MDR Watershed Baseline Load[2]	Baseline Load (MS4 Portion and Caltrans)[3]	Baseline Load City of LA, Culver City and Caltrans Only[4]
Metals	**(mg/kg)**	**(kg/yr)**	**(kg/yr)**	**(kg/yr)**
Copper	35.58	2.283	2.242	1.718
Lead	26.96	1.730	1.699	1.301
Zinc	147.67	9.475	9.305	7.128
Organics	**(µg/kg)**	**(g/yr)**	**(g/yr)**	**(g/yr)**
Chlordane	2.53	0.162	0.159	0.122
PCBs	1.96	0.126	0.124	0.095

Notes:

[1]The average measured concentrations of each constituent were based on the measured data reported in the 2007-2009 TIE Study performed by SCCWRP and the City of Los Angeles. These data provided representative concentrations of these constituents in stormwater runoff.

[2]The baseline load is the concentration of each constituent (column 2) multiplied by the fine sediment load of 64,166 kg/yr (Regional Board, Toxics TMDL Staff Report).

[3]The load that the MS4 permittees and Caltrans are responsible for is based on the portion of the loading capacity that they are responsible for, as listed in the TMDL. The MS4 Permittees and Caltrans are responsible for 98.2 % of the load; therefore the watershed-wide baseline load (column 3) was multiplied by 98.2 %.

[4]Portion of Areas 1A,1B, 3 and 4 that is under the jurisdiction of City of Los Angeles, City of Culver City and Caltrans (the preparers of this Implementation Plan), which is 76 % (based on GIS analysis); therefore the MS4 portion (column 4) was multiplied by 76 %.

Table ES-3
Load Reduction from Quantified BMPs

Constituent	Baseline Load[1]	Load Reduction from BMPs[2]		Estimated Post-BMP Load[3]	TDML Wasteload Allocation[4]	Estimated Post-BMP Load as % of WLA
		Vehicle Brake Pad Product Replacement	Enhanced Street Sweeping			
Metals	(kg/yr)					
Copper	1.72	0.56	0.25	0.908	1.557	58%
Lead	1.30	-	0.34	0.967	2.130	45%
Zinc	7.13	-	0.93	6.194	6.853	90%
Organics	(g/yr)					
Chlordane	0.12	-	-	0.122	0.023	535%
PCBs	0.09	-	-	0.095	1.029	9%

Notes:
1 – Baseline Load City of Los Angeles, City of Culver City and Caltrans only (see Table ES-2, column 5)
2 – Based on build-up and wash-off analysis.
3 – Baseline load (column 1) less BMPs load reductions (columns 2 and 3).
4 – WLAs for stormwater (Table 1-1) multiplied by the percentage watershed area under the jurisdiction of City of Los Angeles, City of Culver City and Caltrans (76%).

Chlordane Sediment Exceedances

Chlordane was used as an insecticide until 1983 when it was banned for all uses except termite control. It was completely banned from any use in 1988.The soil half-life for chlordane is estimated at 350 days but can range from 37 days to 3,500 days (or approximately 10 years) (NPIC, 2001).

As described above, the method for establishing the baseline load used the measured constituent concentrations found in the adjacent Ballona Creek Estuary bottom sediments as determined by the Ballona Creek Estuary TIE study. Since this study represents sediments deposited over multiple years, it is possible that sediments deposited many years ago are erroneously indicating that chlordane concentrations are still high. Over time with the collection of additional data, the benefits of the ban on chlordane use are expected to become more apparent.

Water Column and Fish Tissue Components of the TMDL

The Toxics TMDL contains targets for PCBs in the water column and PCBs in fish tissue. The LARWQCB Staff Report recognizes that PCBs are a legacy pollutant similar to chlordane. The presence of this constituent is expected to be reduced overtime as it is no longer used. **Table ES-4** summarizes the interim and final PCB targets.

Table ES-4
Water Column and Fish Tissue

Condition	Numeric Limit	Concentration in Samples
Interim Target for Total PCBs in Water Column	0.03 µg/L	Non-Detect
Final Target for Total PCBs in Water Column	0.00017 µg/L	Non-Detect
PCBs in Fish Tissue	5.3 µg/kg	No data available

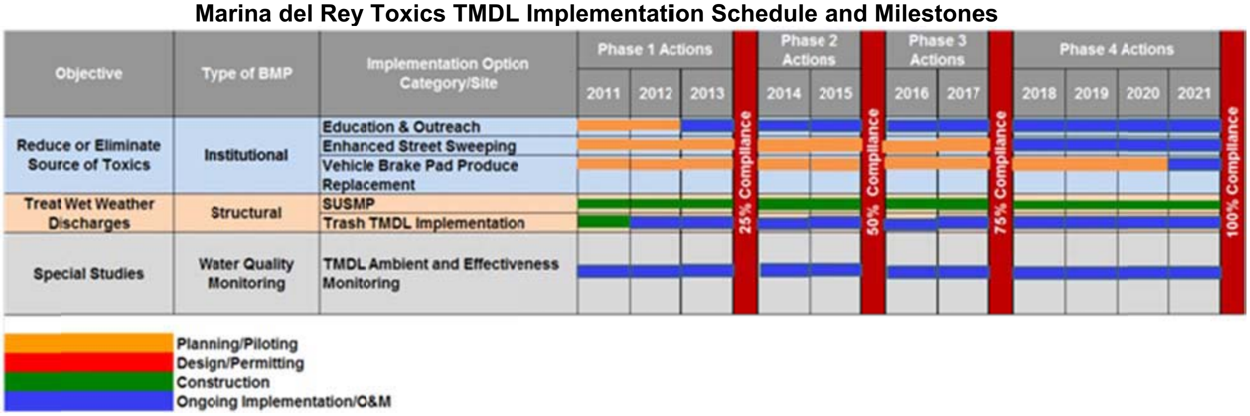
Note:
Results are from the first quarterly report prepared as part of the Marina del Rey Toxics CMP. Concentrations of PCBs were not detected in the samples. However, the detection limit, 0.1 µg/L, is above the interim and final targets. Therefore it is not conclusive whether any exceedances of the numeric targets exist.

CMP results show that concentrations of PCBs were not detected in water column samples. However, the detection limit of 0.1 µg/L is above the interim and final targets. Therefore, it is not conclusive whether any exceedances of numeric targets exist. Concentrations of PCBs in fish tissue were not available for the preparation of the Draft Implementation Plan.

ES.7.4 Interim Compliance

As discussed in the previous section, copper and zinc are the only non-banned constituents that currently are not meeting the final WLAs of 2021. Analyses of the current street sweeping program indicate that over 90% of the upstream watershed area under the jurisdiction of the Marina del Rey Watershed Agencies is already in compliance. As such, it can be assumed that the 20, 50 and 75% interim compliance requirements have already been met based on the baseline loading assumptions and the proposed BMPs of the Draft Implementation Plan. Compliance of the final WLAs by 2021 could be met through implementation of the proposed enhanced street sweeping program. Further, implementation of additional BMPs listed in section ES-8 will also reduce the load of these constituents, though their load reduction benefits have not been quantified. The schedule shown in **Table ES-5** illustrates the proposed implementation of these BMPs.

Table ES-5
Marina del Rey Toxics TMDL Implementation Schedule and Milestones



ES.7.5 Draft Implementation Plan Cost Estimate

The Draft Implementation Plan recommends the implementation of several institutional BMPs. The estimated annual O&M cost for additional street sweeping as proposed for the Marina del Rey watershed is anticipated to be $12,000 ($43 per curb-mile) and assumes that purchase of additional sweepers would not be required.

The costs associated with other recommended BMPs are expected to be incurred by home owners, developers, or product manufacturers (vehicle brake pad product replacement). Other recommended BMPs are already in place and, while they in general require funding from the watershed agencies, the incremental cost related to the Draft Implementation Plan would be negligible.

ES.8 Implementation Plan Revision (December 2012)

The revised Implementation Plan contains several new sections to evaluate recently available monitoring data and to reanalyze the current loadings of toxic pollutants to the Back Basins and the predicted waste load reductions from BMP implementation.

ES.8.1 CMP Monitoring

Section 2.3.2 and **Appendix D** provide the CMP monitoring data (2010-2012) that were obtained after the development of Draft Implementation Plan. CMP monitoring began in August 2010, and is coordinated by the County of Los Angeles and cost-shared by all watershed agencies. CMP monitoring includes toxic pollutants in the water column, toxic pollutants and toxicity in the sediment of the Back Basins, and toxic pollutants in stormwater from the upper watershed.

Table ES-6

Average concentration of toxic pollutants in sediment of the Back Basins

(August 2010 – July 2012).

Constituent	Unit	MdRH-B-1	MdRH-B-2	MdRH-B-3	MdRH-B-4
Copper	mg/kg	319	415	363	235
Lead	mg/kg	64	83	82	60
Zinc	mg/kg	320	395	338	261
Chlordane[1]	µg/kg	ND	ND	ND	ND
PCBs[2]	µg/kg	56	66	67	51

Notes:

[1] ND= non detect; average method detection limit = ~ 20µg/kg

[2] Average of six sampling events; PCBs were below method detection limit in all Back Basins during two sampling events

Table ES-6 summarizes the average concentrations of toxic pollutants in the sediment of Back Basins as determined by quarterly sampling over August 2010 through July 2012. Concentrations of metals were found to be higher than the numeric targets of the Toxics TMDL. PCBs were not detected in two sampling events, but the average concentration of PCBs when it was detected in the six remaining events was about 2-3 times the numeric target of the Toxics TMDL. Chlordane was not detected at a detection limit of about 20 µg/kg. Concentrations of the metals and total PCBs were higher in sediments of the Back Basins as compared the concentrations of the same pollutants in Ballona Estuary sediments as determined by the TIE study over 2007-2009.

ES.8.2 Pollutant Loadings

Since August 2010, CMP monitoring included total recoverable and dissolved concentrations of the metals and total concentrations of chlordane and PCBs in stormwater. **Table ES-7** summarizes the revised estimated pollutant loadings from the upstream watershed in the 2010-2011 wet season (as determined from total recoverable concentrations in stormwater, **Section 2.3.2**) with the TMDL WLAs for stormwater and the pollutant loadings that were estimated from Ballona Estuary TIE results. As discussed in **Section 4.1**, the new data suggest that pollutant loadings of metals and PCBs from the upstream watershed are probably higher than the baseline loadings in **Section 3** that were estimated by using the TIE results for Ballona Estuary sediments. The results in **Table ES-7** also indicate that the estimated pollutant loadings in the 2010-2011 wet season were 2 to 10 times higher than the WLAs of the Toxics TMDLs, depending on the specific pollutant. It should be noted, however, that using the total recoverable concentration in stormwater overestimates pollutant loadings associated with storm-borne sediment. Storm-borne sediment sampling is included in the effectiveness monitoring component of the CMP and expected to start in 2013.

ES.8.3 Waste Load Reductions

Even though the 2010-2011 pollutant loading estimates probably overestimated the actual loadings, the results in **Table ES-7** suggest that the anticipated load reductions by the institutional BMPs proposed in Draft Implementation Plan are probably not sufficient to meet the WLAs of the Toxics TMDL (discussed in **Section 4.2**). The institutional approach was reasonable at the time as some pollutants were initially thought to have already met the WLAs, while loadings of other pollutants exceeded the WLAs but only to a small extent. Future revisions of the implementation strategy for the Marina del Rey Toxics TMDL, however, will probably also need to consider the implementation of structural projects that capture and treat stormwater, storm-borne sediment and associated pollutants from the upstream watershed.

Table ES-7

Comparison of pollutant loading estimates (2010-2011 wet season) with TMDL Waste Load Allocations

Constituent	Pollutant loading estimates for 2010-2011	TMDL WLA[2]	Estimated baseline load based on 2007-2009 TIE Study
Copper (kg/yr)	13.8[1]	1.56	1.718
Lead (kg/yr)	3.83[1]	2.13	1.301
Zinc (kg/yr)	64.85[1]	6.85	7.128
Chlordane	NA[2]	0.023	0.122
PCBs (g/yr)	3.9[3]	1.029	0.095

Notes:
[1] *Pollutant loading based on total recoverable concentration in stormwater.*
[2] *Chlordane was not detected in Back Basins sediments or in stormwater.*
[3] *Pollutant loading based on total PCBs concentration in Back Basins sediment.*

ES.8.4 Recommended approach to Implementation Strategy Revision

Depending on the pollutant, pollutant loadings estimated for the 2010-2011 wet season were between 2 to 10 times higher than the WLAs. Future revisions of the implementation strategy will have to consider a combination of institutional and structural BMPs as no category of BMP is likely to be sufficient to achieve the required WLAs. Toxic pollutants are mostly associated with storm-borne sediment, therefore, implementation of green infrastructure BMPs is recommended as these BMPs have the greatest impact on reducing the pollutant loadings bv retaining stormwater and pollutants for on-site treatment and reuse of the stormwater.

The Marina del Rey Watershed Agencies employ structural approaches to the identification and prioritization of green infrastructure projects and the quantification of water quality benefits and other benefits. Since this process may take up to one year depending on the size of the watershed, the complexity of the TMDL, and other factors, the agencies recommend that identification of new green infrastructure projects in the Marina del Rey watershed be included in the development Watershed Management Plans or Enhanced Watershed Management Plans as provided for in the recently adopted NPDES Permit for the MS4.

Section 1 Introduction

The Marina del Rey Harbor Toxic Pollutants TMDL Implementation Plan (Implementation Plan) defines the approaches that the cities of Los Angeles (lead agency for developing this plan) and Culver City and the California Department of Transportation (Caltrans), (collectively the Marina del Rey Watershed Agencies),propose to comply with the implementation requirements of the *Marina del Rey Harbor Toxic Pollutants TMDL* (Toxics TMDL). This TMDL limits the discharge of specific pollutants to the three Back Basins of Marina del Rey Harbor – Basins D, E and F (**Figure 1-1**). The County of Angeles, the designated lead agency for the Toxics TMDL, elected to develop its own implementation plan to comply with the implementation requirements of the Toxics TMDL.

1.1 Guiding Principles

A guide to the development of this Implementation Plan is the City of Los Angeles Water Quality Compliance Master Plan for Urban Runoff (WQCMPUR). Although the WQCMPUR is a strategic plan for the City of Los Angeles, its guidelines and directions apply to the entire region and were developed in concurrence with all watershed stakeholders, including the Marina del Rey WatershedAgencies. The WQCMPUR includes three initiatives (City of Los Angeles, 2009):

- Water Quality Management Initiative for project identification;
- Citywide Coordination Initiative to develop ordinances and collaborative approaches within and among agencies; and
- Outreach Initiative for pollutant source control.

This Implementation Plan addresses these three initiatives. Further, the WQCMPUR included an Action Plan (Table ES-3 of the WQCMPUR executive summary). The Action Plan identifies high priority items including the development of multiple TMDL Implementation Plans and watershed-specific Water Quality Management Plans, which are currently in development. At the time of the development of this Implementation Plan, three TMDL Implementation Plans have been prepared for the Ballona Creek Watershed (Bacteria, Metals and Estuary Toxics), as well as the Los Angeles River Metals TMDL Implementation Plan and the Machado Lake Lake Water Quality Management Plan which was developed to address the Machado Lake Nutrients TMDL.

Following the WQCMPUR and City of Los Angeles Integrated Resources Plan (IRP) (City of Los Angeles, 2004), thisImplementation Plan usesthe following guiding principles:

- ***Watershed-Wide Approach***: Characterize the watershed as a whole and identify and select projects independent of jurisdictional boundaries in order to develop the most beneficial plan for the watershed.

- ***Integrated Plan***: Identify urban runoff management projects that have multiple benefits and treat multiple pollutants.

- ***Green Solutions***: Wherever possible, implement solutions that are "green," sustainable, and work with the existing natural environment.

- ***Build on Existing Programs:*** Review existing urban runoff programs and identify opportunities to improve current water quality programs.

- ***Adaptive Management***: Develop a plan that can be refined based on the information gathered over time through lessons learned from the implementation of both successful and unsuccessful programs and projects.

1.2 Regulatory and Permitting Requirements

1.2.1 Background

The Clean Water Act of 1972 (CWA) provides the basis for the protection of all inland surface waters, estuaries, and coastal waters. The federal Environmental Protection Agency (EPA) is responsible for administering the CWA and developing regulations, but may delegate its authority to the State.

The State of California (State) implements the CWA by establishing water quality protection laws and regulations and issuing discharge permits through State regulatory agencies. At its own discretion, the State has established requirements in many instances that are more stringent than federal requirements for CWA implementation.

California's primary statute governing water quality is the Porter-Cologne Water Quality Control Act of 1970 (Porter-Cologne Act). The Porter-Cologne Act grants the California State Water Resources Control Board (State Board) and nine California Regional Water Quality Control Boards broad powers to protect water quality, and it is the primary vehicle for the administration of California's regulations under the federally delegated responsibilities of the CWA. The governing Regional Board for the Los Angeles area watersheds is the Los Angeles Regional Water Quality Control Board (LARWQCB).

Biennially, the LARWQCB prepares a list of impaired waterbodies in the region, referred to as the 303(d) list. The 303(d) list outlines the impaired waterbody and the specific pollutant(s) for which it is impaired. All waterbodies on the 303(d) list are subject to the development of a TMDL.A TMDL establishes the maximum amount of a pollutant that a waterbody can receive and still meet the applicable water quality standard for that pollutant. Depending on the nature of the pollutant, TMDL implementation may require a cap on pollutant contributions from point sources (waste load allocation), nonpoint sources (load allocation), or both.

The development of TMDLs affecting waters in the Los Angeles area watersheds is the responsibility of the LARWQCB. Adoption of a TMDL requires an amendment to the regional water quality regulations (Basin Plan) and is subject to a substantial public review process. After the LARWQCB adopts the TMDL as a Basin Plan amendment, it is submitted to the State Board for approval. If approved by the State Board, the TMDL is submitted to EPA Region 9 for final review and federal approval. The TMDL does not take effect until the EPA has issued its formal approval.

Once a TMDL becomes effective, the schedule for TMDL implementation by each named responsible jurisdiction becomes active. TMDL-specific implementation requirements vary, but typically include preparation of a Coordinated Monitoring Plan (CMP) for the affected watershed, and development of an Implementation Plan detailing how the responsible agencies plan to achieve compliance with the TMDL requirements. This Implementation Plan is prepared in response to requirements contained in the ToxicsTMDL (LARWQCB, 2005a).

1.2.2 Toxics TMDL Development History

In order to address the ToxicsTMDL development requirements, the LARWQCB published for public review, draft technical documents, including the Draft Staff Report (LARWQCB, 2005b), a Proposed Basin Plan Amendment, a Tentative Resolution, and the California Environmental Quality Act (CEQA) Requirements Checklist and Determination. After comments were received, these documents were revised and finalized on October 6, 2005.

The LARWQCB adopted the Toxics TMDL October 6, 2005 by Resolution No. 2005-012 (**Appendix A**). Subsequently, the Toxics TMDL was approved by the State Board on January 13, 2006, by the Office of Administrative Law on March 13, 2006, and by EPA Region 9 on March 6, 2006. The Toxics TMDL became effective on March22, 2006.

1.2.3 ToxicsTMDL Numeric Targets

Table 1-1 summarizes the Toxics TMDL numeric targets which are based on the sediment quality guidelines compiled by the National Oceanic and Atmospheric Administration and the corresponding waste load allocations (WLA). Throughout this Implementation Plan, the term "toxic pollutants" refers to the constituents that are listed in the Toxics TMDL (e.g., both metals and organics).

The Toxics TMDL includes numeric targets for the concentration limits of toxic pollutantsin the sediments of the Back Basins of the Harbor, i.e., Basins D, E and F (**Figure 1-1**). Similarly, the Toxics TMDL defines pollutant specific loading capacities by multiplying the average annual total suspended load (64,166 kg/yr) discharged from to the watershed to the Back Basins by the numeric sediment targets. The WLAs for stormwater are determined by accounting for atmospheric deposition and they represent the maximum amount of each of the constituents that can be transported from the Marina del Rey Watershed to the Back Basins. A majority of these constituents are bound to sediment and transported as storm-borne sediment during wet weather runoff events.

Table 1-1
Marina del Rey Harbor Numeric Targets and Waste Load Allocations

Metals	Numeric Target (mg/kg)	WLA (kg/yr)
Copper	34	2.06
Lead	46.7	2.83
Zinc	150	9.11
Organics	**Numeric Target (µg/kg)**	**TMDL (g/yr)**
Chlordane	0.5	0.03
Total PCBs	22.7	1.38

Source:Attachment A to Resolution No. 2005-012, Basin Plan Amendment (see Appendix A).

1.2.4 Additional TMDLs and Watershed Impairments

Water quality concerns in the Marina del Rey Watershed extend beyond elevatedtoxic pollutantconcentrations addressed by the Toxics TMDL. These concerns have resulted in the adoption of other TMDLs and 303(d) listed impairments, as described below.

Adopted TMDLs

One additional TMDL is effective in the Marina del Rey Watershed. *The Marina del Rey Mothers' Beach and Back Basins Bacteria TMDL (Bacteria TMDL)* includes numeric targets and WLAs applicable to urban runoff for total coliform, fecal coliform, and enterococcus (LARWQCB, 2003). The Bacteria TMDL became effective on March 18, 2004, and the Final Bacteria TMDL Implementation Plan was approved by the LARWQCB on April 6, 2006. The Bacteria TMDL Implementation Plan was developed by the County of Los Angeles as the TMDL lead agency, the cities of Los Angeles and Culver City and Caltrans (County of Los Angeles et al., 2005).

Many of the BMPs listed in the Final Bacteria TMDL Implementation Plan have been included in this Implementation Plan since they serve to reduce multiple pollutants of concern. Similarly, new BMPs proposed in this Implementation Plan (**Section 3**) for reducing toxic pollutants in urban runoff discharges from the watershed will also support the removal of bacteria. This multi-pollutant approach for BMP implementation is compatible with the Integrated Water Resources Approach (IWRA) for stormwater management and improving urban runoff quality.

303(d) List of Impaired Waters

The EPA-approved 303(d) list for California was most recently updated in 2010. Within the Marina del Rey Watershed, the 2010 303(d) list identifies the following impairments in addition to those already issued a TMDL:

- Marina del Rey Harbor – Back Basins:
    - Fish Consumption Advisory
    - Sediment Toxicity

These listings have been included on the 303d list since 1998. As discussed in the Toxics TMDL Staff Report, the "sediment toxicity and fish advisory listing will be addressed by theTMDLs [referring to the Toxics TMDL] waste load allocations (WLAs) and load allocations (LAs) for these toxicpollutants." As such, there are no additional pollutants listed on the 303d list for which TMDLs will be forthcoming.

1.2.5 Coordinated Monitoring Plan (CMP) Requirements

The Toxics TMDL requires that the responsible jurisdictions (County of Los Angeles, cities of Los Angeles and Culver City, Caltrans) submit and implementa CMP. A draft CMP was submitted to the LARWQCB on March 22, 2007. The revised CMP was submitted on March 31, 2008 (County of Los Angeles et al., 2008), which was subsequently approved by the LARWQCB. On August 31, 2009, the responsible jurisdictions submitted an addendum with additional monitoring locations and procedures for sampling in the watershed areas that are under tidal influence (LARWQCB approval received on October 28, 2009).

The CMP outlines an extensive program for ambient and effectiveness monitoring with monitoring locations in the harbor and upstream watershed(**Figure 1-1**):

- Monitoring locations MdRH-F-1 through MdRH-F-5 are located in the Front Basins (Basins A, B, C, G, and H). These locations will be monitored for copper in the water column during ambient monitoring only (**Table 1-2**).

- Monitoring locations MdRH-B-1 through MdRH-B-4 are located in the Back Basins (Basins D, E, and F). These locations will be monitored for water quality (ambient monitoring only), sediment quality, and bioaccumulation (**Table 1-3**). Bioaccumulation monitoring will be done by sampling the tissue of two or three species of fish and mussels at MdRH-B-1, MdRH-B-2 and MdRH-B-3.

- Monitoring locations MdR-1 through MdR-5 are located in the upstream watershed (**Table 1-4**) to monitor the quality of stormwater and storm-borne sediment at selected storm events with 0.1 inch or more of rain. All locations will be monitored during effectiveness monitoring; locations MdR-3, MdR-4, and MdR-5 also during ambient monitoring.

- Monitoring locations MdRU-C-1 and MdRU-C-2 are also located in the upstream watershed (**Table 1-5**) but in an area of 282 acres that is under tidal influence. The samples will be collected from representative catch basins instead of the end of pipe to avoid tidal influence, and monitored for storm-borne sediment (effectiveness monitoring only) and stormwater (ambient and effectiveness monitoring).

The ambient monitoring program was started in August 2010 upon execution of an agreement for cost sharing by the responsible jurisdictions.

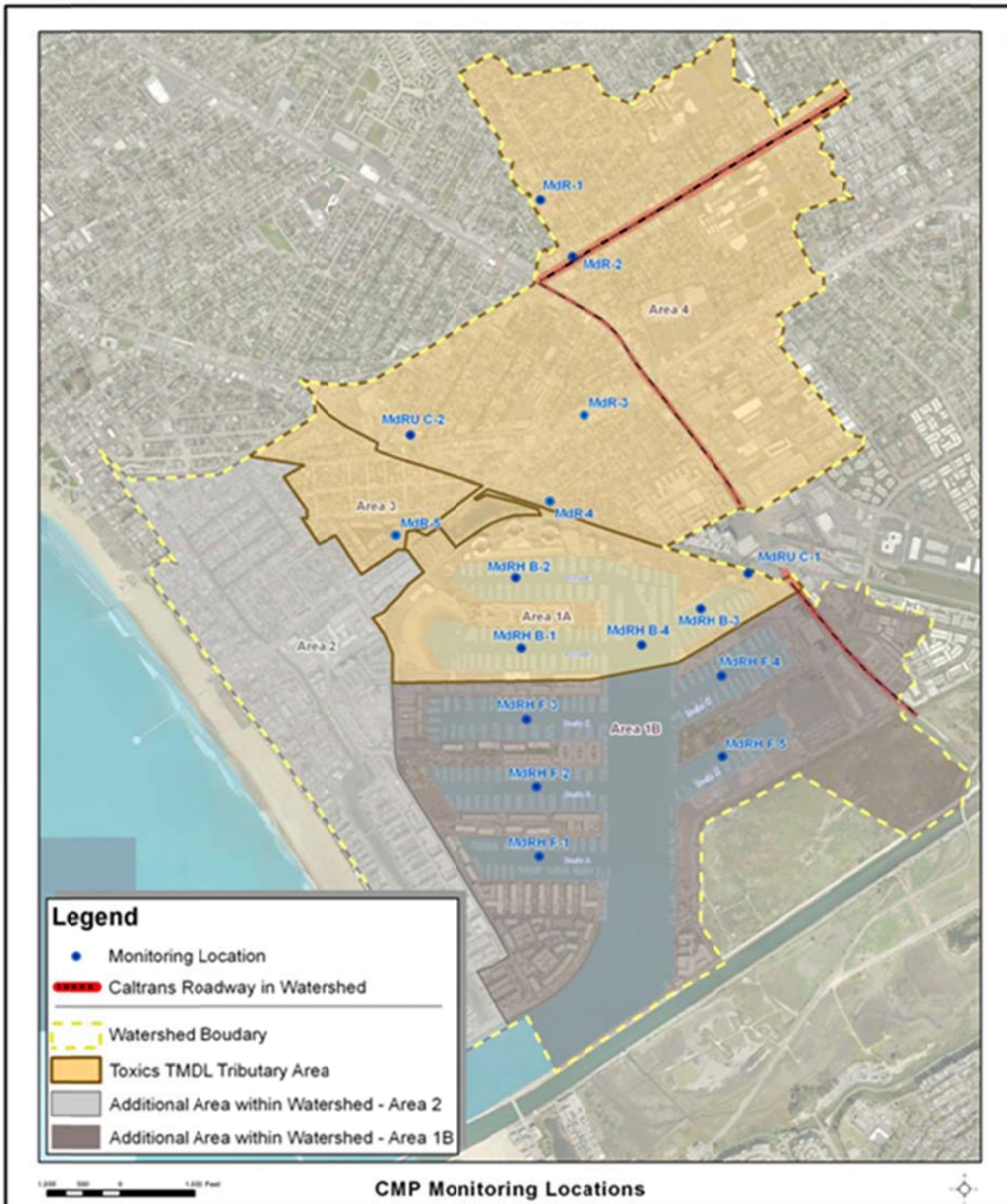


Figure 1-1. CMP Monitoring Locations

Table 1-2
TMDL Harbor Monitoring Sites in Front Basins

Station ID	MdRH-F-1	MdRH-F-2	MdRH-F-3	MdRH-F-4	MdRH-F-5
Location	Mid-channel of Basin A	Mid-channel of Basin B	Mid-channel of Basin C	Mid-channel of Basin G	Mid-channel of Basin H
Subwatershed	1B	1B	1B	1B	1B
Sampling Program	Copper in water column during ambient monitoring				

Table 1-3
TMDL HarborMonitoring Sites in Back Basins

Station ID	MdRH-B-1	MdRH-B-2	MdRH-B-3	MdRH-B-4
Location	Mid-channel of Basin D	Mid-channel of Basin E	Mid-channel of Basin F	End of Main Channel
Subwatershed	1A	1A	1A	1A
Sampling Program	Water quality (ambient only), benthic sediment quality and bioaccumulation	Water quality (ambient only), benthic sediment quality and bioaccumulation	Water quality (ambient only), benthic sediment quality and bioaccumulation	Water quality (ambient only), and benthic sediment quality

Table 1-4
TMDL Watershed Monitoring Sites

Station ID	MdR-1	MdR-2	MdR-3	MdR-4	MdR-5
Location	Victoria Ave &Penmar Ave.	200-ft south on Penmar Ave from intersection with Venice Blvd.	LFD[1] at Washington Blvd and Thatcher Ave.	LFD at east end of Oxford Flood Control Basin	LFD at Boone-Olive Pump Station control house
Subwatershed	Area 4	Area 4	Area 4	Area 4	Area 3
% of Watershed Tributary	10.4%	20.2%	40.9%	16.5	6.7%
Sampling Program	Stormwater and storm-borne sediment (Effectiveness only)	Stormwater and storm-borne sediment (Effectiveness only)	Stormwater and storm-borne sediment (ambient and effectiveness)	Stormwater and storm-borne sediment (ambient and effectiveness)	Stormwater and storm-borne sediment (ambient and effectiveness)

Notes:
1-LFD = Low Flow Diversion

Table 1-5
TMDL Land Use Specific Monitoring Sites

Station ID	MdRU-C-1	MdRU-C-2
Location	North of Bali and Admiralty Ways	North of Abbot Kinney Blvd and Woodlawn Ave
Subwatershed	1A	1A
% of Watershed Tributary	5.8% of total commercial land use within area not represented by other monitoring sites	12.2% of total high-density residential land use within area not represented by other monitoring sites
Sampling Program	stormwater quality (ambient and effectiveness)and storm-borne sediment (effectiveness)	

1.2.6 Toxics TMDL Compliance Requirements

The Toxics TMDL defines milestones for achieving compliance as follows:

- By **March 22, 2011**, MS4 and Caltrans stormwater NPDES permittees shall provide a written draft report to the LARWQCB outlining how they will achieve the waste load allocations for sediment in the Marina del Rey Harbor.
- By **September 22, 2011**, MS4 and Caltrans stormwater NPDES permittees shall provide a written final report to the Regional Board outlining how they will achieve the waste load allocations for sediment in the Marina del Rey Harbor.
- By **March 22, 2012**, the Regional Board shall reconsider this TMDL to re-evaluate the waste load allocations and the implementation schedule.
- By **March 22, 2013**, demonstrate that 25%of the total drainage area is effectively meeting the waste load allocation for sediment (**Table 1-1**).
- By **March 22, 2015,** demonstrate that 50%of the total drainage area is effectively meeting the waste load allocation for sediment (**Table 1-1**).
- By **March 22, 2017,** demonstrate that 75%of the total drainage area is effectively meeting the waste load allocation for sediment (**Table 1-1**).
- By **March 22, 2021,** demonstrate that 100%of the total drainage area is effectively meeting the waste load allocation for sediment (**Table 1-1**).

1.3 Adaptive Management

Adaptive management is an iterative process whereby the Marina del Rey Watershed Agencies will implement an initial suite of priority BMPs, meanwhile continuing with monitoring under the CMP to quantify progress towards meeting the TMDL's numeric targets. Adaptive management addresses the uncertainty regarding the efficacy of BMPs and the monitoring data used to characterize the impacted waterbodies. Refinements or improvements to BMPs or the analytical tools such as water quality models will also be undertaken, if necessary, after initiation of the Implementation Plan. Under the adaptive management process, the Marina Del Rey Watershed Agencies, in coordination with the LARWQCB, would identify and implement improved BMPs and apply the refined analytical tools using current water quality monitoring data.The adaptive management approach enables implementation of new BMPs with reduced uncertainty of their performance, and potentially improved cost-effectiveness.The outcome of this process could result in future periodic revisions to the Implementation Plan.

The Draft Implementation Plan was developed and submitted to the LARWQCB in March of 2011. This revision of the Implementation Plan was submitted in December 2012 and addresses the comments that were received in September 2012.

Section 2
Watershed Background

This section provides an overview of physical conditions (e.g., land use, topography and soils types), hydrologic conditions (e.g., precipitation and storm drain connectivity), and historic water quality in the Marina del Rey Watershed.

2.1 Marina del Rey Watershed

The Marina del Rey Watershed is approximately 1,855 acres (2.9 square miles) in size (**Figure 2-1**) and lies within the jurisdictions of the City of Los Angeles (53%), County of Los Angeles (44%), City of Culver City (2%), and Caltrans (1%). The watershed is bordered by the Santa Monica Bay Watershed and the Ballona Creek Watershed. Marina del Rey Harbor is open to Santa Monica Bay through the Main Channel and it shares a common breakwater with Ballona Creek. The Harbor consists of the Main Channel and eight basins (A-H). Mother's Beach is located at the west end of Basin D. **Figure 2-1** shows that there are five subwatersheds (or Areas) within the Marina del Rey Watershed. Subwatersheds 1A, 3 and 4 are tributary directly to the Back Basins (Basins D, E and F). Subwatershed Area 1B drains to the other basins of the Harbor. Subwatershed Area 2 does not drain to the Harbor but to the Ballona Lagoon.

The Marina del Rey Watershed was developed in two general stages. The area surrounding the Harbor was developed from the late 1800's into the early 1900's. The Marina was constructed in the early 1960s from the remnants of the Ballona Creek Wetlands and Estuary. Subsequently, Marina del Rey developed with construction of a variety of different facilities including housing, restaurants, commercial/retail, office, and marine/boating.

The Marina del Rey Watershed is unique in that it includes the Harbor, the area adjacent to the Harbor and the upper watershed, all of which have distinct activities and characteristics associated with them:

- The Harbor Area includes the docks, Front and Back Basins, Marina Beach, and the Main Channel. This area is part of the Los Angeles County unincorporated area.

- The land adjacent to the Front and Back Basins includes individual parcels, streets, and other facilities. This area is also part of the Los Angeles County unincorporated area and drains directly to the Harbor by sheet flow or through small, local drains.

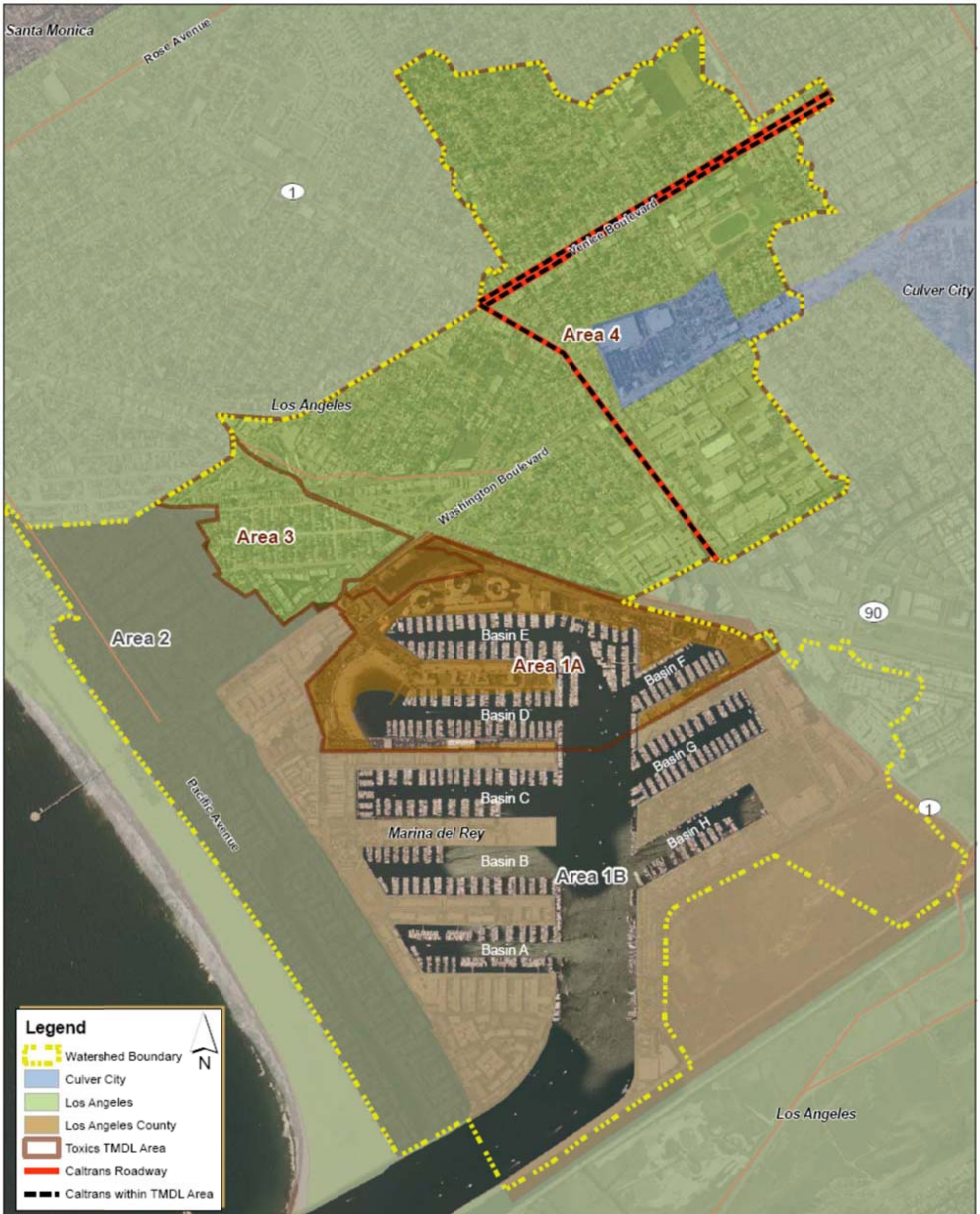


Figure 2-1 Watershed Layout

- The Upper Watershed Area drains to the Harbor via the storm drain network. This area is outside the Los Angeles County unincorporated areaand includes the Cities of Los Angeles and Culver City, and Caltrans right-of-ways, with the exception of theOxford Retention Basin (Oxford Basin) which is within the County of Los Angeles unincorporated area.

Because this Implementation Plan applies to the Cities of Los Angeles and Culver City and Caltrans, this plan only addresses pollutant load management in the upper watershed area.

2.2 Watershed Characteristics

2.2.1 Topography

Figure 2-2 illustrates the topography of the Marina del Rey Watershed. The area is relatively flat, draining towards the Harbor, and elevations range from sea level to approximately 15 feet above sea level at the uppermost part of the watershed.

2.2.2 Hydrologic Connectivity and Storm Drain Network

Hydrologic connectivity refers to the physical connections between a river or channel and its tributaries, between surface water and groundwater, and between wetlands and waterbodies.

Storm drainage throughout most of the Marina del Rey Watershed occurs through a network of underground pipelines (**Figure 2-3**). There are both City and County catch basins throughout the watershed which drain to these pipelines.

Oxford Basin is situated at the north end of Marina del Rey Harbor and drains to Basin E through two slide gates and a culvert system. Oxford Basin serves as a retention basin for the surrounding watershed and the slide gates control tidal influence on its water level. Los Angeles County Flood Control District (LACFCD) storm drain Project No. 52431 drains into the northeast corner of Oxford Basin and Project No. 3872 drains into the east side of Oxford Basin via Oxford Pump Plant. Project No. 3874 drains into Basin E via the Boone-Olive Pump Plant.

2.2.3 Land Use and Impervious Area

Land Use

The land use within Areas 1A, 3 and 4 are presented in **Table 2-1**.

Figure 2-2 Topography

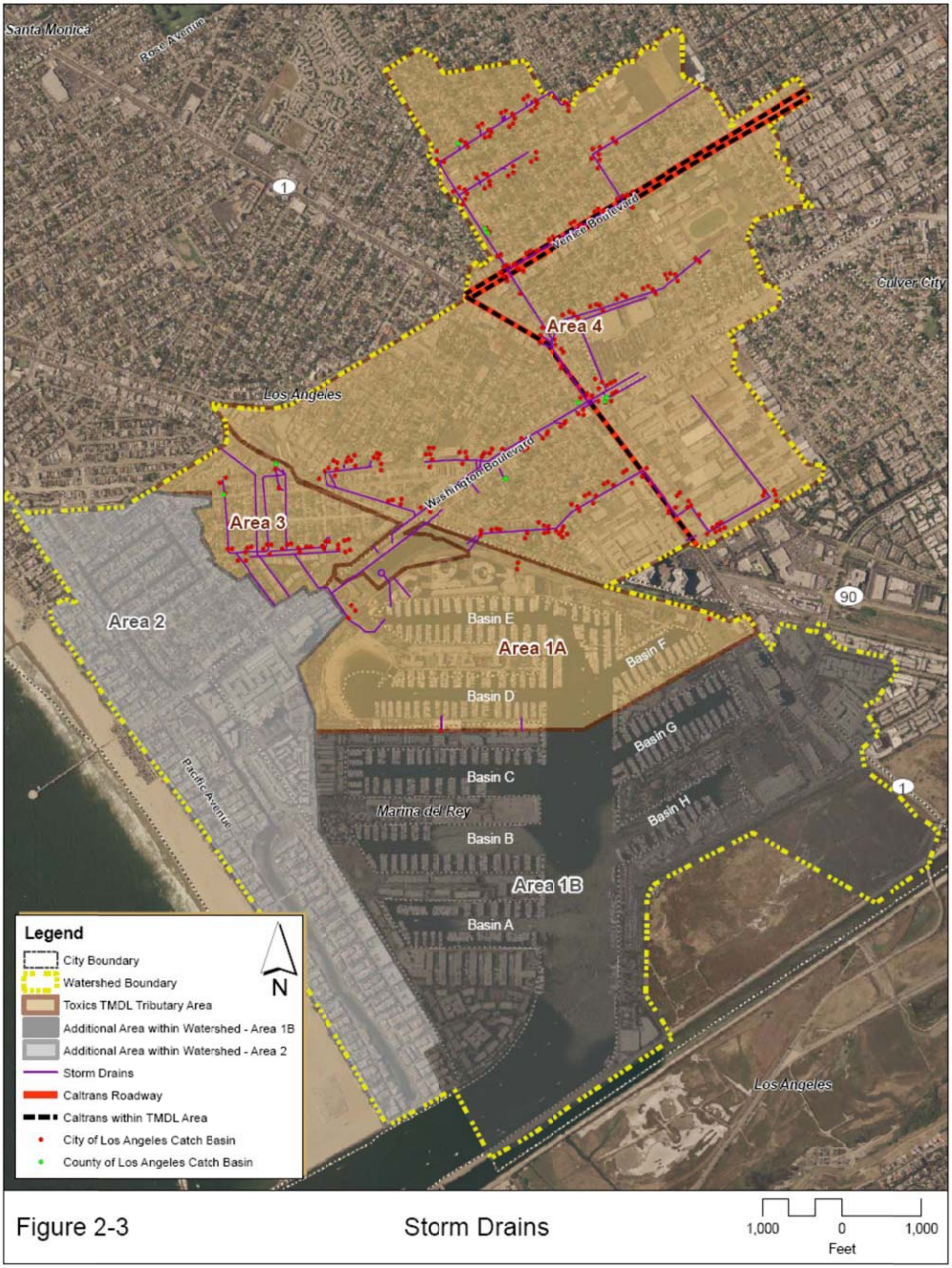


Figure 2-3 Storm Drains

Table 2-1
Marina del Rey Watershed Land Use in Areas 1A, 3 and 4

		Los Angeles, Culver City and Caltrans		**County**	
	Total (acres)	**Total (acres)**	**% of Total**	**Total (acres)**	**% of Total**
Area 1A					
Commercial / Institutional	47.67	0.17	0.1%	47.50	22.7%
Residential	33.01	0.02	0.0%	32.99	15.8%
Natural / Vacant	2.50	-	-	2.50	1.2%
Open Space / Recreation	16.57	-	-	16.57	7.9%
Mixed Urban	-	-	-	-	-
Industrial	-	-	-	-	-
Water / Wetlands	109.06	-	-	109.06	52.2%
Total Area 1A	**208.81**	**0.19**	**0.1%**	**208.25**	**99.9%**
Area 3					
Commercial / Institutional	1.31	1.31	1.9%	-	-
Residential	67.03	67.03	95.1%	-	-
Natural / Vacant	1.01	1.01	1.4%	-	-
Open Space / Recreation	-	-	-	-	-
Mixed Urban	-	-	-	-	-
Industrial	1.15	1.15	1.6%	-	-
Water / Wetlands	-	-	-	-	-
Total Area 3	**70.50**	**70.50**	**100.0%**	**0.0**	**0.0%**
Area 4					
Commercial / Institutional	184.98	183.06	27.3%	1.92	0.3%
Residential	393.69	391.42	58.3%	2.27	0.3%
Natural / Vacant	1.35	-	-	1.35	0.2%
Open Space / Recreation	1.22	-	-	1.22	0.2%
Mixed Urban	5.93	5.93	0.9%	-	-
Industrial	75.59	75.59	11.3%	-	-
Water / Wetlands	8.45	-	-	8.36	1.2%
Total Area 4	**671.22**	**656.10**	**97.7%**	**15.11**	**2.3%**
Total Areas 1A, 3 and 4	**950.53**	**726.79**	***76.5%***	**223.36**	***23.5%***

Note:
As Specified in LARWQCB Staff Report for the Toxics TMDL, Areas 1B and 2 do not drain to the back basins.

The City of Los Angeles, City of Culver City and Caltrans are almost exclusively in Areas 3 and 4. Unincorporated area of the County of Los Angeles is almost exclusively in Area 1A (and Area 1B that drains to the front basins), with the exception of Oxford Basin and its surrounding area which is located in Area 4.

Therefore, for the purposes of this Implementation Plan, it is assumed that the Cities of Los Angeles and Culver City and Caltrans are responsible for Areas 3 and 4 only (excluding the portions that are under the jurisdiction of the County of Los Angeles). This essentially is the Upper Watershed Area (**Figure 2-1**) as identified in **Section 2.1**.

Table 2-2 summarizes the land use breakdown for Areas 3 and 4 combined. The land use distribution in **Figure 2-4** shows that the Upper Watershed Area is predominantly residential and commercial.

Table 2-2
Land Use in Areas 3 and 4

Land Use	Area (acres)	% of Total
Commercial / Institutional	186.29	25%
Residential	460.72	62%
Natural / Vacant	2.36	0%
Open Space / Recreation	1.22	0%
Mixed Urban	5.93	1%
Industrial	76.74	10%
Water / Wetlands[1]	8.45	1%
Total	**741.72**	**100%**

Note:
[1] The water/wetlands area is 99 % under the County's jurisdiction. This area includes the Oxford Basin.

Impervious Areas

Imperviousness is a measure of the fraction of the total area covered by impervious surfaces, such as roads, rooftops,sidewalks, patios, parking areas, and highly compacted soil. Rainfall and dry weather water sources (e.g., irrigation, car washing, etc.) that fall on pervious surfaces havethe best opportunity to infiltrate into the ground and reduce the total amount of runoff generated from an area. The degree to which infiltration is expected to occur in pervious areas is related to soil types and associated infiltration rates (**Section 2.2.5**).

The Los Angeles County Department of Public Works (LACDPW) Hydrology Manual assigns an imperviousness factor to a number of land use types (LACDPW, 2006) (**Table 2-1**). Higher numbers indicate greater imperviousness. With a potential range of 0 to 1, the weighted average imperviousness factorfor Areas 3 and 4 of the Marina del ReyWatershed is estimated to be 0.80.

2.2.4 Soil Types

Soil types are an integral factor in determining how much runoff can infiltrate into the ground. This is an important component in evaluating the feasibility of siting an infiltration BMP. **Figure 2-5** identifies the primary soil types and presents their geographic distribution in the watershed (LACDPW Hydrology GIS Database). Note that soil type is only one factor in identifying ideal sites for infiltration BMPs. Other factors, such as depth to groundwater and geotechnical issues, are also important.

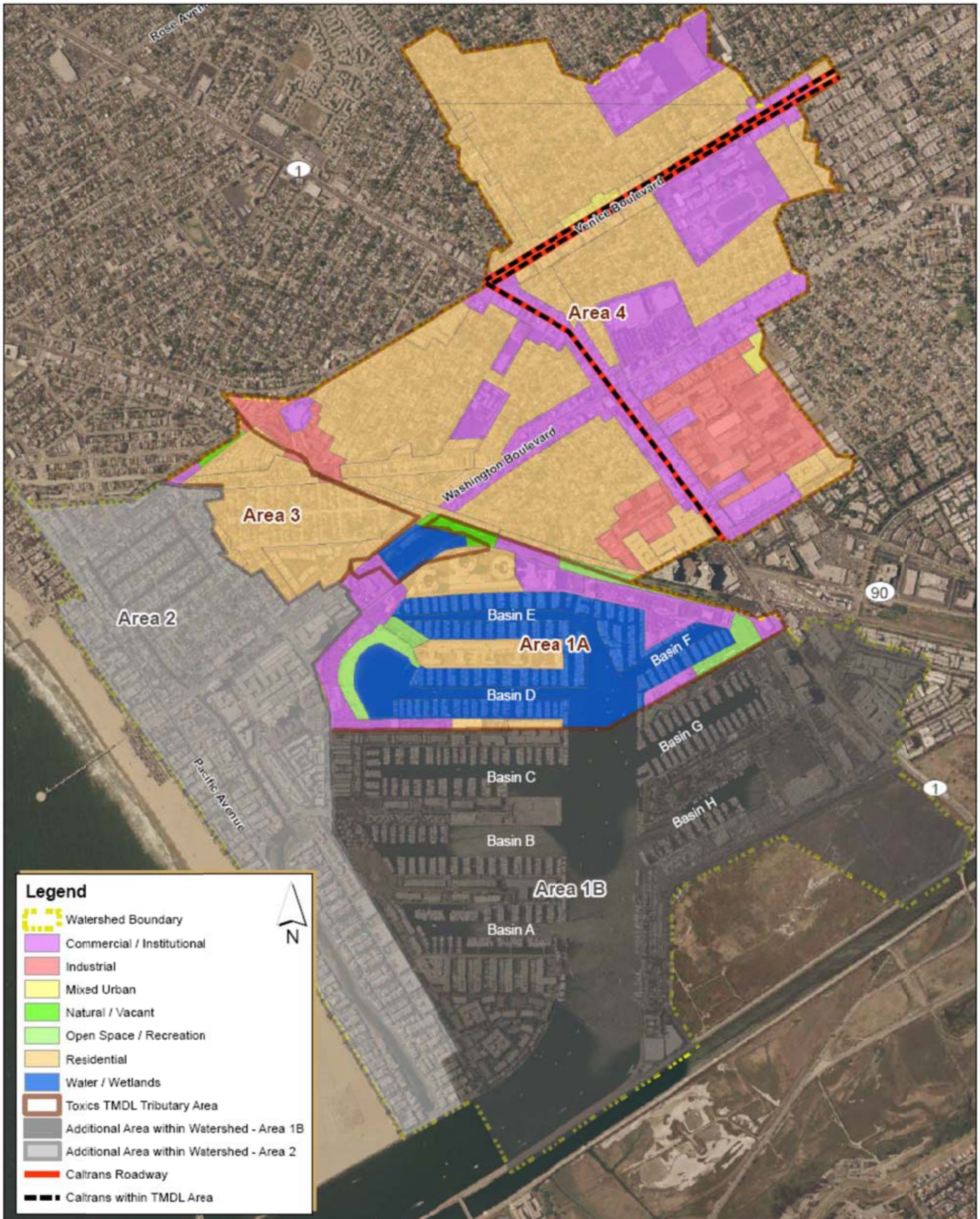


Figure 2-4 Land Use

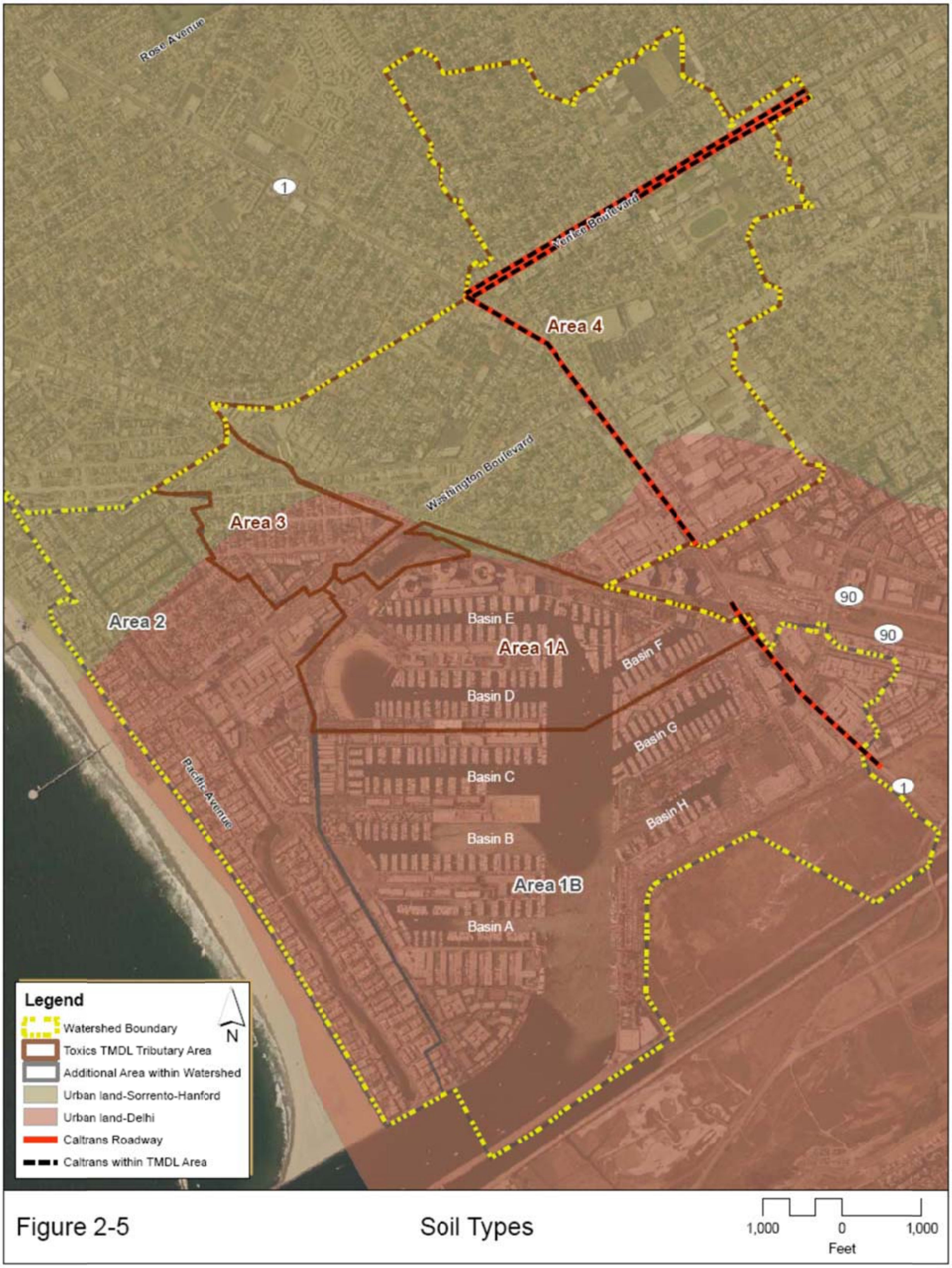


Figure 2-5 Soil Types

2.2.5 Liquefaction and Landslide Zones

Liquefaction refers to the behavior of soils (e.g. loose sand) that, under conditions such as an earthquake, shift from a solid state to a liquefied state with a consistency similar to that of a heavy liquid. This occurs in saturated soils where the water pressure increases with the earthquake eventand changes the behavior of the soil. Soil liquefaction can cause tremendous damage during earthquakes. Liquefaction zone areas in the watershed are located throughout the entire watershed with the exception of the uppermost portion (**Figure 2-6**). Liquefaction potential may preclude siting of typical structural infiltration BMPs in these areas.

Landslides occur when a slope's stability changes from stable to unstable, causing the ground to move. Landslides can be caused by many natural factors, including earthquakes, increased groundwater pressure, heavy rains, and human factors, including the use of heavy machinery, blasting, and earthwork. There are no landslide areas within the Marina del Rey Watershed.

2.2.6 Rainfall Data Summaries

The Marina del Rey Watershed climate can be characterized as Mediterranean with average annual rainfall of approximately 12 inches per year over most of the watershed. **Table 2-3** summarizes rainfall data from 1998 to 2008 from Los Angeles County Gauge 634C in the Santa Monica area (monthly totals, max/min rainfall data, and yearly summaries).

2.3 Sediment and Water QualityData

2.3.1 Initial Data for Draft Implementation Plan

The responsible agencies are required to collect water, fish tissue, mussel tissue and sediment quality data to evaluate compliance with theToxics TMDL and to assist in the design and sizing of BMPs. At the time of the preparation of the Draft Implementation Plan, only limited monitoring results were available as included in **Appendix B**:

- ***Appendix B Part 1***: First Quarterly Report: August to October 2010 – this report includes: 1) water column data which did not include analysis of constituents found in water borne sediments; and 2) benthic sediment data. All benthic sediment results were "not detectable".

- ***Appendix B Part 2***: Marina del Rey Harbor Sediment Characterization Study – this report includes results of sediment samples taken from the bottom of the Harbor at various points.

Figure 2-6 Liquefaction and Land Slide Zones

Available sediment quality data are not directly applicable to estimate the baseline pollutant loadings in storm-borne sediment from Areas 3 and 4 for comparison to the WLAs. Sediment samples taken from the Harbor bottom not only reflect discharges of storm-borne sediment from the upper watershed, but also the discharges from Harbor activities and from the areas adjacent to the basins. As will be discussed in **Section 3.3**, these contributions from the Harbor and immediate surroundings could be significant (which is recognized in the TMDL Staff Report to be sources of pollutants[1]). Therefore, the use of Harbor sediment data would result in an overestimation of the actual baseline pollutant loadings from Areas 3 and 4. A more accurate estimation of the baseline pollutant loading would require the analysis of storm-borne sediment collected from stormwater in Areas 3 and 4, but these data will only become available as CMP implementation progresses over the upcoming years.

Due to the lack of appropriate data at the time of developing this Draft Implementation Plan, it was decided to use the data of the Toxicity Identification Study (TIE) study that was recently completed for the adjacent Ballona Creek Estuary. The use of TIE is the best option available at this time because:

- The upstream watershed areas of the Marina del Rey and Ballona Creek watersheds are in close vicinity and very similar in land use characteristics.
- Sediment in Ballona Creek Estuary is not impacted by harbor activities or boat discharges as Ballona Creek and its Estuary are not navigated by any vessels.

Accordingly, the TIE data were considered to be more representative of pollutant concentrations in storm-borne sediment from Areas 3 and 4 than the Harbor sediment data.

The TIE sediment quality data used for developing this Draft Implementation Plan cover the period from September 2007 to September 2009 and were from six locations in Ballona Creek Estuary (Appendix B Part 3). A summary of the TIE results is presented in **Table 2-4**, which includes a comparison of the average pollutant concentrations in sediment with the numeric limits for the same pollutants specified in the Marina del Rey Toxics TMDL.

[1] Per the LARWQCB Staff Report, page 28, sources of pollutants from marina activities (under County of Los Angeles jurisdiction, which are not included in this Implementation Plan) include: “Elevated metal concentrations occur in the middle and back basins of Marina del ReyHarbor. The numerous boats that utilize the Marina are a likely contributor to the metalsimpairment in this area. Boats have metal components and engines that constantlycorrode from salt water and air. Anti-fouling paints contain heavy metals such as copperthat are designed to constantly ablate or leach out (passive leaching) to effectively reducefouling organisms. Lead and zinc concentrations were also found in high amounts in theback harbor sediments. These metals might have originated from the historical industrialland uses of the Marina or have been derived from boating activity, including copper andlead in the boat paints, and zinc in the anodes of boat engines.”

Table 2-3
Precipitation Summary (inches) based on Daily Precipitation Records in the Santa Monica Area, November 1998 to May 2008, Los Angeles County Gauge 634C

Year		Statistic	Month												Year Total
From	To		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
1998	1999	Monthly Total		1.09	0.64	1.00	0.82	1.99	1.74		0.37				7.65
		Mean		*0.36*	*0.21*	*0.25*	*0.21*	*0.33*	*0.44*		*0.12*				
		Max Day		*0.86*	*0.45*	*0.38*	*0.58*	*1.15*	*0.82*		*0.28*				
		Min Day		*0.06*	*0.05*	*0.12*	*0.04*	*0.02*	*0.13*		*0.02*				
		# Rain Days		*3*	*3*	*4*	*4*	*6*	*4*		*3*				*27*
1999	2000	Monthly Total				1.41	5.48	2.13	1.47	0.05				0.02	10.56
		Mean				*0.20*	*0.55*	*0.36*	*0.74*	*0.05*				*0.02*	
		Max Day				*0.69*	*1.65*	*1.27*	*1.02*	*0.05*				*0.02*	
		Min Day				*0.02*	*0.10*	*0.01*	*0.45*	*0.05*				*0.02*	
		# Rain Days				*7*	*10*	*6*	*2*	*1*				*1*	*27*
2000	2001	Monthly Total	0.01		0.02	6.05	7.29	1.66	0.73						15.76
		Mean	*0.01*		*0.02*	*0.76*	*0.52*	*0.55*	*0.37*						
		Max Day	*0.01*		*0.02*	*3.25*	*2.03*	*0.80*	*0.40*						
		Min Day	*0.01*		*0.02*	*0.01*	*0.02*	*0.10*	*0.33*						
		# Rain Days	*1*		*1*	*8*	*14*	*3*	*2*						*29*
2001	2002	Monthly Total	0.09	2.00	0.95	0.40	0.30	0.32	0.05						4.11
		Mean	*0.05*	*0.40*	*0.16*	*0.13*	*0.30*	*0.08*	*0.05*						
		Max Day	*0.07*	*0.91*	*0.30*	*0.25*	*0.30*	*0.17*	*0.05*						
		Min Day	*0.02*	*0.03*	*0.02*	*0.03*	*0.30*	*0.01*	*0.05*						
		# Rain Days	*2*	*5*	*6*	*3*	*1*	*4*	*1*						*22*

Table 2-3
Precipitation Summary (inches) based on Daily Precipitation Records in the Santa Monica Area, November 1998 to May 2008, Los Angeles County Gauge 634C

Year		Statistic	Month												Year Total
From	To		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
2002	2003	Monthly Total		2.04	2.44		4.49	2.52	1.31	1.54	0.04	0.06			14.44
		Mean		*0.41*	*0.35*		*0.75*	*0.84*	*0.17*	*0.39*	*0.02*	*0.03*			
		Max Day		*1.53*	*1.00*		*3.08*	*2.00*	*0.46*	*1.15*	*0.03*	*0.05*			
		Min Day		*0.01*	*0.03*		*0.05*	*0.07*	*0.01*	*0.03*	*0.01*	*0.01*			
		# Rain Days		*5*	*7*		*6*	*3*	*5*	*4*	*2*	*2*			*34*
2003	2004	Monthly Total	0.04	1.29	0.91	1.04	4.20	0.84	0.01					0.01	8.34
		Mean	*0.02*	*0.26*	*0.13*	*0.09*	*0.47*	*0.21*	*0.01*					*0.01*	
		Max Day	*0.03*	*0.95*	*0.57*	*0.42*	*2.50*	*0.79*	*0.01*					*0.01*	
		Min Day	*0.01*	*0.02*	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*					*0.01*	
		# Rain Days	*2*	*5*	*7*	*5*	*9*	*4*	*1*					*1*	*34*
2004	2005	Monthly Total	3.13	0.50	6.03	8.50	11.68	1.56	0.87	0.15				0.20	32.62
		Mean	*0.52*	*0.13*	*0.67*	*0.85*	*1.06*	*0.20*	*0.44*	*0.05*				*0.20*	
		Max Day	*1.26*	*0.30*	*2.25*	*1.87*	*3.88*	*1.10*	*0.85*	*0.09*				*0.20*	
		Min Day	*0.05*	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*	*0.02*	*0.01*				*0.20*	
		# Rain Days	*6*	*4*	*9*	*10*	*11*	*8*	*2*	*3*				*1*	*54*
2005	2006	Monthly Total	1.16	0.38	1.50	2.40	1.30	2.54	2.05	0.68	0.01				12.02
		Mean	*0.39*	*0.19*	*0.38*	*0.60*	*0.33*	*0.32*	*0.26*	*0.68*	*0.01*				
		Max Day	*0.57*	*0.32*	*1.18*	*1.38*	*0.67*	*0.92*	*1.10*	*0.68*	*0.01*				
		Min Day	*0.03*	*0.06*	*0.01*	*0.12*	*0.10*	*0.01*	*0.01*	*0.68*	*0.01*				
		# Rain Days	*3*	*2*	*4*	*4*	*4*	*8*	*8*	*1*	*1*				*35*

Table 2-3
Precipitation Summary (inches) based on Daily Precipitation Records in the Santa Monica Area, November 1998 to May 2008, Los Angeles County Gauge 634C

Year		Statistic	Month												Year Total
From	**To**		**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	
2006	2007	Monthly Total	0.01	0.13	0.51	0.53	0.67	0.02	0.44			0.01		0.95	3.27
		Mean	*0.01*	*0.13*	*0.17*	*0.08*	*0.13*	*0.01*	*0.22*			*0.01*		*0.95*	
		Max Day	*0.01*	*0.13*	*0.30*	*0.36*	*0.23*	*0.01*	*0.36*			*0.01*		*0.95*	
		Min Day	*0.01*	*0.13*	*0.09*	*0.01*	*0.04*	*0.01*	*0.08*			*0.01*		*0.01*	
		# Rain Days	*1*	*1*	*3*	*7*	*5*	*2*	*2*			*1*		*1*	*23*
2007	2008	Monthly Total	1.12	0.61	1.98	4.39	1.58		0.05	0.06					9.79
		Mean	*0.56*	*0.31*	*0.28*	*0.40*	*0.40*		*0.05*	*0.06*					
		Max Day	*1.11*	*0.60*	*1.08*	*1.03*	*0.77*		*0.05*	*0.06*					
		Min Day	*0.01*	*0.01*	*0.01*	*0.02*	*0.01*		*0.05*	*0.06*					
2007	2008	Monthly Total	1.12	0.61	1.98	4.39	1.58		0.05	0.06					9.79
		# Rain Days	*2*	*2*	*7*	*11*	*4*		*1*	*1*					*28*
Average by month of each parameter for the total period from Nov 1998 to May 2008 (based on daily precipitation):															
Average Monthly Total			0.62	0.80	1.50	2.57	3.78	1.36	0.87	0.28	0.05	0.01	0	0.13	11.96
Average of each Mean			0.17	0.22	0.24	0.34	0.47	0.29	0.27	0.14	0.02	0.00	0	0.13	
Average Max Day			0.34	0.56	0.72	0.96	1.57	0.82	0.51	0.23	0.04	0.01	0	0.13	
Average Min Day			0.02	0.03	0.03	0.04	0.07	0.03	0.11	0.09	0.00	0.00	0	0.03	
Average # rain of days			1.9	2.7	4.7	5.9	6.8	4.4	2.8	1.1	0.7	0.3	0	0.4	31.7

Notes:
"Monthly Total" is the sum of all rainfall that month
"Mean" is the average of each daily rain event by month, for days that it rained
"Max Day" is the maximum rainfall observed for the days that had rain that month
"Min Day" is the minimum rainfall observed for the days that had rain that month
"# of Rain Days" is a count of the total number of days that it rained that month
"Average by month of each parameter for the total period from Nov 1998 to May 2008 (based on daily precipitation)" is the average by month over the entire period based on daily rainfall. The averages include zeros for months that had no rainfall
Source: Los Angeles County Gauge 634C, Santa Monica area

Table 2-4
TMDL Numeric Limits Compared to Average Concentration Measured during the Ballona Creek Watershed TIE Study

Constituent	Unit	TMDL Numeric Target	Average TIE Study Results[1,2]
Copper	mg/kg	34	35.58
Lead	mg/kg	46.7	26.96
Zinc	mg/kg	150	147.67
Chlordane	ug/kg	0.5	2.53
PCBs	ug/kg	22.7	1.96

Source: 2007-2009 TIE results. See Appendix B.
Note:
[1]Samples were taken at six sampling locations in September and October 2007, June 2008, and August 2009.
[2]For each constituent, the values presented are the average of all of the six sampling locations over all of the sampling events.

2.3.2 Data from CMP Monitoring (2010-2012)

Implementation of the CMP was initiated in August 2010 and is coordinated by the County of Los Angeles as the lead agency for the Toxics TMDL. The CMP provides for an extensive program of monitoring of the water column and sediment in the Back Basins as well as stormwater quality from the upper watershed area. The first annual monitoring report (August 2010-July 2011) was submitted to the LARWQCB in January, 2012. The second annual monitoring report (August 2011-July 2012) is anticipated to be submitted in December 2012.

CMP monitoring provides additional information that was not available at the time of developing the draft Implementation Plan. This section summarizes the recent results, focusing on those results that may have an impact on the strategies for compliance with the WLAs. More detailed summaries of monitoring data are provided in **Appendix D**.

Harbor water and sediment

Since August 2010, the Back Basins are being monitored on a monthly basis during dry weather for toxic pollutants in the water column. The results of two years of monitoring are summarized in **Table 2-5**, providing the following conclusions:

- Copper: the CTR target for chronic toxicity of 3.1 µg/L was exceeded at all locations. Average copper concentrations inBack Basins D and E also exceeded the CTR target for acute toxicity of 4.8 µg/L.
- Lead and zinc: none of the locations exceeded the CTR targets for chronic or acute toxicity.

- Chlordane and PCBs: all samples were below the detection limit 0.069 and 0.21 µg/L, respectively. As these detection limits are above the CTR targets, it cannot be determined from the CMP monitoring data if the water column in the Back Basins meets the CTR targets for chlordane and PCBs.

Table 2-5
Average concentrations of toxic pollutants in the water column of Back Basins (August 2010-July 2012)

Constituent	Unit	MdRH-B-1	MdRH-B-2	MdRH-B-3	MdRH-B-4
Copper	Total, µg/L	7.65	7.65	6.02	6.09
	Dissolved, µg/L	6.42	5.39	4.07	4.33
Lead	Total, µg/L	0.86	0.72	0.71	0.65
	Dissolved, µg/L	0.35	0.14	0.15	0.15
Zinc	Total, µg/L	48.3	53.1	37.6	38.6
	Dissolved, µg/L	27.1	45.8	31.1	33.1
Chlordane[1]	µg/L	ND	ND	ND	ND
PCBs[2]	µg/L	ND	ND	ND	ND

Note:
[1] ND = non detect; method detection limit = 0.069 µ/L
[2]ND = non detect; method detection limit = 0.21 µ/L

The Partitioning Coefficient Special Study determined that copper concentrations during dry weather were in general the highest at the surface, lower at mid-depth, and the lowest at the bottom above the sediment. This may indicate that copper diffuses from the surfaces to deeper levels during dry weather.

Toxic pollutants in sediment of the Back Basins were determined on a quarterly basis and average concentrations are shown in **Table 2-6**. Copper, lead and zinc exceeded the numeric targets of these metals in sediment: copper concentrations were about 10 times the limit, whereas lead and zinc concentrations were about twice their limits. PCBs were non-detect in the Back Basins on two of the eight sampling events at a method detection limit of 20-25µg/kg. The results in **Table 2-6** are the average concentrations of the six sampling events where PCBs were detected. For those events where PCBs were detected, the average concentration was 2-3 times higher than the numeric target of 22.7 µg/kg. Chlordane was never detected at a method detection limit of about 20 µg/kg. As the numeric target for chlordane is well below the detection limit, the current results are inconclusive whether the sediment in the Back Basins meets the numeric targets for chlordane.

Table 2-6
Average concentrations of toxic pollutants in harbor Back Basins sediment (August 2010-July 2012)

Constituent	Unit	MdRH-B-1	MdRH-B-2	MdRH-B-3	MdRH-B-4
Copper	mg/kg	319	415	363	235
Lead	mg/kg	64	83	82	60
Zinc	mg/kg	320	395	338	261
Chlordane[1]	µg/kg	ND	ND	ND	ND
PCBs[2]	µg/kg	56	66	67	51

Note:
[1] ND = non detect; average method detection limit = ~ 20 µg/kg
[2]Average of six sampling events; PCBs were below method detection limit in all Back Basins during two sampling events.

Toxicity testing was conducted quarterly at stations MdRH-B-1 through MdRH-B-4 which confirmed that sediments in the Back Basins exhibited toxicity as compared to laboratory controls (results are shown for the first year of CMP monitoring, 2010-11):

- Survival rate of Leptocheirusplumulosus, 28 days: 2-60%
- Survival rate of Eohaustoriusestuarius, 10- days: 68-97%
- Growth of Leptocheirusplumulosus, 28 days: 0.02 – 0.31 mg
- Reproduction of Leptocheirusplumulosus, 28 days: 0-0.05
- Development rate of Mytilusgalloprovincialis, 48 hours: 91-99%
- Fertilization rate of Strongylocentrotus Perpetrates, 20 minutes: 44-97%

Stormwater

Stormwater sampling in the areas draining to the Back Basins is conducted during first three years of CMP implementation (2010-13, ambient monitoring) at monitoring stations MdR-3, MdR-4, MdR-5, MdRU-C1, and MdRU-C2 (**Figure 1-1**). Monitoring at the two most upstream stations in the watershed (MdR-1 and MdR-2) will commence during effectiveness monitoring. Currently, two years of stormwater monitoring have been conducted with 9 storm events in the 2010-11 wet season and 8 storm events in the 2011-12 wet season. In general, concentrations in the 2011-2012 season were higher than in the 2010-2011 season (**Appendix D**). The results presented in **Table 2-7** are the average concentrations over both seasons.

Table 2-7

Average concentrations of toxic pollutants instormwater from the upstream watershed (August 2010-July 2012)

Constituent	Unit	MdRB-3	MdRB-4	MdRB-5	MdRU-C1	MdRU-C2
Copper	Total, µg/L	48.6	33.3	29.9	37.2	34.2
	Dissolved, µg/L	18.8	16.7	15.6	17.5	17.7
Lead	Total, µg/L	20.8	6.38[1]	10.1	15.7	29.4
	Dissolved, µg/L	2.26[1]	1.38[1]	2.63[1]	6.77[1]	2.23[1]
Zinc	Total, µg/L	274	202	139	113	98.4
	Dissolved, µg/L	139	154	95.6	68.3	52.2
Chlordane[2]	µg/L	ND	ND	ND	ND	ND
PCBs[3]	µg/L	ND	ND	ND	ND	ND

Note:
[1]Average concentration in 2011-2012 season; lead was not detected in the 2010-2011 season at a detection limit of 4.6 µg/L
[2]Nondetect at method detection limit of 0.05 µg/L
[3]Non detect at method detection limit of 0.1 µg/L

Pollutant concentrations in stormwater follow more or less the same pattern at the various sampling locations in the upper watershed:

- Average dissolved copper concentrations were well above the CTR targets for acute and chronic toxicity.
- Average dissolved lead concentrations were well below the CTR targets for acute and chronic toxicity.
- Average dissolved zinc concentrations exceeded the CTR targets at MdR-3, MdR-4 and MdR-5, but were below these targets in the under-represented area (MdRU-C1 and MdRU-C2).
- Chlordane and PCBs were not detected in stormwater samples, but the method detection limits were above the CTR targets. Hence, it cannot be determined if the targets were met or not.

Pollutant loading estimates

Determination of actual pollutant loadings from the upstream watershed requires the amount of stormwater discharged to the Back Basins, the concentration of storm-borne sediment in stormwater, and the concentrations of pollutants in storm-borne sediment. If one or more of these parameters are not known, pollutant loadings can only be estimated by making certain assumptions. The Draft Implementation Plan in

Section 3.3.1 estimated the baseline loadings of individual pollutants as the product of the baseline sediment loading rate (64,166 kg/yr) and sediment pollutant concentrations as determined by the Toxicity Identification Evaluation Special Study for Ballona Creek Estuary sediments in 2007-2009. CMP monitoring over 2010-2012 included stormwater sampling, thereby providing additional information about pollutant discharges from the upstream watershed. However, CMP monitoring did not include analyses of storm-borne sediment which would have been necessary to determine the actual pollutant loadings. An approximation of pollutant loadings from the upstream watershed is to use the total (recoverable) concentration instead, although this approach overestimates the pollutants loadings associated with storm-borne sediment.

A total of nine storm events were monitored in the 2010-2011 season, which corresponds to an amount of rain of 11.94 inches (**Table 2-8**). This amount is close to the annual average, and close to the total amount of rain in 2010-2011 (i.e., 16.9 inches), indicating that the nine storm events that were sampled can be considered representative of the entire storm season. The total estimated volume of each storm event was calculated by adding up the estimates of storm event volumes at each individual monitoring location that was sampled (MdR-3, MdR-4, MdR-5, MdRU-C1, MdRU-C2; total drainage area of about 600 acres or 82% of the area of upstream watershed). Storm event volumes were determined by the County of Los Angeles using different methodologies: 1) measured water levels and the Manning equation; 2) data from the Boon-Olive Pump Station; or 3) by assuming that the estimated runoff volume is 60% of the amount of rainfall.

Table 2-9 provides estimated pollutant loadings of copper, lead and zinc from the upstream watershed to the Back Basins, specified by storm event. These loadings were calculated from the estimated volumes of stormwater (**Table 2-8**) and the total recoverable metals concentrations in stormwater (**Table 2-7**).**Table 2-9** does not include pollutant loading estimates for chlordane and PCBs because both constituents were not detected in any of the stormwater samples. However, pollutant loadings of total PCBs were estimated from PCB concentrations in harbor sediment (**Table 2-6**) and multiplied by the baseline sediment loading rate (64,166 kg/yr). This resulted in a tentative loading of total PCBs of 3.9 g/yr. Pollutant loadings of chlordane are not possible at this time as chlordane has not been detected in stormwater or in harbor sediments.

Table 2-8

Storm events monitored in 2010-2011 wet season

Storm event date	Rainfall (inch)	Estimated total runoffvolume(MG)
12/17/10 – 12/22/10	6.39	52.84
12/25/10 – 12/26/10	0.72	4.95
12/29/10 – 12/30/10	0.59	3.17
1/2/11 – 1/3/11	0.44	2.73
2/16/11 – 2/17/11	0.32	5.25
2/19/11 – 2/19/11	0.42	5.37
2/25/11 – 2/26/11	0.57	12.34
3/19/11 – 3/21/11	2.22	34.33
3/24/11 – 3/25/11	0.27	14.31
Total	11.94	135

Table 2-9

Estimated pollutant loadings from upstream watershed to the Back Basins

(2010-2011 wet season)

Storm event date	Copper(kg)	Lead[1](kg)	Zinc(kg)
12/17/10 – 12/22/10	4.83	0.17	15.73
12/25/10 – 12/26/10	0.54	0.077	1.43
12/29/10 – 12/30/10	0.12	0.028	0.84
1/2/11 – 1/3/11	0.22	0.058	1.12
2/16/11 – 2/17/11	0.47	0.049	1.50
2/19/11 – 2/19/11	1.82	0.94	10.59
2/25/11 – 2/26/11	1.10	0.58	7.44
3/19/11 – 3/21/11	3.39	1.11	19.38
3/24/11 – 3/25/11	1.31	0.82	6.83
Total	13.8	3.83	64.85

Note:

[1] For storm events when lead was not detected, pollutant loadings were determined by assuming a concentration of one half of the method detection limit.

2.3.3 Data from Special Studies

Two special studies required by the Toxics TMDL have been completed since the development of the Draft Implementation Plan:

- Low Detection Level Special Study: The objective of this study was to evaluate low detection level techniques to determine water quality concentrations for those contaminants where standard detection limits cannot be used to assess California Toxic Rule standards or are not sufficient for estimating source loadings from tributaries and stormwater. The final report was submitted to the LARWQCB on December 22, 2011.

- Partitioning Coefficient Study: The objective of this study was to evaluate partitioning coefficients between the water column and sediment to assess the contribution of water column discharges to sediment concentrations in the harbor. This study mostly focused on copper, but also addressed lead and zinc. The final report was submitted to the LARWQCB on December 22, 2011.

The primary focus of these special studies was on the Back Basins but several results, in particular those for PCBs and chlordane,should be considered in future revisions of this Implementation Plan:

- Copper concentrations in storm-borne sediment ranged from 121 to 2381 mg/kg with an estimated average concentration of about 800 mg/kg. This concentration is about 2-3 times higher than the average concentration of copper in sediments of the Back Basins.

- The concentration of total PCBs in storm-borne sediment was in the range of 100 to 180 µg/kg, which is 4-8 times higher than the TMDL target of 22.7µg/kg.

- Using analytical procedures with a lower detection limit, chlordane was detected in some of the stormwater samples at an average concentration of 1.5 µg/L.

These results tentatively confirm the findings of CMP monitoring that stormwater from the upstream watershed is (one of) the sourcesof the constituents listed in the Toxics TMDL, and that pollutant loadings from the watershed are probably higher than was initially determined by using Ballona Estuary sediment concentrations.

Section 3
Draft Implementation Plan (March 2011)

This Draft Implementation Plan emphasizes the use of watershed-based strategies that combine structural and institutional BMPs. These BMPs decrease pollutant loading through implementation of localized source control activities and reductions in the amount of dry and wet weather anthropogenic/urban runoff. This chapter describes the planned and existing institutional and structural BMPs, quantify the expected load reduction from quantifiable BMPs, compare the resulting pollutant loads to the TMDL WLAs, and provide a schedule for implementation. The approach to developing this Implementation Plan is based on an Integrated Water Resources Approach and similar to the approach followed by the City of Los Angeles for development of the Ballona Creek TMDL Implementation Plans.

As there were no storm-borne sediment data available for the Marina del Rey watershed at the time of developing this Draft Implementation Plan, quantification of pollutant load reductions and comparison to TMDL WLAs was mostly based on Ballona Estuary sediment data as summarized in **Section 2.3.1**. Revisions to the Implementation Plan to address newly available data (discussed in **Section 2.3.2**) are included in **Section 4**.

3.1 Institutional BMPs

Institutional BMPs reduce pollutant loads by either reducing the source of a pollutant or capturing built-up pollutants before they can be washed off by stormwater. Information about the institutional BMPs described here was obtained from existing BMP implementation in the Marina del Rey Watershed, BMP implementation in the Ballona Creek Watershed, and programs implemented elsewhere in the United States. For those BMPs already undergoing implementation in the watershed, the evaluation considered how BMPs could be enhanced to provide additional water quality benefits for the Toxics TMDL.

Quantifying toxic pollutant sources in urban watersheds is difficult because sources and activities that mobilize these pollutants are numerous and diverse. In addition, some BMPs do not lend themselves well to quantifying the water quality benefits, e.g., public education and outreach. Accordingly, while all BMPs reduce pollutant loads to some degree, this Draft Implementation Plan estimates benefits only for those BMPs that can be reasonably quantified: improved street sweeping program and vehicle brake pad product replacement (reduction in copper found in brake pads). Water quality monitoring will demonstrate how the non-quantified BMPs provide additional benefits.

Estimating pollutant load reductions achieved through the implementation of product replacement and enhanced street-sweeping BMPs involves two key computations:

- Pollutant buildup – describes how a pollutant from a targeted source builds up on the land surface within a watershed.

- Pollutant wash-off – describes the transport of a pollutant from the watershed land surfaces to downstream waterbodies.

Numerous studies have found that pollutant buildup and wash-off are most appropriately estimated using non-linear relationships. Pollutant buildup occurs at the fastest rate in the initial days following a wash-off or rain event, but declines as buildup approaches the maximum carrying capacity (or Pmax) for the watershed over long dry periods (Sartor and Boyd, 1972; EPA NURP Study, 1983). Maximum possible mass build-up occurs after approximately 20 dry days within an urban watershed (Pitt and Shawlee, 1982). These studies also show that the greatest amount of pollutant wash-off occurs with the first ½ inch of runoff, with lower wash-off rates associated with each increment of additional runoff. Therefore, exponential functions were used to estimate pollutant buildup and wash-off associated with specific sources of metals in the watershed. These exponential functions, which are consistent with the TMDL model (SCCWRP, 2004) and other researchers (Chen and Adams, 2006), include:

$$P_t = P_{\max} * [1 - e^{(-k_b * DD)}] + [P_{t-1} - W_{t-1}] * e^{-k_b * DD}$$
$$W_t = P_t * [1 - e^{(k_w * R)}]$$

Where: P_t is the pollutant buildup for the current storm (lbs)
$P_{\max}$ is the maximum possible mass build-up (lbs)
k_b is the build-up rate coefficient (hr^{-1})
P_{t-1} is the pollutant buildup of the previous storm (lbs)
W_{t-1} is the pollutant wash-off of the previous storm (lbs)
DD is the dry inter-event period (hr)
k_w is the wash-off rate coefficient (in^{-1})
R is the runoff depth (in)

For this Draft Implementation Plan, pollutant buildup and wash-off analyses were completed for specific sources of metals including copper in brake pad dust and copper, lead and zinc in street sediment. A 59-year rainfall record was used to estimate the buildup of metals from controllable sources prior to a storm event (Pt), as a function of preceding dry days (DD). Using NetSTORM (computer program for precipitation data assessment and rapid long-term urban runoff simulation, CDM), watershed-wide hydrologic simulations were used to estimate runoff volumes for distinct storm events in the historical rainfall record. The produced time series of discrete runoff events were then used in a spreadsheet model to estimate the wash-off of pollutants from the watershed surface (W), as a function of runoff depth (R). The results of this analysis are included in the appropriate sections below.

The concentration of toxic pollutants in accumulated sediment will be reduced by implementing other non-quantifiable institutional BMPs. Therefore, in the future the wash-off of accumulated sediment is expected to result in additional reduced metals loading. These institutional BMPs will have similar effects on buildup rates of copper, lead, and zinc.

3.1.1 Vehicle Brake Pad Product Replacement

The purpose of this BMP is to reduce a significant source of metals and other toxic pollutants in the environment by developing safe alternative products. California Senate Bill (SB) 346 was signed by former Governor Arnold Schwarzenegger in 2010, thereby requiring that brake pads contain no more than 5% copper by 2021 and no more than 0.5% copper by 2025.

Copper from vehicle brake pad wear debris accounts for a significant portion of total copper loads in urban watersheds. In subwatersheds of the San Francisco Bay, brake pad wear debris accounted for 15-50% of total copper loads, depending upon the land use in each subwatershed (AquaTerra 2007). The Santa Clara Valley Urban Runoff Program estimated that brake pads are responsible for 42% of copper loading to the San Francisco Bay (SCVURP 1997). To develop this Draft Implementation Plan, a similar analysis for the Marina del Rey Watershed estimated the fraction of total copper loading manageable through direct source control activities related to copper content in brake pads. The mass of copper released to the watershed per vehicular kilometers traveled (VKmT) provides a basis to quantify baseline loads of total copper from brake pad wear debris. Copper loading rates per VKmT were estimated in several targeted studies conducted by the Brake Pad Partnership (Rosselot 2006). Rosselot (2006) identified a brake pad wear rate of approximately 0.5 milligrams per vehicle kilometer traveled (mg per VKmT) (6.5 % of 7.0 mg per VKmT). Rosselot (2006) also evaluated the copper content in different types of vehicles within the San Francisco Bay area.

Studies have shown equilibrium pollutant carrying capacity occurs after approximately 20 dry days within an urban watershed (Pitt and Shawlee, 1982). Therefore, the maximum buildup of copper on impervious areas is estimated as the buildup over 20 dry days.

Based on the previously mentioned studies, an average copper content for vehicles in the Marina del Rey Watershed was assumed to be 6.5%. Thus, 6.5% of 7.0 mg per VKmT is the rate at which copper is released to the Marina del Rey Watershed for every VKmT. Daily VKmT was estimated by taking the number of vehicles in the watershed and a conservatively estimated average annual distance driven in the watershed of 5,000 km per year. Per the 2005 Census, there are approximately 1,600 people living in the watershed. To establish the number of vehicles driving in the watershed, this number was tripled to account for the high number of other vehicles passing through the watershed in addition to these residents. Marina del Rey Harbor is a destination point which requires travelers to drive through the upper watershed. Lincoln Blvd (State Route 1) also passes through the watershed and is a major thoroughfare for people traveling north and south along the coast including to and from the airport. Venice Blvd (State Route 187) and Washington Blvd are also well traveled roads for those accessing the beaches.

Based on the quantification methodology described above, in the Marina del Rey Watershed approximately 2.56 kg of copper is washed off roadways per year from this source based on the current content of copper in brake pads (6.5%). Refer to **Appendix C** for tables showing model outputs. Brake pad dust was assumed to be uniformly distributed across the watershed but can only be washed off from impervious surfaces. The mass of accumulated sediment on a given day is an exponential function of the maximum carrying capacity, residual pollutant not washed off during the preceding runoff event, and dry days prior to the storm event.

Since State Bill 346 requires new brake pads in the State of California to contain less than 5% copper by 2021, the mass of copper built up on the watershed, and available for wash-off, will be reduced. In order to account for the introduction of new brake pads into the market, this compliance analysis assumed average copper content could be reduced to 5%content by the 2021 first compliance milestone.

Assuming copper content in brake pads will be reduced to 5%, modeling results show that approximately 0.56 kg less copper per year would be washed off the roadways, resulting in a 0.56 kg/yr copper load reduction.

The Marina del Rey Watershed Agencies have supported the Brake Pad Partnership and the adoption process of SB 346 through monetary contributions, in-kind technical services, committee memberships, etc. Caltrans in conjunction with the State Board contributed close to $1,000,000 to research on impacts of brake pads to surface waters.

3.1.2 Enhanced Street Sweeping

Metals released to the urban environment during dry weather conditions are likely to adsorb on street sediments, which provide a transport mechanism for metals to reach downstream waterbodies. Street sweeping removes sediment, debris, and other pollutants from road and parking lot surfaces. Several studies conducted on the effectiveness of street sweeping for pollution reduction have shown variable results dependent on traffic volume, type of sweeper used, frequency of sweeping, land use, and pavement type (Herrera, 2006). Another study showed annual sediment removal for a residential street of 20 to 31% for mechanical sweepers and 50 to 88%for new vacuum sweepers, depending on sweeping frequency (Rosselet, 2007). A separate study found that the frequency of street sweeping necessary to maximize sediment removal is once every week (Brinkman and Graham, 2001). Given the number of variables involved, including sweeping frequency or sweeper efficiency, the effectiveness of this program can vary widely.

The City of Los Angeles Bureau of Street Services (BSS) currently operates a street sweeping program that includes over 130 mechanical broom sweepers with a staff of over 100 operators. Citywide, BSS conducts routine street sweeping for 7,600 curb-km of posted streets on a weekly basis, and an additional 13,000 curb-km of non-posted or arterial streets on a monthly basis. Approximately 100 curb-km (63 curb-mi) of these swept roads (some swept weekly and some swept monthly) are located within the City of Los Angeles' portion of the Marina del Rey Watershed.

Additionally, maintenance responsibility of Lincoln Boulevard(State Route 1) and Venice Boulevard (State Route 187) has been delegated to City of Los Angeles, by a Delegated Maintenance Agreement. Caltrans will be working closely with the City in achieving optimal maintenance performance that includes, among other things, sweeping, trash pickup and drainage cleanup.

Lastly, the City of Culver City currently has a street sweeping program in place that includes weekly sweeping of street in the Culver City portion of the watershed.

Several alternatives exist for enhance street sweeping programs to capture more sediment for roads within the upstream portion of the Marina del Rey Watershed, including increased frequency of sweeping on roads that are currently swept monthly (e.g., increase frequency to weekly) or replacement of aging mechanical broom sweepers within the current fleet with new more efficient types of street sweepers. The City of Dana Point doubled sediment removal by increasing street sweeping from biweekly to weekly (Dana Point, 2005). Several studies comparing mechanical broom sweepers to newer high efficiency alternative equipment have shown increases in sediment removal of 35% (Pitt, 2002), 15 to 60% (Minton, 1998), and up to 140% (Schwarze Industries).

This Draft Implementation Plan uses a conservative target of increasing current sediment removal by 15% with enhancements to street sweeping. **Appendix C** provides an analysis, using available data and estimates of the City of Los Angeles street sweeping program, of the number of additional curb-miles that would need to be swept to achieve this goal of increasing street sweeping by 15%. As shown in **Appendix C**, approximately 9 curb-km (3.7 curb-mi), which is approximately 9% relevant watershed area, would need to be converted from monthly to weekly sweeping frequency. Additional evaluations and potential pilot programs coordinated with BSS will be necessary to determine the most effective and suitable approach to achieve this target.

Findings from local studies on accumulation rate and metals composition in street sediment provide necessary information to quantify the sediment loading. Sartor and Gaboury (1984) estimated sediment accumulation for impervious surfaces to range from 12 to 21 kg/curb-km/day. In a more recent study to support the Brake Pad

Partnership in California, Rosselot (2007) measured a street sediment accumulation rate of 14 kg/curb-km/day. Using this rate of accumulation for 20 days following a wash-off event, and the estimated 100 curb-km within the City of Los Angeles and Culver City's portion of the Marina del Rey Watershed, a maximum washoff amount of sediment on streets within the watershed is approximately 50,356 kg/year (without any street sweeping).

The mass of accumulated sediment on a given day is an exponential function of the maximum carrying capacity, residual pollutant not washed off during the preceding runoff event, and dry days prior to the event.

It was assumed that mechanical sweepers can remove 5 kg/curb-km (20 lbs/curb-mile) (Seattle, 2010) and that existing street sweeping practices could remove approximately 16,700 kg/yr of sediment. Based on an analysis of the current street sweeping program (**Appendix C**), the increase in street sweeping by 15% would result in an additional 2,518 kg/yr of sediment removed from streets.

Accumulated street sediments contain a high concentration of metals of concern in the Marina del Rey Watershed, based on the findings of Lau and Stenstrom (2005) from several roadways (**Table 3-1**). These values facilitate quantification of reductions in pollutant buildup for specific metals associated with additional sediment removal from current street cleaning operations.

Based on the concentration of each metal in sediment shown in **Table 3-1**, the predicted average annual load reduction achieved by increasing street sediment removal by 15% from current levels is approximately 0.25 kg per year (kg/yr) for copper, 0.33 kg/yr for lead, and 0.93 kg/yr for zinc (**Table 3-1**).

Table 3-1
Metals Concentrations in Street Sediments and Load Reduction from Increased Street Sweeping

Metal	Concentration (ppm)	Kg Removed by 15% Increase in Street Sweeping[1]
Sediment	NA	2,518
Copper	99	0.25
Lead	133	0.33
Zinc	371	0.93

[1]Based on a storm by storm buildup and wash-off analysis.

Concentrations of PCBs and chlordane in street sediment are unknown, so the absolute load reductions for these pollutants could not be determined. However, as it is estimated that current street sweeping practices remove approximately 33% of the total amount of street sediment available to wash-off (16,700 kg/yr removed of a total estimated amount of 50,356 kg/yr), it may be assumed that the removal efficiency of PCBs and chlordane by current street sweeping practices is 33%. Enhanced street sweeping would increase this removal efficiency to about 38%.

3.1.3 Education and Outreach

Education and outreach programs for residents and businesses about water quality impacts from controllable sources of metals include brochures, posters, websites, event attendance, utility bill inserts, and surveys. Education and outreach programs require a change in consumer behavior to be effective. In order to evaluate BMP performance, the City of Portland Bureau of Environmental Services assumed that eight % of the public would change their habits based on educational programs. This figure was derived from public relations outreach data developed by Clean Water Services (Herrera, 2006).

Education and outreach has been an ongoing activity for many years and it is implemented on a city-wide or watershed-wide basis. Many of these activities will benefit this Draft Implementation Plan by reducing toxic pollutants in the Marina del Rey watershed but, as noted, quantification of these benefits is very difficult. Examples of ongoing education and outreach activities that may reduce the toxic loadings include:

- Urban Runoff Websites—The City of Los Angeles maintains the Stormwater Website (www.lastormwater.org) to provide information on urban runoff management practices and good housekeeping tips for residents, businesses, and others to reduce pollutants from private properties.

- Rapid Transit Promotion—Agencies will continue to promote the use of rapid transit and other alternative transportation modes to minimize the number of vehicle miles driven in the watershed.

- Targeted Metals Education & Outreach—The City of Los Angeles currently implements a comprehensive education program to reduce potential mobilization of metals into storm drains from car washing (both at home and charity car washes, see below), hosing down driveways, improper disposal of used oil, and vehicle maintenance activities at home.

- Individual Car Washing – This BMP targets car owners that wash their own cars. Past surveys have indicated that 56 to 73% of car owners wash their own cars and over 90% of those let water drain to the pavement (CWP, 2008). This activity washes metals off of the car, increases dry weather urban runoff, and mobilizes metals present on impervious surfaces. Educational materials encourage car owners to use commercial car washes or wash cars on permeable surfaces.

  LADWP has a five phase Emergency Water Conservation Ordinance that includes restrictions on car washing. Two of these phases limit car washing activities. In the first phase, car washing is only permitted with a hose equipped with a shut-off device. In the third phase car washing is only permitted at commercial car wash facilities.

Implementation of BMPs to address trash reduction is also expected to help reducesediment loadings, which will assist in achieving compliance with the Toxics TMDL WLAs. Caltrans has been conducting Don't Trash California (DTC) public education program since 2005. Survey results have indicated reduction of trash from the public through behavior change.

3.1.4 Catch Basin Cleaning

Studies have shown that catch basins can be effective in removing 40 to 50% of total suspended solids (Herrera, 2006). Catch basin performance declines as flow increases, catch basin turbulence increases, and retention time decreases. In addition, when over 50% of the catch basin is full, previously captured sediments can be re-suspended (Herrera, 2006). Catch basin cleaning can maintain higher pollutant removal rates and reduce remobilization of pollutants entrained in the sediments including metals and organics. However, increasing the cleaning frequency to more than quarterly provides little additional benefit. For example, one study determined that semi-annual cleaning is optimal for the average catch basin (Herrera, 2006). Overall, catch basin cleaning is an important institutional BMP, but the benefits of increased frequency of catch basin cleaning should be evaluated. Also see the discussion on catch basin inserts under Section 3.2.

3.1.5 Downspout Retrofit

This BMP redirects runoff from roofs to pervious areas, resulting in reduced flow to storm drains. Implementation options include redirecting downspouts to lawns, gardens or swales, or installing a rain barrel or cistern to collect roof runoff for later use. The City of Portland has been implementing an effective downspout retrofit program since 1996. The program's Website indicates that over 56,000 property owners have disconnected downspouts. Downspout retrofit is an effective institutional BMP for commercial, industrial, and public buildings as well. This opportunity is especially important since buildings associated with these land use types tend to have roofing materials containing higher leachable metals content.

The City of Los Angeles currently has a pilot program in place for downspout retrofit of single family residential roofs. Pending the results of the pilot program, the City of Los Angeles may expand the program citywide. Additionally, downspout retrofit is an important component of other TMDL Implementation Plans, including the Los Angeles River (Metals) and Ballona Creek (Metals, Bacteria and Toxics) Implementation Plans, therefore, there is a move for widespread implementation of this BMP.

3.2 Structural BMPs

The Draft Implementation Plan includes structural BMPs designed to treat wet weather runoff, which in many cases will also treat dry weather runoff. Structural BMPs include regional projects serving multiple catchments as well as distributed BMPs that consist of small-scale decentralized, structural BMPs.

Structural BMPs include new and significant redevelopment projects subject to Standard Urban Stormwater Mitigation Plan (SUSMP), Trash TMDL implementation, and other BMPs installed in the watershed to address other water quality concerns.

3.2.1 SUSMP Projects

The SUSMP requirements of the MS4 permit apply to new development and redevelopment projects. The MS4 in the Marina del Rey Watershed is permitted under a single permit issued to Los Angeles County and 84 incorporated cities (all except the City of Long Beach). An important part of the MS4 permit is the SUSMPrequirements. In general, SUSMP applies to new developments and redevelopments of a certain minimum size. The BMPs installed on-site must be able to infiltrate, capture and reuse, or treat all of the runoff from an 85th percentile storm, which is approximately a 3/4-inch, 24-hour storm in the Marina del Rey Watershed. New guidelines approved on July 9, 2008 require developers to give top priority to BMPs that infiltrate stormwater and lowest priority to mechanical/hydrodynamic units. **Table 3-2** provides a summary of the number of SUSMP projects that have been completed in the City of Los Angeles portion of the Marina del Rey watershed between 2002-2012. Since 2002, 22 SUSMP projects have been implemented:

- Sixteen 10+ housing developments
- Two commercial and one industrial facility.
- One parking lot.
- Two residential units.

Table 3-2

City of Los Angeles SUSMP project implementation in Marina del Rey Watershed

Year	Number of SUSMP projects	Year	Number of SUSMP projects
2002	0	2008	0
2003	1	2009	1
2004	3	2010	0
2005	6	2011	1
2006	4	2012	2
2007	4		

The City of Los Angeles adopted a Low Impact Development (LID) Ordinance in December 2010 which requires that properties beyond those subject to SUSMP requirements implement stormwater control measures. It is anticipated that the LID ordinance will result in an increase in the number of properties that have stormwater control measures implemented, resulting in additional reductions in pollutant discharges from private properties. For example, five additional projects have been implemented in the Marina del Rey watershed in 2012 to meet the requirements of the LID ordinance but that were not subject to SUSMP requirements.

SUSMP and LID implementation is an important tool to reduce the discharge of sediment and associated pollutants from private properties to the public right-of-way. It is estimated that since 2002 approximately 40 acres within the Marina del Rey watershed has been redeveloped to SUSMP standards. While it is difficult to project SUSMP and LID implementation in the Marina del Rey watershed over the next ten years, it may be assumed that up to 100 acres of the upstream watershed (13.7% of the area) will meet the SUSMP and/or LID standards by the year 2021.

3.2.2 Trash TMDL Implementation

The LARWQCB has adopted several TMDLs within the Los Angeles area (Los Angeles River, Ballona Creek, Dominguez Channel), which established limits on the amount of trash allowed into these waterbodies. The TMDLs required Southern California cities to reduce their trash contribution to these water bodies by 10% each year for a period of 10 years with the goal of zero trash to waterbodies. The City of Los Angeles has achieved every yearly milestone, solely through the implementation of structural measures without having to take credit for implemented institutional measures that are also resulting in a reduction of trash.

Implementation of BMPs to address the Trash TMDLs is also expected to help reduce sediment loadings, which will assist in achieving compliance with the Toxics TMDL WLAs. The Bureau of Sanitation’s Watershed Protection Division (WPD) is the lead office in charge of city-wide Trash TMDL implementation in the City of Los Angeles. As part of this effort, in the spring of 2002 WPD completed a study entitled *High Trash Generation Areas and Control Measures*, which identified the spatial distribution of trash in the City of Los Angeles for both the Los Angeles River and Ballona Creek Watersheds. The study examined the amount of trash accumulating in City-owned catch basins beginning in 1999 through the end of 2003. The ensuing analysis of the data resulted in the identification of three categories of trash generation potential (low, medium, and high) to describe areas within the City of Los Angeles. The high trash generation area was shown to contribute approximately 60% of the trash within the City of Los Angeles. It was concluded that implementing both institutional and structural control measures first in the high and medium trash generating areas would have the greatest impact in reducing trash discharges.

The City of Los Angeles' strategy for compliance is based on using the following two-pronged approach: 1) implementing institutional measures such as public outreach, street sweeping, catch basin cleaning, enforcement, etc., with a special focus on the high trash generation areas, and 2) installing structural trash control devices in the storm drain system, targeting first the high trash generating areas of the City of Los Angeles, followed by the medium and low trash generating areas.

As of September 2010, the City of Los Angeles has installed over 19,000 catch basins in the Los Angeles River Watershed and 16,200 catch basin opening screen covers in the Ballona Creek Watershed with either inserts and / or opening screen covers. In addition, 13 netting systems and three continuous deflection separators (CDS) units certified as full capture devices, have been strategically installed throughout the City of Los Angeles and continue to operate effectively in preventing trash from getting to the Los Angeles River and Ballona Creek. Thus far, the City of Los Angeles has committed over $80 million to fully meet compliance with the Trash TMDLs.

In the Marina del Rey Watershed, approximately 100 catch basin opening screen covers will be installed, with completion estimated to be June 30, 2011. While the benefits associated with implementation of this program to toxic load reductions have not been quantified, it is expected that continued removal of the associated sediment loads will result in additional reductions of toxic pollutants being discharged to Marina del Rey Back Basins.

3.2.3 Other Installed BMPs

The BMPs listed below have been installed in the watershed by the County of Los Angeles for the purpose of reducing bacteria loads, but which provide the additional benefit of removing other pollutants, including sediment bound toxic pollutants.

Three Low Flow Diversions (LFDs) (owned and operated by County):

- LFD Facility at Boone-Olive Pump Station (Project No. 3874 LFD); completed in 2007; operational during summer dry-weather periods; 104,720 gallons storage capacity; 45 gpm pump discharge rate, 64,800 gpd daily discharge volume.
- LFD Facility at Oxford Basin (Project No. 3872 LFD); completed in 2010.
- LFD Facility at Washington and Thatcher (Project No. 5243 LFD); completed in 2007; operational during summer dry-weather periods; 1,363 gallons storage capacity; 100 gpm pump discharge rate, 144,000 gpd daily discharge volume.

Five tree wells (owned and operated by County):

- Bio-Retention Filter-Garfield Avenue (two tree wells)
- Bio-Retention Filter-Abbot Kinney Blvd. (one tree well)
- Bio-Retention Filter-Coeur D'Alene (two tree wells)

The low flow diversion facilities divert dry weather flows to the sanitary sewer system, thereby preventing that flow and the associated pollutants from being discharged to the Marina del Rey Back Basins. The bio-retention filter tree wells treat wet and dry weather flows that pass through them, which also reduces pollutant discharges.

3.2.4 Additional Future BMPs

In additional to the BMPs identified herein, the Marina del Rey Watershed Agencies will continue identifying opportunities for green infrastructure projects that will further serve to reduce the discharge of multiple pollutants, including those listed in the Toxics and Bacteria TMDLs. Additionally, Oxford Basin (owned and operated by the County of Los Angeles) was identified in the Marina del Rey Bacteria TMDL Implementation Plan as an opportunity site for installation of a regional BMP, which could provide the opportunity to remove multiple pollutants from Areas 3 and 4 of the watershed.

3.3 Quantification of Water Quality Benefits

The Toxics TMDL limits the loading of sediment bound toxic pollutants discharged by stormwater into the Marina del Rey Back Basins. Following is a summary of the potential amount of sediment and pollutants removed from the baseline load by BMPs in the Draft Implementation Plan described under **Section 3.1**.

3.3.1 Sediment Based Components of the TMDL

The Toxics TMDL limits the amount of sediment bound copper, lead, zinc, chlordane and PCBs. Ideally, to calculate the baseline loading of each constituent to the Marina del Rey Back Basins, sediment samples taken directly from runoff flowing to the Back Basins would have been analyzed to determine a concentration of each constituent in the inflowing sediment. This concentration would have been multiplied by the total annual sediment load to determine the total load of each constituent to the Back Basins. However, as previously discussed, these data were not available when the Draft Implementation Plan was developed.

To address the lack of sediment data from urban runoff to the Back Basins, the pollutant concentration data from the Ballona Creek Estuary TIE study was used as a surrogate, but representative, dataset (see additional discussion in **Section 2.3.1**). Per this study, the estimated baseline load was calculated using the sediment loading of 64,166 kg/yr (Regional Board TMDL Staff Report). As shown in **Table 3-3**, the total baseline load for Areas 1A, 3 and 4 were scaled down to account for (1) the load that the MS4 permittees and Caltrans are responsible for; and (2) the portion of the load that the preparers of this Implementation Plan are responsible for (the City of Los Angeles, Culver City and Caltrans only). **Table 3-4** presents the analysis of institutional post-BMP implementation.

Table 3-3
Baseline Load

Constituent	Average of Measured Concentrations in BC Estuary[1]	Area 1A, 3 and 4 of MDR Watershed Baseline Load[2]	Baseline Load (MS4 Portion and Caltrans)[3]	Baseline Load City of LA, Culver City and Caltrans Only[4]
Metals	**(mg/kg)**	**(kg/yr)**	**(kg/yr)**	**(kg/yr)**
Copper	35.58	2.283	2.242	1.718
Lead	26.96	1.730	1.699	1.301
Zinc	147.67	9.475	9.305	7.128
Organics	**(µg/kg)**	**(g/yr)**	**(g/yr)**	**(g/yr)**
Chlordane	2.53	0.162	0.159	0.122
PCBs	1.96	0.126	0.124	0.095

Notes:

[1]The average measured concentrations of each constituent were based on the measured data reported in the 2007-2009 TIE Study performed by SCCWRP and the City of Los Angeles (see also Section 2 and Appendix B of this Implementation Plan). These data provided representative concentrations of these constituents in stormwater runoff.

[2]The baseline load is the concentration of each constituent (column 2) multipliedby the fine sediment load of 64,166 kg/yr (Regional Board, Toxics TMDL Staff Report).

[3]The load that the MS4 permittees and Caltrans are responsible for is based on the portion of the loading capacity that they are responsible for, as listed in the TMDL. The MS4 Permittees and Caltrans are responsible for 98.2% of the load; therefore the watershed-wide baseline load (column 3) was multiplied by 98.2%.

[4]Portion of Areas 1A, 3 and 4 that is under the jurisdiction of City of Los Angeles, City of Culver City and Caltrans (the preparers of this Implementation Plan), which is 76% (based on GIS analysis); therefore the MS4 and Caltrans portion (column 4) was multiplied by 76%.

Table 3-4
Load Reduction from Quantified BMPs

Constituent	Baseline Load[1]	Load Reduction from BMPs[2]		Estimated Post-BMP Load[3]	TDML Wasteload Allocation[4]	Estimated Post-BMP Load as % of WLA
		Vehicle Brake Pad Product Replacement	Enhanced Street Sweeping			
Metals	**(kg/yr)**					
Copper	1.72	0.56	0.25	0.908	1.557	58%
Lead	1.30	-	0.34	0.967	2.130	45%
Zinc	7.13	-	0.93	6.194	6.853	90%
Organics	**(g/yr)**					
Chlordane	0.12	-	-	0.122	0.023	535%
PCBs	0.09	-	-	0.095	1.029	9%

Notes:
1 – Baseline Load City of Los Angeles, City of Culver City and Caltrans only (Table 3-3, column 5)
2 – See Section 3.1 and Appendix C.
3 – Baseline load (column 1) less BMPs load reductions (columns 2 and 3).
4 – WLAs for stormwater (Table 1-1) multiplied by the percentage watershed area under the jurisdiction of City of Los Angeles, City of Culver City and Caltrans (76%).

As shown in **Table 3-4**, the baseline load will be reduced through the implementation of the vehicle brake pad product replacement program and through enhanced street sweeping. After implementation of these BMPs, all constituents with the exception of chlordane would be expected to be in compliance with the WLAs of the Toxics TMDL.

Chlordane was used as an insecticide until 1983 when it was banned for all uses except termite control. It was completely banned from any use in 1988.The soil half-life for chlordane is estimated at 350 days but can range from 37 days to 3,500 days (or approximately 10 years) (NPIC, 2001), therefore, chlordane is very persistent in the environment even though it was banned many years ago. Using the concentration of chlordane in Ballona Estuary sediments may have overestimated the actual chlordane concentrationin storm-borne sediment in the Marina del Rey watershed, because of sediment deposition over many years in Ballona Estuary. Options to reduce the loadings of chlordane from the Marina del Rey watershed to the Back Basins are limited as banning its use, as implemented in the 1980's, is the ultimate source control measure. Hence, further reductions of the chlordane loadings should focus on green infrastructure BMPs that remove chlordane-containing storm-borne sediments before discharge to the Back Basins. This is further discussed in **Chapter 4**.

3.3.2 Water Column and Fish Tissue Components of the TMDL

The Toxics TMDL contains targets for PCBs in the water column and PCBs in fish tissue. The LARWQCB Staff Report recognizes that PCBs are a legacy pollutant similar to chlordane. The presence of this constituent is expected to be reduced overtime as it is no longer used. The interim and final targets are shown in **Table 3-5**.

Table 3-5
Water Column and Fish Tissue

Condition	Numeric Limit	Concentration in Samples
Interim Target for Total PCBs in Water Column	0.03 μg/L	Non-Detect
Final Target for Total PCBs in Water Column	0.00017 μg/L	Non-Detect
PCBs in Fish Tissue	5.3 μg/kg	No data available

Note:
Results are from the first quarterly report prepared as part of the Marina del Rey Toxics CMP. Concentrations of PCBs were not detected in the samples. However, the detection limit, 0.1 μg/L, is above the interim and final targets. Therefore it is not conclusive whether any exceedances of the numeric targets exist.

As shown in **Table 3-5**, CMP results (**Appendix B**) show that concentrations of PCBs were not detected in water column samples. However, the detection limit of 0.1 μg/L is above the interim and final targets. Therefore, CMP results are not conclusive whether any exceedances of numeric targets exist. However, since PCBs are a legacy pollutant, it is anticipated that water column concentrations would not be exceeded in runoff from the upper watershed. Concentrations in fish tissue were not available during the preparation of this Draft Implementation Plan.

3.3.3 Compliance Analysis Conclusion

As shown in **Table 3-4**, lead and PCBs are already in compliance with the sediment WLAs based on the available sampling data. Those that are not in compliance currently include copper, zinc and chlordane. The institutional BMPs are anticipated to reduce the concentrations of copper and zinc to below the WLAs. Further, as described above, chlordane is likely showing exceedances due to the historic use and persistence in the environment.

The water column PCBs are not detected in existing samples coming from the watershed. However, the detection limits are higher than the numeric targets. As lower detection limits become available compliance with the numeric targets will be reassessed.

It should also be noted that the other BMPs listed in **Section 3.1 and 3.2** will further serve to reduce the concentration of each constituent in runoff entering the Back Basins. These BMPs include:

- Education and outreach;
- Catch basin cleaning;
- Downspout disconnection;
- SUSMP and LID implementation (e.g., approximately 100 acres within the watershed will have BMPs installed to treat or capture stormwater runoff by 2021);
- Trash TMDL implementation (100 opening screen covers will be installed, with completion estimated to be June 30, 2011); and
- Other installed BMPs (three low flow diversions and five bio-retention tree wells).

As such, the estimates presented in **Table 3-4** are conservative as they only account for the load reduction expected from two institutional BMPs (e.g., vehicle brake pad product replacement and enhanced street sweeping).

3.3.4 Uncertainty and Limitations of the Quantification Approach

There are several unavoidable sources of uncertainty in the pollutant load reduction estimates for BMPs due to data limitations, unknown future conditions, simplifying assumptions, and site-specific factors. For the development of this Draft Implementation Plan as outlined in Section 3 the major uncertainties include:

***Uncertainty #1*: Institutional BMP Performance Quantification**

Available data on the performance of institutional BMPs is scarce and highly uncertain. Two approaches for quantifying the downstream benefits of institutional BMPs includes reference watersheds or before/after studies. Both of these approaches typically require many years of monitoring to detect statistically significant differences due to natural variability in hydrology and water quality, unknown changes in land uses or activities in the control or target watersheds, and episodic or illicit discharges of pollutants. Due to the lack of statistically conclusive studies, the quantification of potential sediment load reductions from sources controls was based on a combination of data-supported assumptions and best professional judgment.

- The effectiveness of enhanced street sweeping was based on an estimate of the amount of street sediment and the expected performance of the sweepers. Sediment volumes would be expected to be highly variable and site specific. In addition, all of the studies base sweeper performance on the quantity of collected sediment rather than changes in downstream water quality. Finally, the proportion of collected sediment that would have reached the receiving water is unknown.

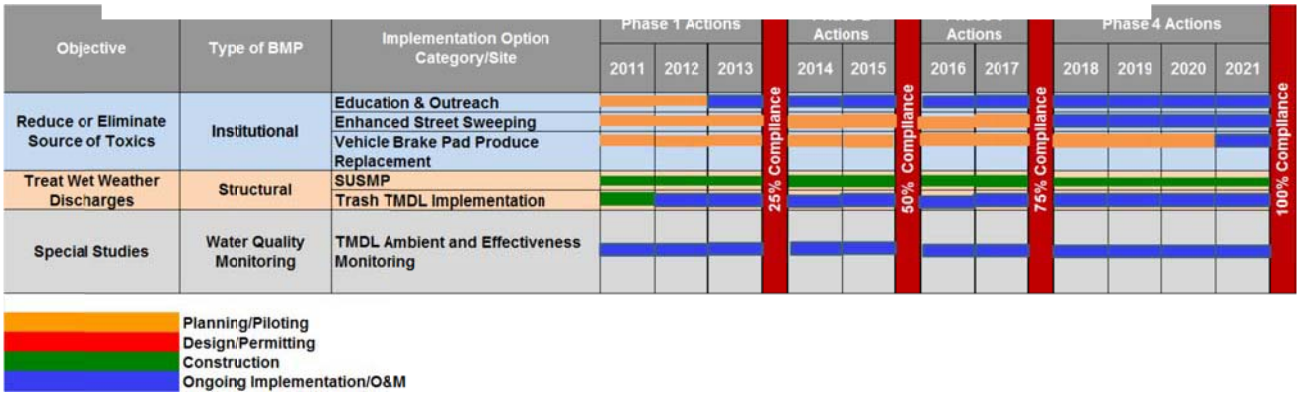
***Uncertainty #2*: Existing Sediment Data**

- In order to perform the compliance analysis, the expected concentration of each constituent in the sediment in the Marina del Rey Watershed was required. Ideally, measured data would have been used from samples of sediment in runoff water in the Marina del Rey Watershed which included the concentration of each constituent in this runoff water. This would have represented the concentration of each constituent in the actual sediment coming from the watershed. However, the only available data was constituent concentrations in the sediment on the bottom of the Ballona Creek Estuary. The uncertainty associated with these data is that it is not possible to know the time frame with which these collected sediments were deposited, and while it is for an adjacent, similar watershed, it is not Marina del Rey Watershed specifically. Confirmation of sediment bound loading will need to be made as the CMP is implemented, which will result in the appropriate data being collected.

Since the Draft Implementation Plan was developed in March 2011, additional data have become available from the implementation of the Coordinated Monitoring Program as discussed in **Section 2.3.2**.These data provide more insight into pollutant discharges to the Back Basins. The implications for the implementation strategy are further discussed in **Section 4**.

3.4 Implementation Plan Schedule and Milestones

Table 3-6 summarizes the preliminary schedules and milestones for institutional BMPs and structural BMPs for achieving compliance with relevant TMDL targets in the Marina del Rey Watershed. For each BMP, **Table 3-6** shows the proposed initiation and duration of: (1) planning/piloting activities, (2) design and permitting, (3) construction, and (4) ongoing implementation/operation & maintenance (O&M). It is assumed that the Marina del Rey Watershed Agencies will continue to act collaboratively and coordinate on scheduling the implementation activities. Caltrans, however reserves the right to proceed independently to address the TMDL goals depending on the specific costs and implementation measures identified during the implementation process.



In **Section 3.3**, sediment load reductions from each of the quantifiable elements of the Implementation Plan scheduled for implementation prior to 2021 were subtracted from the baseline load to demonstrate compliance with the TMDL. The compliance milestones, as discussed in **Section 1**, include the following:

- March22, 2013: 25% of the total drainage area served by the MS4 system is effectively meeting the waste load allocations for sediment.
- March22, 2015: 50% of the total drainage area served by the MS4 system is effectively meeting the waste load allocations for sediment.
- March22, 2017: 75% of the total drainage area served by the MS4 system is effectively meeting the waste load allocations for sediment.
- March22, 2021: 100% of the total drainage area served by the MS4 system is effectively meeting waste load allocations for sediment.

As discussed in **Section 3.3**, copper and zinc are the constituents listed in the Toxics TMDL that are not currently in compliance and have not been historically banned from use. As such, the interim compliance analysis will serve to illustrate how the copper and zinc load will be reduced to meet the interim compliance requirements.

As shown in **Table 3-7**, the copper and zinc load would be reduced sufficiently to meet the Toxics TMDL WLAs through the enhanced street sweeping program alone.

Table 3-7
Load Reduction and Post BMP Load

Constituent	Baseline Load	Load Reduction from Enhanced Street Sweeping BMP	Estimated Post-BMP Load	Waste Load Allocation from TMDL	Estimated Post-BMP Load as % of WLA
Copper	1.72	0.25	1.47	1.557	91%
Zinc	7.13	0.93	6.194	6.853	90%

The Draft Implementation Plan proposes to enhance street sweeping by 15%. As shown in **Appendix C**, this can be achieved by converting a portion of the streets that are swept monthly to a weekly sweeping frequency. Analysis shows that to increase street sweeping by 15%, 8.5 curb-km would need to be swept weekly versus monthly (**Appendix C**). Since there are 100 curb-km within Areas 3 and 4 of the Marina del Rey watershed, this indicates that 8.5 %of the watershed area requires this BMP be implemented to bring this area into compliance. The remaining 91.5% of the watershed is assumed to already be in compliance. As such, since the TMDL requires that 75% of the watershed area be in complianceby 2017, it can be assumed that this (and previous) interim compliance requirements have already been met. The remaining 8.5% of the watershed will be in compliance by the final milestone of 100% of the watershed area in compliance by 2021 through the implementation of the enhanced street sweeping program.

3.5 Cost Estimate for Draft Implementation Plan

Planning-level (order-of-magnitude) budget and staff resources estimates were developed based on the preliminary project and program concepts presented for the Draft Implementation Plan in this **Section 3**. Given the iterative and adaptive nature of the Implementation Plan, the budget forecasts should be considered preliminary and subject to change as future revisions of the Implementation Plan may require the implementation of additional BMPs. This is further discussed in Section 4.

This Draft Implementation Plan mostly relies on the implementation of institutional measures to meet the WLAs of the ToxicsTMDL. Cost estimates for implementation of the BMPs recommended in the previous sections are as follows:

Enhanced Street Sweeping

The Marina del Rey Watershed Agencies already have an aggressive sweeping program which includes both weekly and monthly sweeping of most of the streets in the watershed. The additional planned 15% load reduction may be achieved by expanding the sweeping program incrementally to increase total annual number of curb-miles swept within the applicable areas of the Marina del Rey Watershed, e.g., by increasing the frequency of sweeping on streets currently swept monthly. Based on the analysis presented in **Appendix C**, using Los Angeles City data, it is estimated that the 15% load reduction can be achieved by additional street sweeping of 274 curb-miles per year. At an average cost of $43 per curb-mile, this translates to a cost for enhanced street sweeping of $12,000 per year.

Vehicle Brake Pad Product Replacement

As discussed in **Section 3.1**, there is a statewide initiative which requires that manufacturers of brake pads reduce the amount of copper allowed in brake pads to 5% or less by 2021 and 0.5% or less by 2025. While the Marina Del Rey Watershed Agencies provided support to Brake Pad Partnership enabling passage of the legislation, there will be no further costs associated with this BMP as SB 346 was signed into law in 2010 and the manufacturers will incur the costs to modify the brake pad content.

Education and Outreach

Education and outreach in the Marina del Rey watershed is part of broader and ongoing outreach programs by the Marina del Rey Watershed Agencies in the Los Angeles area. Therefore, a substantial cost increase for additional outreach in the Marina del Rey watershed is not expected.

SUSMP Retrofit for New and Redevelopments and Downspout Retrofit Programs

The costs associated with the stormwater BMPs required under SUSMP and the upcoming LID ordinance are to be implemented by the property owner, therefore it is assumed that no net increase in cost will be seen by the responsible parties. Similarly, if the downspout retrofit program is expanded to the Marina del Rey watershed, it is assumed that these costs will be incurred by the property owners as well.

Catch Basin Cleaning and Installation of Opening Screen Covers

Costs associated with the catch basin cleaning and the installation of the opening screen covers are included in the costs developed for the City of Los Angeles implementation of the Trash TMDL Implementation Plan, therefore no net increase in cost is anticipated.

Section 4
Revised Implementation Plan (December 2012)

LARWQCB staff provided comments on the Draft Implementation Plan in September 2012 with the direction to resubmit the plan in December 2012. Accordingly, most of the comments specific to the Draft Implementation Plan have been addressed in the preceding sections. In addition, the LARWQCB staff recommended to evaluate recently available monitoring data and to reanalyze the current loadings of toxic pollutants to the Back Basins and the predicted waste load reductions from BMP implementation.This re-evaluation has been included in **Sections 4.1 and 4.2. Section 4.3** provides considerations and recommendations for future revisions of the implementation strategy.

4.1 Pollutant Loading Estimates

Section 2.3.2 discussed the results of two years of CMP monitoring (August 2010-July 2012) that were not available at the time of developing the Draft Implementation Plan. While CMP monitoring has provided a large amount of new data regarding water and sediment quality in the Back Basins and the quality of stormwater in the upstream watershed, there are still data gaps and/or uncertainties that would need to be addressed in order to accurately estimate pollutant loadings from the upstream watershed to the Back Basins, including the following:

- Volume of stormwater discharges from the upstream watershed to the Back Basins.
- Concentrations of storm-borne sediment in stormwater discharges.
- Concentrations of TMDL constituents in storm-borne sediment.
- Concentrations of chlordane and PCBs in stormwater.
- Concentrations of chlordane in sediments of the Back Basins.

Table 4-1 summarizes the estimated pollutant loadings from the upstream watershed in the 2010-2011 wet season (as determined from total recoverable concentrations in stormwater, **Section 2.3.2**) with the TMDL WLAs for stormwater and the pollutant loadings that were estimated from Ballona Estuary TIE results. Compared to the assumptions made during the development of the Draft Implementation Plan, it can be concluded that:

- Concentrations of copper, lead, zinc and PCBs in sediments of the Back Basins are higher than the concentrations of the same pollutants as found in sediments of Ballona Estuary during the TIE study (**Table 2-6** vs. **Table 2-4**).

- Concentrations of copper, lead, zinc and PCBs in sediments of the Back Basins are above the targets as specified in the Toxics TMDL (**Table 2-6** vs. **Table 2-4**).

- Pollutant loadings from the upstream watershed, estimated for the 2010-2011 wet season, are higher than pollutant loading estimates that were based on the TIE results for Ballona Estuary sediment (**Table 2-10**).

Overall, these new data suggest that pollutant loadings of metals and PCBs from the upstream watershed to the Back Basins are probably higher than the baseline loadings in **Section 3** that were estimated by using the TIE results for Ballona Estuary sediments. The results in **Table 4-1** also indicate that the estimated pollutant loadings in the 2010-2011 wet season were 2 to 10 times higher than the WLAs in the Toxics TMDLs, depending on the specific pollutant. However, it should noted that confirmation of the 2010-2011 results is warranted by sampling and analysis of storm-borne sediment to unequivocally determine the pollutant loadings associated with storm-borne sediment from the upstream watershed. Storm-borne sediment sampling is included in the effectiveness monitoring component of the CMP and expected to start in the 2012-2013 wet season.

Table 4-1

Comparison of pollutant loading estimates (2010-2011 wet season) with TMDL Waste Load Allocations

Constituent	Pollutant loading estimates for 2010-2011[1]	TMDL WLA[2]	Estimated baseline load based on 2007-2009 TIE Study[3]
Copper (kg/yr)	13.8	1.56	1.718
Lead (kg/yr)	3.83	2.13	1.301
Zinc (kg/yr)	64.85	6.85	7.128
Chlordane	NA	0.023	0.122
PCBs (g/yr)	3.9[4]	1.029	0.095

Note:
[1]Data from Table 2-9 except for PCBs
[2]Column 6 in Table 3-4
[3]Column 5 in Table 3-3
[4]PCB loadings were estimated by multiplying the concentration in Back Basin sediments (Table 2-6) and the baseline sediment loading rate.

4.2 Waste LoadReductions

Despite the aforementioned uncertainties in determining actual pollutant loadings, the 2010-2011 pollutant loading estimates are significantly higher than earlier estimates which would warrant revisiting the water quality benefits and anticipated load reductions by the BMPs proposed in the Draft Implementation Plan. This is illustrated in **Table 4-2**, which is a revision of **Table 3-4** by replacing the baseline load that was based on TIE results for Ballona Estuary sediments with the 2010-2011 pollutant loading estimates from the Marina del Rey watershed. Even though the 2010-2011 pollutant loading estimates probably overestimated the actual loadings (i.e., by using total recoverable concentrations in stormwater instead of storm-borne sediment concentrations), it can be postulated that the anticipated load reductions by the institutional BMPs proposed in Draft Implementation Plan are probably only a small fraction of the estimated pollutant loadings from the upstream watershed. As such, a re-evaluation of the implementation strategy with identification of additional BMPs would be needed to ensure that the implementation strategy will meet the WLAs of the Toxics TMDL for the upstream watershed.

Table 4-2

Re-evaluation of load reductions from quantified BMPs identified in Draft Implementation Plan by comparing to revised baseline loads 2010-2011

Constituent	Revised Baseline Load[1]	Load Reduction from BMPs[2]		Estimated Post-BMP Load[3]	TDML Wasteload Allocation[4]	Estimated Post-BMP Load as % of WLA
		Vehicle Brake Pad Product Replacement	Enhanced Street Sweeping			
Metals	**(kg/yr)**					
Copper	13.8	0.56	0.25	12.99	1.56	830%
Lead	3.83	-	0.34	3.49	2.13	165%
Zinc	64.9	-	0.93	64.0	6.85	935%
Organics	**(g/yr)**					
Chlordane	0.12[5]	-	-	0.122	0.023	535%
PCBs	3.9	-	-	3.9	1.029	205%

Notes:
1 – Revised baseline load from Table 4-1, column 1.
2 – The Draft Implementation Plan quantified two BMPs (Section 3.1 and Appendix C).
3 – Revised baseline load (column 1) less BMPs load reductions (columns 2 and 3).
4 – WLAs for stormwater (Table 1-1) multiplied by the percentage watershed area under the jurisdiction of City of Los Angeles, City of Culver City and Caltrans (76%).
5 – Baseline load for chlordane has not been revised and is based on Ballona Estuary sediment concentrations.

4.3 Proposed Approach to Implementation Plan Revision

4.3.1 Options for BMP implementation

As noted, the Draft Implementation Plan mostly relied on institutional measures, either already ongoing or recommended for future implementation. This approach was reasonable at the time as some pollutants were initially thought to have already met the WLAs, while loadings of other pollutants exceeded the WLAs but only to a small extent. Future revisions of the implementation strategy for the Marina del Rey Toxics TMDL will probably need to consider a combination of BMP categories as no one category is likely to be sufficient to provide required load reductions. In general, the following categories of BMPs can be considered:

- Institutional BMPs for source control may reduce new inputs of pollutants into the watershed, but have less impact on existing pollution levels, in particular for those pollutants that are persistent in the environment. Examples are chlordane and PCBs, which were banned for use in the 1980s, but are still found in urban runoff and the environment.

- Other institutional BMPs such as street sweeping and catch basin cleaning reduce the amount of sediment and associated pollutants. However, the Marina del Rey Watershed Agencies already have extensive programs for these BMPs in place, hence, program improvements would only result in a relatively small increase in pollutant load reductions.

- Conventional treatment BMPs that rely on pollutant breakdown or degradation are in general not an option as toxics pollutants usually are stable and thus not susceptible to degradation.

- To date, three LFDs have been implemented in the Marina del Rey watershed for the capture of urban runoff and diversion to the sewer system. However, LFDs are typically used for diversion of dry weather runoff only, as stormwater volumes are much larger and exceeding the capacity of the sewer conveyance and treatment system.

- Green infrastructure BMPs provide the best opportunity for stormwater management and reduction of toxic pollutant loadings as this category of BMPs prevent the discharge of stormwater and storm-borne sediment to the Back Basins and they provide the added opportunity of using the water for infiltration, irrigation, or other beneficial uses. Distributed BMPs such as green street retrofits capture local runoff from relatively small drainage areas of up to about 10 acres. Regional BMPs often divert stormwater from stormdrains that serve much larger drainage areas. Regional BMPs usually have a large footprint and are located in parks or other areas with sufficient open space.

In summary, as the required load reductions probably are larger than originally anticipated, future revisions of the implementation strategy for the Toxics TMDL would have to follow an approach that is similar to the implementation strategy developed for the Ballona Creek watershed by combining institutional and structural BMPs and with a strong emphasis on green infrastructure BMPs to maximize the beneficial use of stormwater.The Marina del Rey watershed is highly developed and primarily consists of residential land uses. As such, the area would lend itself the best for implementation of distributed green infrastructure BMPs. Limited opportunities would exist for the implementation of larger regional projects.

4.3.2 General approach to green infrastructure strategy development

The City of Los Angeles conducts a uniform and systematic approach to identify and implement green infrastructure projects in its watersheds.This is an extensive process that has been applied to the Ballona Creek and the Los Angeles River watersheds and it consists of the following general steps:

1. Identification and prioritization of high pollution areas and opportunities for BMPs: Computer models such as SBPAT or equivalent models are used to analyze the GIS data that are key factors in deciding whether a project should be placed at a certain location within the watershed. These factors include landuse type, parcel size, land ownership, soil type, groundwater depth, slope (topography), stormdrain size, location, depth, operatorship, and accessibility. These key factors indicate land availability, hydrologic connectivity, infiltration opportunity, and the level of pollutant load contributions within the watershed.
2. Field investigation for verification of identified BMP locations: In this step, additional factors are investigated by staff in the field to verify utility locations, public right-of-way, and proximity to infrastructure, and other parameters to verify and confirm that the selected location is indeed suitable for situating a BMP. Filed investigations are also used to develop a preliminary selection of the type of BMPs that would best fit the conditions of the selected location. Typical BMPs include vegetated swales, infiltration wells, subsurface wetlands, and stormdrain daylighting.
3. Quantification of water quality benefits and other benefits: Once all BMPs and their locations have been identified, computer models such as SWMM and SBPAT are used to quantify expected pollutant load reductions and water quality benefits.
4. Estimation of the capital cost for BMP implementationand the cost for O&M.

This process may take up to one year or longer depending on the size of the watershed, the complexity of the TMDL, the level of coordination required between watershed agencies, and many other factors.

4.3.3 Regulatory Developments

Two new regulatory developments have been initiated since the development of the Draft Implementation Plan in March 2011:

- Reconsideration of the Marina del Rey Toxics TMDL: On November 19, 2012, LARWQCB staff conducted the first workshop to solicit public participation for the reconsideration of the Toxics TMDL. Adoption of the revised Toxics

TMDL is tentatively anticipated by the spring or early summer of 2013. As indicated during the workshop, potential items for reconsideration include: WLAs and the implementation schedule; consistency with Sediment Quality Objectives; toxicity hotspots within sediments; potential impairments of copper in the water column of the Back Basins and the Front Basins; and redefinition of interim compliance milestones.

- Revision of the NPDES permit for MS4 discharges: Adopted on November 8, 2012, this new MS4 Permit contains many additional requirements including TMDL provisions for compliance with water quality-based effluent limitations and receiving water limitations. The MS4 permit provides permittees the flexibility to develop and implement Watershed Management Programs (WMP)or Enhanced Watershed Management Programs (EWMP) that include, among many other components, the structural and non-structural BMPs for compliance with the TMDL provisions. WMPs and EWMPs are due for submittal to the LARQWCB 18 or 30 months after the effective date of the new MS4 Permit, respectively.

The Marina del Rey Watershed Agencies recommend that a more detailed revision of this Implementation Plan for the Toxics TMDL with the identification of the specific green infrastructure BMPs be aligned or included with the development of the WMPs and/or EWMPs as provided for by the new MS4 permit. This alignment would provide additional time and other benefits for the Implementation Plan revision:

- It would provide the opportunity to address the reconsideration of the Toxics TMDL, in particular the potential reconsiderations of the WLAs, the implementation schedule and redefinitions of interim compliance milestones.

- Continuation of monitoring would provide additional data to confirm the preliminary data analyses that have been included in this plan revision. Starting in early 2013, the Toxics TMDL and CMP require that storm-borne sediment sampling and analyses be conducted, which will provide the much needed data to determine actual pollutant loadings from the watershed to the Back Basins for comparison with the WLAs. Also starting in 2013, the TMDL and CMP require that accelerated monitoring and / or toxicity identification evaluations be initiated, which would allow the future Implementation Plan revisions and identification of green infrastructure BMPs to target those pollutants (or areas) that are the most toxic.

- It would allow integration of this Toxics TMDL Implementation Plan with implementation plans for other TMDLs (e.g., the Marina del Rey Harbor Bacteria TMDL) by developing a multi-pollutant approach to address all water quality and sediment impairments in the Back Basins in an integrated manner.

- It would provide the time to identify pollutant hotspots and additional BMP opportunities in the watershed by using systematic approaches to maximize the anticipated pollutant load reductions.

4.3.4 Integrated Water Resources Approach

The City of Los Angeles has a long history of urban runoff management that relies on green infrastructure as the approach to water quality compliance, while at same time using runoff and stormwater for groundwater replenishment, irrigation and other beneficial uses, greening communities and the public right-of-way, and other benefits. This strategy has been outlined in the Water Quality Compliance Master Plan for Urban Runoff and has been used in more detail for identifying green infrastructure projects in multiple TMDL Implementation Plans for the various watersheds. In addition, the City has developed and employed various tools to facilitate green infrastructure implementation, including but not limited to:

- Various models and screening tools for identification of green infrastructure projects and their locations.
- Several manuals with guidelines for implementation of green infrastructure elements at private properties and the public right-of-way recommendation for operation and maintenance.
- Standard plans for several green street elements to facilitate the design and implementation of green streets throughout the City.

Accordingly, the final revision of the Toxics TMDL Implementation Plan will fully satisfy the requirements of an Integrated Water Resources Approach because it is anticipated that final compliance with the WLAs will require extensive implementation of green infrastructure projects (i.e., distributed and regional) in addition to the institutional BMPs that were identified in Draft Implementation Plan.

Section 5
References

AquaTerra.Modeling the Contribution of Copper from Brake Pad Wear Debris to the San Francisco Bay. October 2007.

Bannerman, R.; D. Owens; R. Dodds and N. Hornewer."Sources of Pollutants in Wisconsin Stormwater."*Water Science and Technology*. 28(3-5): 241-259.1993.

Brinkman, R. and Graham A. Tobin. Urban Sediment Removal: The Science, Policy, and Management of Street Sweeping. Boston: Kluwer Academic Presses. 2001.

Chen, Chen and Barry J. Adams. Analytical Urban Storm Water Quality Models Based on Pollutant Buildup and Washoff Processes. Journal of Environmental Engineering.v132(10).2006.

City of Los Angeles, Issuance of Task Order Solicitation No. 9 Downspout Disconnection Program. http://www.lacitysan.org/general_info/pdfs/contracts/TOS_S9_Downspout_Disconnection.pdf. August 2008.

City of Los Angeles, Integrated Resources Plan for the Stormwater Program (IRP). 2004.

City of Los Angeles.Reference Guide for Stormwater Best Management Practices. Stormwater Management Program, Bureau of Sanitation, Department of Public Works. July 2000.

City of Los Angeles.Water Quality Compliance Master Plan for Urban Runoff. Watershed Protection Division, Bureau of Sanitation, Department of Public Works. 2009.

City of Palo Alto. Clean Bay Business Program, http://www.cityofpaloalto.org/business/news/details.asp?NewsID=526&TargetID=5

Clean Water Education Program (CWEP). Pre- and Post-TV Campaign Surveys of Stormwater Awareness & Behavior in the CWEP Service Area: Comparisons and Findings, North Carolina. 2008.

Dana Point, California. Street sweeping will make a clean sweep to protect the ocean. http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=99

EPA (Environmental Protection Agency).Results of the National Urban Runoff Program.Volume 1 - Final Report.Environmental Protection Agency, Office of Water, Washington, DC. December1983.

Geosyntec Consultants. Los Angeles County Wide Structural BMP Prioritization Methodology, submitted by County of Los Angeles, Department of Public Works, Heal the Bay and the City of Los Angeles Bureau of Sanitation. 2006.

Hardwick, N. Lake Sammamish Watershed Water Quality Survey. King County Water and Land Resources Division. Seattle, WA.1997.

Herrera Environmental Consultants. Technical Memorandum: Nonstructural Stormwater BMP Assessment. Prepared for the City of Portland Bureau of Environmental Services. May 2006.

Imperial, Mark and Llyod Jones. Evaluation of the Burnt Mill Creek Outreach and Demonstration Project: Final Report, Prepared for the City of Wilmington, NC. 2005.

Irvine Ranch Water District, Richard A. Diamond.Project Review of the Irvine ET Controller Residential Runoff Reduction Study.November 2003.

Los Angeles County Department of Public Works (LACDPW), Water Resources Division.Hydrology Manual. January 2006. (http://dpw.lacounty.gov)

Los Angeles County, City of Los Angeles, City of Culver City and Caltrans. Marina del Rey Harbor Mothers' Beach and Back Basins Bacteria TMDL Implementation Plan. October 31, 2005.

Los Angeles County, City of Los Angeles, City of Culver City and Caltrans. Marina del Rey Harbor Toxic Pollutants Total Maximum Daily Load Coordinated Monitoring Plan. March 31, 2008.

Los Angeles Regional Water Quality Control Board. Attachment A to Resolution No. 2003-012. Amendment to the Water Quality Control Plan – Los Angeles Region to incorporate the Marina del Rey Harbor Mothers' Beach and Back Basins Bacteria TMDL Adopted by the California Regional Water Quality Control Board, Los Angeles Region on August 7, 2003.

Los Angeles Regional Water Quality Control Board. Attachment A to Resolution No. 2005-012. Amendment to the Water Quality Control Plan – Los Angeles Region to incorporate the Marina del Rey Harbor Toxic Pollutants TMDL Adopted by the California Regional Water Quality Control Board, Los Angeles Region on October 6, 2005a.

Los Angeles Regional Water Quality Control Board.Total Maximum Daily Load for Toxic Pollutants in Marina del Rey Harbor. October 6, 2005b.

Los Angeles Unified School District Facilities Services Division. New Construction Strategic Execution Plan. 2001. http://www.laschools.org/sepdocs/sep/pdf/sep-2009-web.pdf

McPherson, Greg, Simpson, Jim, Qingfu, Xiao and Wu, Chelsea. Los Angeles One Million Trees Canopy Cover Assessment: Final Report. Center for Urban Forest Research and University of California at Davis. March 2007.

Minton, G.R., Lief, B. & Sutherland, R. High efficiency sweeping or clean a street, save a Salmon! Stormwater Treatment Northwest, Vol. 4, No. 4.November 1998.

Municipal Water District of Orange County and Irvine Ranch Water District.The Residential Runoff Reduction Study. 2004. http://www.irwd.com/Conservation/R3-Study-Revised11-5-04.pdf

Northern Virginia Planning District Commission.Nonstructural BMP Handbook.Prepared by Virginia Department of Conservation and Recreation Division of Soil and Water Conservation. December, 1996.

National Pesticide Information Center (NPIC). Chlordane General Fact Sheet. Online at: http://npic.orst.edu/factsheets/chlordanegen.pdf. January 2001.

Olivieri, A., Boehm, A., Sommers, C.A., Soller, J.A., Eisenber, J.N., Danielson, R. “Development of a Protocol for Risk Assessment of Microorganisms in Separate Stormwater Systems.”2007.

Pitt, R. Emerging stormwater controls for critical source areas. In: Management of Wet-Weather Flow in the Watershed. Sullivan, D. & Field R. (Eds). Street cleaning (pp. 14-16), CRC Press, Boca Raton, FL.2002.

Pitt, R. and J. McLean.Toronto Area Watershed Management Strategy Study - Humber River Pilot Watershed Project. Ontario Ministry of the Environment, Toronto, Ontario, June 1986.

Pitt, R. and G. Shawley.A Demonstration of Non-Point Source Pollution Management on Castro Valley Creek. Alameda County Flood Control and Water Conservation District (Hayward, CA) for the Nationwide Urban Runoff Program, U.S. Environmental Protection Agency, Water Planning Division, Washington, D.C. June1982.

Pitt, R.; Williamson, D.; Voorhees, J.; and Clark, S. “Review of Historical Street Dust and Dirt Accumulation and Washoff Data.” In: Effective Modeling of Urban Water Systems,Monograph 13. W. James, K.N. Irvine, E.A McBean, and R.E. Pitt, Eds. ISBN 0-9736716-0-2. CHI. 2004.

Rosselot, Kirsten. Copper and Solids Removed via Street Sweeping. Report prepared for the Brake Pad Partnership. March 2007.

Rosselot, Kirsten. Copper Released from Brake Pad Lining Wear in the San Francisco Bay Area. Report prepared for the Brake Pad Partnership. January2006.

Sartor, J.D., and Gaboury, D.R. Street sweeping as a pollution control measure—Lessons learned over the past ten years: Science of the Total Environment, v. 33, p. 171–183.1984.

Seattle Public Utilities Study. Online at: http://www.seattle.gov/util/Services/Drainage_&_Sewer/Keep_Water_Safe_&_Clean/Street_Sweep_Project/QuestionsAnswers/index.htm. Captured 2010.

Schwarze Industries.Virginia test further documents pickup of high efficiency sweepers.American Sweeper 8(1).2004.

SCVURP (Santa Clara Valley Urban Runoff Program).Metals Control Measures Plan and Evaluation of Nine Metals of Concern, Volume I. February.1997.

Stein, ED and LL Tiefenthaler. Characterization and source identification of dry-weather metals and bacteria in Ballona Creek, in: S.B. Weisberg and D. Elmore (eds.), Southern California Coastal Water Research Project 2003-04 Biennial Report. Southern California Coastal Water Research Project.Westminster, CA. pp. 179-191. 2004.

Steuer, J., W. Selbig, N. Hornewer, and J. Prey."Sources of Contamination in an Urban Basin in Marquette, Michigan and an Analysis of Concentrations, Loads, and Data Quality." U.S. Geological Survey, *Water-Resources Investigations Report 97-4242*.1997.

Surbeck S.Q., Jiang, S.C., Ahn, J.H., and S.B. Grant. Flow Fingerprinting Fecal Pollution and Suspended Solids in Stormwater Runoff from an Urban Coastal Watershed. Environmental Science Technology 40: 4435-4441.2006.

Sutherland, R. C. &Jelen, S. L. A technique for accurate urban runoff load estimation. Water Environment Federation.National TMDL Science and Policy 2002 Specialty Conference, November 13 –16, 2002.Phoenix, AZ.2002.

Swann, C. A Survey of Residential Nutrient Behaviors in the Chesapeake Bay.Widener-Burrows, Inc. Chesapeake Research Consortium.Center for Watershed Protection, Ellicott City, Maryland.1999.

Tetra Tech. Nutrient and Coliform Modeling for the Malibu Creek Watershed TMDL Studies.Prepared for USEPA Region 9 and the Los Angeles Regional Water Quality ControlBoard. 2002.

Tiefenthaler, L.L., E.D. Stein, and G.S. Lyon. 2008. Fecal Indicator Bacteria Levels During DryWeather from Southern California Reference Streams. Southern California Coastal WaterResearch Project (SCCWRP), Technical Report 542. January 2008.

University of California, Los Angeles.2002 Long Range Development Plan.2001.http://www.capital.ucla.edu/EIR/Final_UCLA_2002_LRDP.pdf